

# A Message to Parents and Teachers

In this manual I have attempted to provide the material you will need to successfully teach this course. The book and manual are meant for use by home school parents as well as Christian schools.

At the beginning of the chapters are suggestions sheets. These provide thought questions and illustrations to arouse students' interest and get them involved in thinking critically about what they are going to learn. Please take advantage of them. In addition, there are worksheets, review sheets and tests for each chapter and keys for all. There are also concept maps. Their best use is as a group review with the use of a computer or overhead projector.

I have also provided two vocabulary review sheets for a final exam. They cover everything that will be mentioned in the test. In addition, there is a final exam that is entirely objective. I set it up this way because I have found it very difficult to grade essay questions at the end of the semester.

The manual material can be copied, and you can then make the adjustments you need without changing the original. Some of the worksheets, especially those in Chapter 8, are geared to making students think, to helping them become more critical observers and interpreters of the information they receive from evolutionists. This is absolutely essential. If we are to help members of the next generation to remain faithful to God, it is crucial that we foster a Christian world view in them—one that is grounded in His Word and in a solid scientific understanding of His world. God's hand is on everything He made. Help them to see it.

Please believe me when I say that what you are doing is extremely important. One of the main reasons college students give for no longer believing in God's Word is that their immersion in evolution has convinced them the Bible is not trustworthy. The great irony is that the theory of evolution is not only theologically unsound but also scientifically unsound.

Above all else, bathe this course in prayer. You will find, as I did, that it can be the most important class you will ever teach, in terms of the lasting effect on your students.

# Critical Thinking

## Situation One

Walt was an eighth grader and an avid science fan. One night he was awakened by heavy rain coming down outside his window. The next day he awoke to find that it was still raining. “How long has it been raining?” he wondered. He looked through the dining room window and saw a bucket on the patio that was partially filled with water. He knew it had been empty yesterday evening when he went to bed. “I can know how hard and how long it has been raining!” he exclaimed. He ran to the kitchen, grabbed a bucket just like the first one, and set it by the first bucket where it could also catch rainwater. An hour later, at eight o’clock, he stepped out into the rain long enough to pick up both the buckets. The second bucket had a half inch of water in it. The first bucket had three inches of water. “It’s been raining at the rate of one half inch per hour,” he stated. A few minutes later Walt’s mom and sixteen year old brother Fred came into the kitchen.

“Mom, can you wash my good jacket? It was raining when I came in, and somehow I got mud on it.”

Before Mom could suggest to Fred that he wash his jacket himself, Walt yelled excitedly. “Mom, you’ve got to ground Fred. He came in after curfew!!!”

“What makes you think that?” Mom asked.

“Well, it’s been raining at the rate of one half inch per hour and there are three inches of rain in the bucket that was left outside, so it’s been raining for only six hours. That means he got in after two A.M., an hour past curfew.”

Mom smiled. “Why don’t we call the weather bureau just to verify your findings?”

“Not necessary,” Walt answered. “The facts don’t lie.”

When Mom contacted the weather bureau, she found it had been raining for about eight hours.

1. *How did Walt come up with one half inch per hour as the rate at which it had been raining?*
2. *What assumption did Walt make based on the half inch of water in the pan?*
3. *As a scientist, would you have accepted Walt’s findings without verification? If not, why not?*
4. *When Walt said “the facts don’t lie,” was he wrong? What does Walt know for sure? What doesn’t he know?*
5. *When Walt explains why he thinks Fred was out past his curfew, what error in reasoning does he make?*
6. *When he insists that it is not necessary to check with the weather bureau, what error in scientific procedure is he making?*

## Critical Thinking Situation Two

Mr. Jones, a teacher at Damon High School, was convinced that Tommy Brown, a student in his English class, was a complete loser who would soon end up in jail. Mr. Jones felt this way because Tommy tended to be somewhat “rowdy” in his class and was not very respectful. Tommy, along with two other students, James Wallace and George Kendrum, had been absent from school for several days due to the flu. When they returned, Mr. Jones called them out of study hall to help them catch up in their work. During the time that they were in the room, money that Mr. Jones had been collecting from his students for a field trip disappeared. Mr. Jones immediately suspected Tommy. His suspicion was based on two things: his opinion of Tommy’s past behavior and the fact that he had seen Tommy near his desk while he was in the hall for a short time.

Later that day, however, Melissa, a shy but conscientious and hard working student in one of his classes, stopped to see him. At first she was hesitant to talk, but finally she blurted out,

“Mr. Jones, I heard the field trip money was stolen today. I just wanted you to know that when I passed your class while you were speaking to Mr. Taft, I saw George Kendrum at your desk. I didn’t think anything of it at the time, but later I heard him tell his girlfriend Josie that they could go out to dinner and a show because he had “come into some money.” That’s the way he put it—“come into some money.” So when I heard the money had been taken from your desk, I thought it was important to let you know what I had seen and heard.”

Mr. Jones thanked Melissa for the information. After she left, he considered the facts. “I can’t believe George would steal from me,” he thought. “After all, he is always courteous, and I have never had any trouble with him. I’m not going to mention this to the principal. I’ll simply tell him I saw Tommy near my desk, and the money was gone when I checked immediately after he left.”

The next day Tommy was suspended from school for stealing.

1. *What affects Mr. Jones’ ability to examine all the facts?*
2. *What error in reasoning is he guilty of?*
3. *How does his error in reasoning affect the judgment of his principal?*

## Critical Thinking Situation Three

John was an intelligent but somewhat lazy eleventh grader. Shortly after the beginning of the semester, he was in speech class when he suddenly realized he had forgotten that today was the day he was to give a summary of his speech on the contributions of the Republican Party to the United States. John, a Republican, was also a good speaker. In spite of his lack of preparation, he decided to proceed. He walked to the lectern and began.

“It is always advantageous for the Republican Party to be in power because it is highly beneficial to the country for Republicans to lead us. Although the other students clapped as John sat down, his teacher, also a Republican, pointed out to him that he had a low mark for his summary and could expect a low grade on his speech unless he did his research and came up with valid reasons for his position. He also told him that he had committed a serious error in reasoning.

1. *What error in reasoning did John commit?*
2. *What does this mean?*

## Critical Thinking

# Situation Four

Tommy's dad was very upset with him. Mr. Martin had been called to the principal's office because his twelve-year-old son had been caught copying another student's answers on a test.

"What did you think you were doing?" Mr. Martin thundered. "You know it's wrong to copy. That's cheating! How can you hope to do well if you are stealing other people's work? You know better than that."

"I—I'm sorry, Dad," Tommy whispered. "I guess—I wasn't thinking."

"Well, you're going to be sorrier," his father replied. "You're grounded for two weeks." Tommy and his dad were told that he was suspended from school for a day because of his actions, and father and son went home.

The house was strangely silent through dinner. Both parents were disappointed with Tommy and had no desire to talk to him. Later, Tommy's dad went to his study to work on his income tax returns. Tommy felt increasingly guilty about his actions and decided to join his father in his study and, at the first opportunity, apologize again. He sat behind his father and watched him working at the computer. Suddenly, Mr. Martin picked up the phone and called the treasurer of the church the family attended.

"Hi, Al. It's me, Arthur Martin. Say, I think you made a mistake on the summary of our

church offerings," he stated. "I made a \$100 contribution on July 23rd of last year that you don't have recorded. I have the check to prove it."

Tommy's face filled with concern. "Dad, that's not..."

Tommy's father frowned and shook his head at Tommy. He remained quiet.

"Do I need to show you the check on Sunday?" Mr. Martin continued. "Okay then, thanks a lot. See you Sunday."

When Mr. Martin hung up, Tommy burst out, "Dad, you made a mistake. That \$100 was money you paid for me to go to camp. That wasn't an offering!"

"Sure it was. I gave it to the church, didn't I?" his dad answered.

"Yeah, but it wasn't an offering," Tommy repeated. "That's cheating!"

Mr. Martin's face grew red. An angry scowl appeared. "It is not cheating! Uncle Sam gets too much of my money as it is. What I'm doing is just good business!"

Tommy stared at his father. He knew he was wasting his time and taking a chance on being grounded for an additional two weeks, so he just shook his head, turned around and went to his room, all thoughts of apologizing gone from his mind.

1. *What did Mr. Martin have to say about Tommy's behavior when he was in the principal's office?*
2. *How does Mr. Martin define cheating when he is at home?*
3. *What is this error in logic called?*

## Critical Thinking Situation Five

Mr. Burns owned a public skating rink that many of the teens in his town patronized. One particular Saturday Mr. Burns overheard some of the teens talking about their activities. One of them, a boy named Morris, mentioned that he was going on a skiing weekend with the First Christian Church, a congregation that worshipped nearby. Later, Mr. Burns had to break up two fights in which Morris was involved. After the second one he expelled Morris and returned to his office, exhausted and angry. Soon after, the phone rang.

The caller was the youth pastor from First Christian Church. He wanted to book the rink one Monday night for his youth group.

"I'm sorry, but we have no openings," Mr. Burns stated.

"Well, that's okay," replied the pastor. "We can wait a few weeks until something opens up."

Mr. Burns looked at his schedule for Monday nights and noted it was half empty. "I'm sorry, but we are booked for the rest of the year," he stated emphatically. "We have NO openings!"

Since he knew how slow business was on Monday nights, the puzzled youth pastor thanked Mr. Burns anyway and then wondered what he had done to offend him.

1. *What led Mr. Burns to lie about having openings in his schedule? Why didn't he want to allow the youth group of First Christian Church to rent his rink?*
2. *What error in reasoning is Mr. Burns guilty of?*

## Critical Thinking Situation Six

Max, an eleventh grade student at Washington High, was anxious to get out of the house one Friday night. He was going on a weekend trip with his youth group, skiing and snowboarding. Although he still had an hour before he was scheduled to go to the church, he was anxious to get there early to talk with his friends before leaving. As he was preparing to leave, his mom stopped him.

"Are you sure you have all your homework done?" she asked. "You know you won't have any time this weekend, once you leave here."

"Mom, I got all my math and chemistry done. That's what I've been working on," Max answered.

"What about your English?"

"I don't remember anything, but Mrs. Droulliard never assigns any homework on Fridays."

Max's mom shook her head. "Things change. If you're not sure, why not call Pete or Manny. They're good students; they will know."

Max considered this. He was doing well in English, and he wanted to keep his grades up. Yet Mrs. Droulliard did not often give homework assignments on Fridays. "I'm sure she didn't give any work today, Mom. Gotta go!" With that, he picked up his equipment and headed for the door.

Monday, Max lost some English credit because he forgot to finish as homework the class work Mrs. Droulliard had given that day.

1. *What was the mistake Max made?*
2. *What error of reasoning is this? Explain.*
3. *How could he have tested his assumption?*

## Critical Thinking Situation Seven

Jeff was talking with two of his co-workers, Andrew and Paul, during their lunch break at McDonald's.

"So, you go to a Christian school, don't you?" Paul asked.

"Yeah," Jeff replied, his mouth full of double cheeseburger.

"They teach any creationism there?"

Jeff sighed. He didn't know if he wanted to get into this discussion with Andrew present because Andrew was known as a hothead, who didn't listen to anything others had to say. "Yeah, they teach creationism. I am in a semester course in origins right now."

"What are you learning?" Paul asked.

"Well, so far our teacher has explained to us that change does occur but not evolution as it is

defined in public school. She has given us several scientific examples to support her claims."

"Are you kidding?" Andrew practically yelled. "The only thing creationism's got going for it is the Bible. How could they have a semester course on Adam and Eve?"

"We don't study the Bible in this class. We study just science," Jeff answered. "What I'm learning could be taught in the public schools because it's all science."

"Yeah, right!" Adam sneered, his face turning red with exasperation. "They talk about God having to create the world. Creation is religion and evolution is science! You can't teach religion in the public schools!"

1. *What has Andrew failed to do before making his statements?*
2. *If one can prove through science that the specified complexity of this world could not have happened by chance, would it be good science to say so? When would religion come into the picture?*
3. *What error of reasoning has Andrew committed that leads him to the conclusion that creationism cannot be taught in the public schools?*



# Chapter 1

## Suggestions for Beginning

One profitable way to begin your semester is by a discussion of the theories of origins. Guide your student(s) to an understanding that there are basically only two possibilities—everything came about as a result of a cosmic “accident” (random mechanistic processes), or some intelligent being had to create it. (He may suggest that God used evolution to create the world. This still fits in one category or the other. He either allowed chance to determine the outcome or He guided the process.)

Then discuss how each of these world views will affect how people interpret the scientific facts. Point out that the first three chapters of the book reflect the evolutionary viewpoint—everything that exists today is here as a result of millions of random changes.

If you have a secular university nearby, it would be profitable to set up a field trip to their museum of natural history. About midway through to the end of the book is a good time. Take a trip on your own prior to the date of the field trip and “scout out” how many of the so-called proofs of evolution are displayed there.

If you and your student(s) are prepared to get a real “dose” of evolution, arrange for a docent to take you around. If not, then look over the displays, determine how many relate to what you are studying, and act as your own docent. Give your students a list of questions about the displays and what they have learned in class. Have them answer the questions as they go through the museum. Collect these at the end of the trip and check them for completeness. You can use them as your basis for a discussion of the trip the following day.

It is also important to point out as your student reads and discuss the first three chapters that even though what is said may seem logical and reasonable, there is much more to the “story” than that. This is especially true with the so-called “evidence” of evolution given in the second and third chapters. Emphasize as your student(s) covers these sections that all the facts have not yet been given.

# Sections Question Key

## Section One: Types of Rocks

1. *What are igneous, sedimentary, and metamorphic rocks?*

## Section Two: The Geologic Column

1. *Who started the first geologic column? How did he put it together?*
2. *How did Lyell contribute to this work?*
3. *Define "correlating the rocks".*

## Section Three: Developers of Evolutionary Theory

1. *What was Lyell's major contribution to the theory of evolution?*
2. *Explain Lamarck's Theory of Acquired Traits and Use and Disuse of Organs.*

3. *Explain natural selection as Darwin pictured it.*

#### **Section Four: Mendel's Work**

1. *Describe Mendel's work with pea plants. What did he discover?*

2. *Define the principle of dominance and the principle of segregation.*

3. *Does the recessive factor ever show up in later generations? When and in what ratio?*

#### **Section Five: Later Contributions**

1. *Describe the process of meiosis. What does it do?*

2. *What contribution did Weisman make?*

3. *Describe the process, which de Vries postulated as another cause of changes within organisms.*

## Sections 1 & 2

# Types of Rocks & the Geologic Column

Use the following words to correctly fill in the blanks below. Four words will be used twice.

ages  
Charles Lyell  
chart(s)  
dating  
exposed  
fossils  
geologic column  
heat  
igneous

information  
lava  
layers  
magma  
metamorphic  
nineteenth century  
organizing  
primary  
sedimentary

sediments  
similar  
three  
water  
William Smith  
years  
correlating principle of uniformity  
dates

The Earth is made up of \_\_\_\_\_ basic types of rock. One type, \_\_\_\_\_, is formed from molten material either beneath or on the Earth's surface. Molten material beneath the Earth's surface is \_\_\_\_\_. However, molten material reaching the Earth's surface is referred to as \_\_\_\_\_. As each of these harden, they form \_\_\_\_\_ rock. Igneous rock that is exposed to wind, water and weathering will erode into small rock particles. If these \_\_\_\_\_ gradually build up, especially under \_\_\_\_\_, they can harden, forming \_\_\_\_\_ rock. Finally, both igneous and sedimentary rocks can be subjected to \_\_\_\_\_ and pressure, forming yet another rock which is called \_\_\_\_\_.

The \_\_\_\_\_ is made up of layers of \_\_\_\_\_ rock. \_\_\_\_\_, a surveyor, began studying rock layers that had been \_\_\_\_\_ when his workers dug a canal in England. He made \_\_\_\_\_ of the rock sequence and the \_\_\_\_\_ in them. He combined this data with \_\_\_\_\_ he got in other locations. Using this data, he made a \_\_\_\_\_ of the layers of rocks throughout the area. When he showed other geologists what he had done, they began to make \_\_\_\_\_ charts for their areas also.

\_\_\_\_\_, a lawyer and amateur geologist, began gathering and \_\_\_\_\_ this information. He also began examining rocks from different locations and determining that they were the same age because of their similar character and fossils. This is known as \_\_\_\_\_

Student Name: \_\_\_\_\_ Teacher: \_\_\_\_\_ Period: \_\_\_\_\_

the rocks. Using the \_\_\_\_\_, he assigned \_\_\_\_\_ to each layer of rock in the column. By the end of the \_\_\_\_\_ century, Lyell had developed a \_\_\_\_\_ for the whole Earth. His geologic column is very similar to the one used in textbooks today. This method of \_\_\_\_\_ the \_\_\_\_\_ of rocks and fossils was the only one used for many \_\_\_\_\_ and is still the \_\_\_\_\_ method used today.

## Section 3

# Developers of Evolutionary Theory

*Fill in the blanks by unscrambling the words below them.*

1. Charles Lyell first proposed the \_\_\_\_\_.  
crippnlei fo froinutimy
2. The principle of uniformity states that “the \_\_\_\_\_ is the key to the past”.  
treepsn
3. This principle (see #2) means that the \_\_\_\_\_ that shape the world today are no  
cropsesse  
different from those of the past.
4. This principle (see #2) means that the world is very \_\_\_\_\_.  
dol
5. Jean Baptiste de Lamarck first proposed \_\_\_\_\_.  
therecinain fo queadicr rattis
6. Lamarck believed that organisms changed their \_\_\_\_\_ to adapt to a new environment.  
gornas
7. He also believed that \_\_\_\_\_ could be passed on to an organism’s offspring.  
adicrque sittar
8. Scientists still call organs \_\_\_\_\_ if they appear to have no function.  
gestialvi
9. Charles Darwin was influenced by both \_\_\_\_\_ and \_\_\_\_\_.  
yellL                      carakLM
10. During his job as a naturalist he traveled to the \_\_\_\_\_.  
apagGaslo dIsslan
11. He saw \_\_\_\_\_ on the islands that were similar to those in South America.  
minalas

## Section 4

# Mendel's Work

*Determine whether the following statements are true or false. On the line provided, rewrite the false statements correctly.*

\_\_\_\_\_ 1. Gregor Mendel was a mayor and politician who was born in 1822.

\_\_\_\_\_

\_\_\_\_\_ 2. He entered the University of Vienna and became interested in plant breeding.

\_\_\_\_\_

\_\_\_\_\_ 3. He joined a monastery and continued his research.

\_\_\_\_\_

\_\_\_\_\_ 4. Over a period of several years he discovered natural selection.

\_\_\_\_\_

\_\_\_\_\_ 5. Mendel used bean plants for his experiments.

\_\_\_\_\_

\_\_\_\_\_ 6. Mendel chose seven characteristics to study, one to three traits at a time.

\_\_\_\_\_

\_\_\_\_\_ 7. When Mendel crossed two different varieties, he got a blending of traits.

\_\_\_\_\_

\_\_\_\_\_ 8. Traits disappeared in the second generation and reappeared in the third.

\_\_\_\_\_

\_\_\_\_\_ 9. Mendel developed the principle of homology, which states that if the factors for a trait in an organism are different, one factor may prevent the other from being expressed.

\_\_\_\_\_

\_\_\_\_\_ 10. The factors expressed in an organism Mendel called recessive.

\_\_\_\_\_

Student Name: \_\_\_\_\_ Teacher: \_\_\_\_\_ Period: \_\_\_\_\_

\_\_\_\_\_ 11. The factors which were masked he called dominant.

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## Section 5

# Later Contributions

### Matching

*Use the letters below to fill in the space provided.*

A. August Weismann

B. crossover

C. homologous

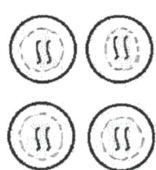
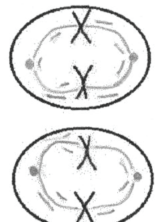



D. Hugo de Vries

E. mutation

F. mutation theory

- \_\_\_\_\_ 1. Chromosomes which carry genes for the same traits.
- \_\_\_\_\_ 2. The belief that random changes in genes provided the new genes for the evolutionary process.
- \_\_\_\_\_ 3. A process in which homologous chromosomes come together and trade genes.
- \_\_\_\_\_ 4. Proposed the mutation theory.
- \_\_\_\_\_ 5. Showed that changes brought about by the environment cannot be passed on to an organism's offspring.
- \_\_\_\_\_ 6. A spontaneous change in a gene or chromosome.

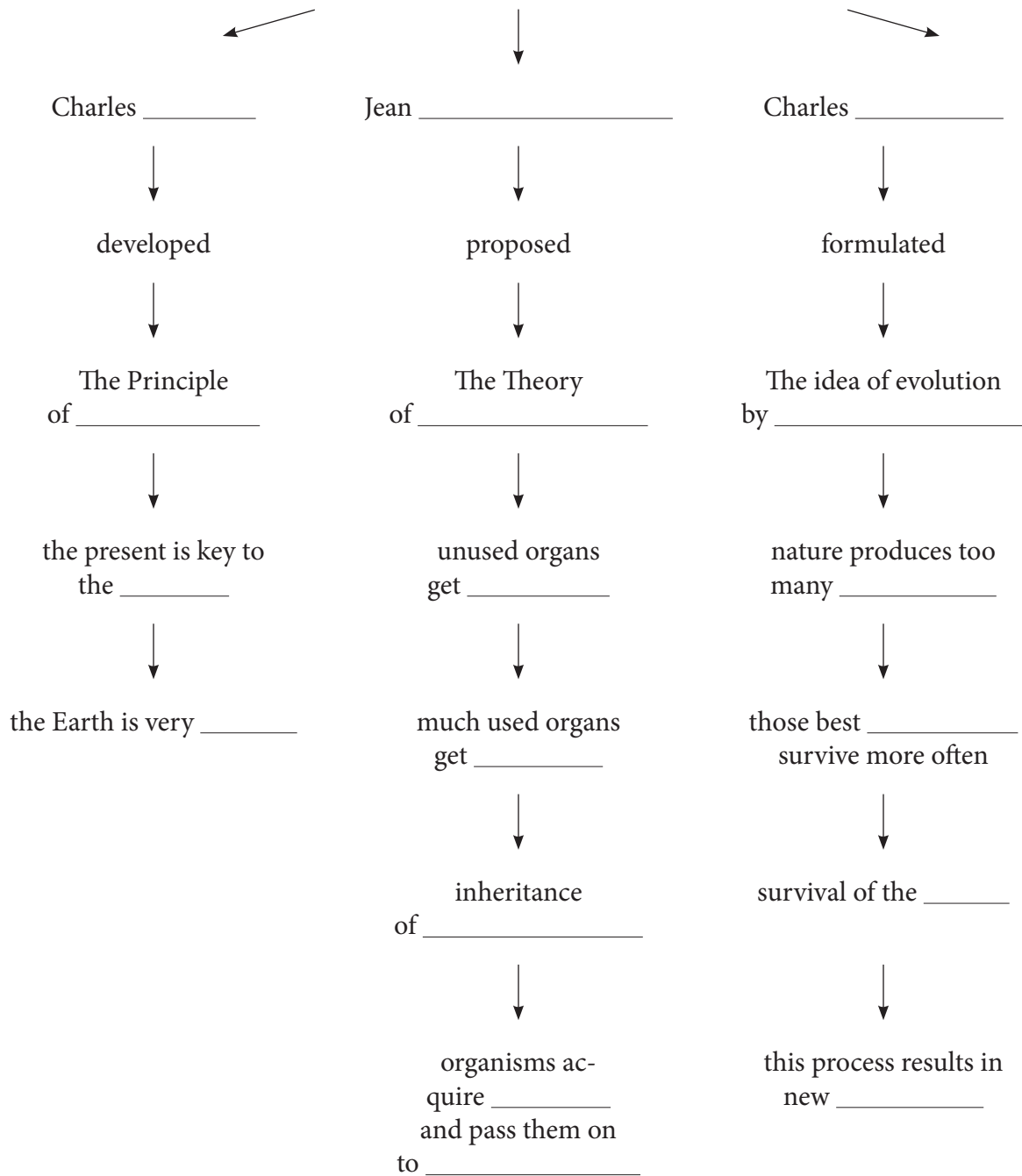
*II. Below are pictured the stages of Meiosis. Label each one correctly.*

					1. _____ 2. _____ 3. _____ 4. _____ 5. _____
1 2	3 4	5 6	7 8	9 10	6. _____ 7. _____ 8. _____ 9. _____ 10. _____

# Concept Map

## History of Evolution

### *Developers of Evolutionary Theory*



## Group Activity

# Geologic Column

This activity is designed to show how geologic column dating works. On the attached sheet is a sample cross section of rock strata. Using the information given you there, demonstrate how some scientists determine the approximate age of the rocks. This cross section does not represent any particular location and the rate of deposition of the sediments is also arbitrary.

### *Materials:*

- ▶ Sample cross section of rock strata
- ▶ Question sheet
- ▶ Calculator—if necessary

### *Procedure:*

1. Looking at the sedimentary rock layers on the rock strata cross section. Which layer was laid down first? How do you know?

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2. You will notice there are several layers of sedimentary rock with an igneous rock intrusion extending through some of the layers. Which occurred first—the deposition of the sedimentary layers or the igneous rock intrusion?

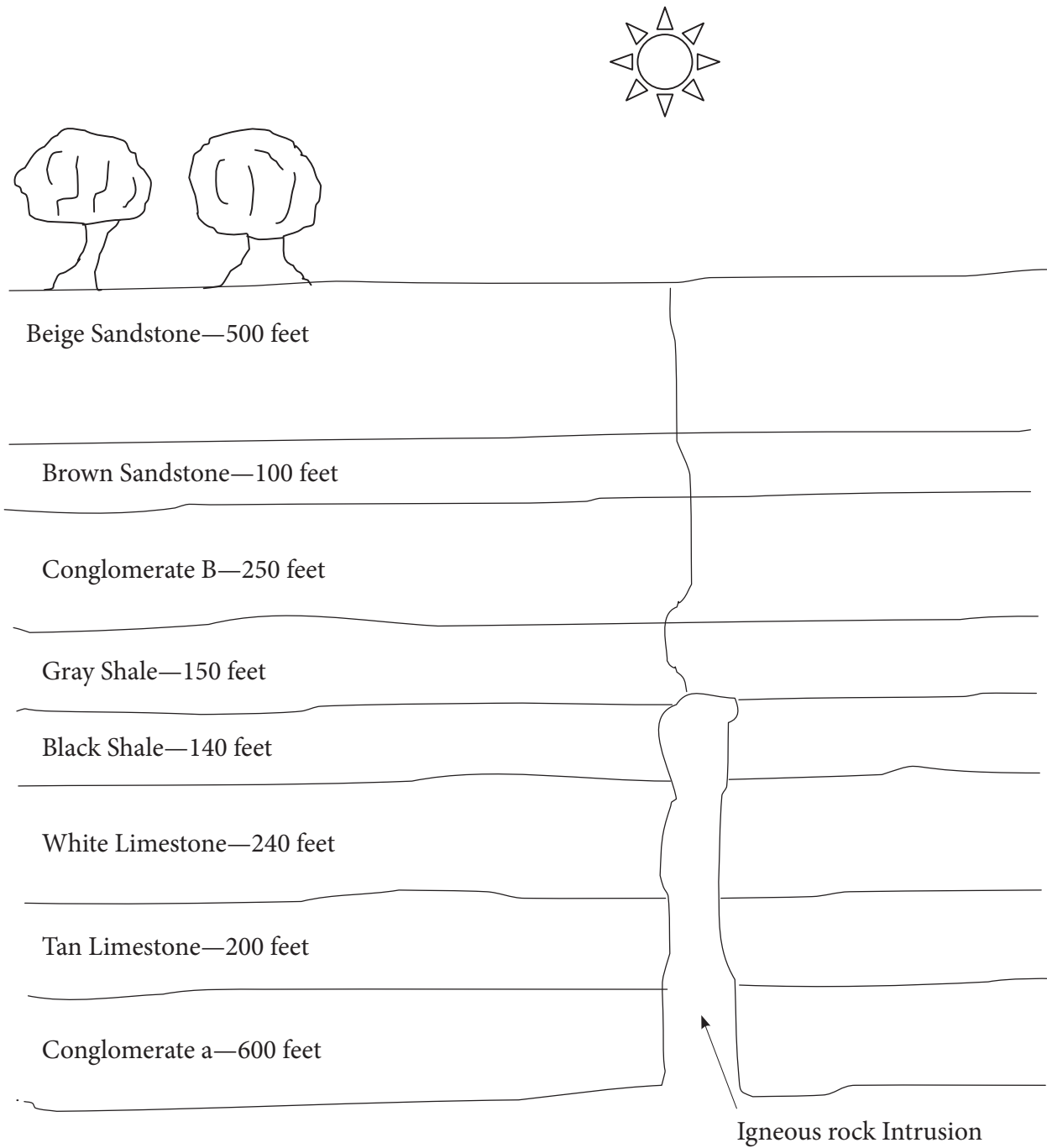
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3. If we had an independent means of dating the igneous rock intrusion, what would we know about the age of the layers through which it extends?

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# Vocabulary

*Use the letters below to fill in the space provided.*

- |                          |                                   |                             |
|--------------------------|-----------------------------------|-----------------------------|
| A. acquired trait        | H. inheritance of acquired traits | N. principle of segregation |
| B. adaptation            | I. meiosis                        | O. principle of uniformity  |
| C. crossover             | J. metamorphic rock               | P. recessive                |
| D. dominant              | K. mutation theory                | Q. sedimentary rock         |
| E. geologic time scale   | L. natural selection              | R. use and disuse of organs |
| F. homologous chromosome | M. principle of dominance         | S. vestigial                |
| G. igneous rock          |                                   |                             |

- \_\_\_\_\_ 1. States that if the factors for an organism's trait are different, one factor may prevent the other from being expressed.
- \_\_\_\_\_ 2. When hybrids are crossed, the recessive factor separates in some of the offspring.
- \_\_\_\_\_ 3. The present is the key to the past.
- \_\_\_\_\_ 4. Random changes in genes provide the genetic variety on which natural selection can work.
- \_\_\_\_\_ 5. Reduced in size and with no apparent function.
- \_\_\_\_\_ 6. Traits that organisms have which help them to survive in their environments.
- \_\_\_\_\_ 7. Rocks formed by heat and pressure.
- \_\_\_\_\_ 8. Organs that are heavily used become more prominent in an organism; those that are not gradually disappear, according to Lamarck.
- \_\_\_\_\_ 9. The organism best adapted to its environment will survive better and reproduce more often.
- \_\_\_\_\_ 10. Traits acquired in one generation can be passed on to the organism's offspring, according to LaMarck.
- \_\_\_\_\_ 11. The process by which a parent's genes are divided and passed on to the offspring.
- \_\_\_\_\_ 12. A new or changed organ developed through adaptation to the environment, according to Lamarck.
- \_\_\_\_\_ 13. One of two chromosomes which carry genes for same trait.
- \_\_\_\_\_ 14. Rock formed from molten material.
- \_\_\_\_\_ 15. The factors that are expressed in an organism.

- \_\_\_\_\_ 16. Rocks formed by rock, plant and animal fragments being pressed or glued together.
- \_\_\_\_\_ 17. A calendar that scientists have developed to try to outline the history of the Earth.
- \_\_\_\_\_ 18. The factors that are not expressed in an organism.
- \_\_\_\_\_ 19. A process in which homologous chromosomes come together and trade genes.

# Review

*I. In the spaces provided, explain what the words have in common.*

1. Igneous, metamorphic, sedimentary

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2. Use and disuse, acquired trait, inheritance of acquired traits

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3. Emus, rheas, finches

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4. Dominant, recessive, principle of segregation

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5. Homologous chromosomes, crossover, 23 pairs

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*II. Following are several false statements. Rewrite each statement to make it true.*

1. Fossils are usually found in metamorphic rock.

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2. An adaptation is a chart of the sedimentary rock layers of the world with their relative ages.

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3. Charles Lyell discovered the principles of heredity.

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4. Evolutionists propose that meiosis provides enough genetic variety for large scale evolution to occur.

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# Test

*Place the letter in the space provided that best completes the sentence.*

*Worth 1 point each*

- \_\_\_\_\_ 1. Most fossils are found in \_\_\_\_\_ rock.
- A. sedimentary
  - B. metamorphic
  - C. basalt
  - D. igneous
- \_\_\_\_\_ 2. According to Lamarck's theory,
- A. evolution was a quick, punctuated process
  - B. traits acquired in one generation would be passed on only if they were in the sex cells
  - C. traits acquired in one generation were passed on to the next generation
  - D. only the fittest survive
- \_\_\_\_\_ 3. Natural selection is a process by which
- A. acquired traits are passed on to the next generation
  - B. organisms well adapted to the environment will survive and reproduce more often than other organisms
  - C. mutations change organisms
  - D. all answers are correct
- \_\_\_\_\_ 4. Two scientists who influenced Darwin were
- A. de Vries
  - B. Redi
  - C. Lyell
  - D. Lamarck
- \_\_\_\_\_ 5. De Vries
- A. wrote a book on populations
  - B. proved the theory of use and disuse
  - C. discovered genes
  - D. proposed that species changed suddenly by mutations
- \_\_\_\_\_ 6. Lyell proposed
- A. the theory of use and disuse
  - B. the principle of uniformity
  - C. the theory of populations
  - D. the mutation theory



- \_\_\_\_\_ 7. Darwin developed much of his theory of evolution by studying
- A. finches
  - B. emus
  - C. rheas
  - D. all of these
- \_\_\_\_\_ 8. Meiosis:
- A. reshuffles existing information
  - B. provides enough variety to go from molecules to man
  - C. does not effect evolution
  - D. none of these
- \_\_\_\_\_ 9. Darwin did much of his research in
- A. Peru
  - B. The United States
  - C. Galapagos Islands
  - D. Tahiti
- \_\_\_\_\_ 10. Organs which appear to be reduced in size and to have no function are said to be
- A. vestigial
  - B. adaptations
  - C. acquired traits
  - D. recessive
- \_\_\_\_\_ 11. Rocks which are formed from fragments of plants, animals and other rocks are
- A. metamorphic
  - B. granite
  - C. gneous
  - D. sedimentary
- \_\_\_\_\_ 12. Recessive genes
- A. are often expressed in an organism's phenotype
  - B. are not usually expressed in an organism's phenotype
  - C. gradually disappear from an organism
  - D. none of these
- \_\_\_\_\_ 13. The process by which a parent's genes are divided and passed on to the offspring is
- A. an acquired trait
  - B. meiosis
  - C. mutation
  - D. adaptation
- \_\_\_\_\_ 14. Dominant genes
- A. are expressed in an organism's phenotype
  - B. are not expressed
  - C. gradually disappear
  - D. none of these
- \_\_\_\_\_ 15. "The present is the key to the past" is
- A. the mutation theory
  - B. the theory of acquired traits
  - C. the principle of uniformity
  - D. the principle of segregation

*Use the letters below to fill in the space provided. Worth 1 point each.*

- |                        |                    |                                     |
|------------------------|--------------------|-------------------------------------|
| A. acquired trait      | E. homologous      | I. principle of dominance           |
| B. adaptations         | F. igneous         | J. principle of segregation         |
| C. crossover           | G. metamorphic     | K. theory of use & disuse of organs |
| D. geologic time scale | H. mutation theory |                                     |

- \_\_\_\_\_ 16. Organs that are heavily used become more prominent in an organism; those that are not gradually disappear.
- \_\_\_\_\_ 17. One of two chromosomes that carry genes for the same trait.
- \_\_\_\_\_ 18. Random changes in genes are the usual way a species changes.
- \_\_\_\_\_ 19. A new or changed organ supposedly developed through adaptation.
- \_\_\_\_\_ 20. States that if the factors (genes) for an organism's trait are different, one factor may prevent the other from being expressed.
- \_\_\_\_\_ 21. Rock formed from molten material.
- \_\_\_\_\_ 22. When hybrids are crossed, the recessive factor separates in some of the offspring.
- \_\_\_\_\_ 23. A calendar developed to try to outline the history of the Earth.
- \_\_\_\_\_ 24. A process in which homologous chromosomes come together to trade genes.
- \_\_\_\_\_ 25. Traits that organisms have that help them to survive in their environment.
- \_\_\_\_\_ 26. Rocks formed by heat and pressure.

*Answer the following questions in complete sentences. Points vary per question*

**1. Give the four parts of Darwin's theory of evolution. (8 points)**

1. \_\_\_\_\_
  2. \_\_\_\_\_
  3. \_\_\_\_\_
  4. \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_

**2. Explain why the principle Lyell developed was so important to a theory of evolution. (2 points)**

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**3. Give the contributions of the following men. (2 points each)**

***A. Weismann***

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***B. de Vries***

---

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## Chapter 2

# Suggestions for Beginning

**B**egin this chapter with a discussion of how information can be changed. You might give an example of a page within this book. If you have time, type a portion of the page on a computer or a sheet of paper. How can it be changed to say something different? Take suggestions as to how it can be made to say something somewhat different.

Your student(s) will no doubt suggest the addition of several sentences to change its meaning. If time permits, write some of these in the margins. After you have completed this, point out that they are adding information and ask if there is another way they can change the meaning of the text. Help them to see that the meaning can also be changed, sometimes dramatically, by simply subtracting words and/or sentences.

Demonstrate by erasing or marking through some key words from the text. You will need to choose a portion of text or some other selection ahead of time and plan carefully in order to demonstrate well. However, this exercise will help them to understand that change does not have to be due to the addition of information. Point out that Chapter 2 will deal with this issue of addition and subtraction of information in the genomes of all species.

It is also good to have a selection of fossils to show your pupil(s). Try to get enough of them to have a sample of each kind. The only one which may be difficult to get is an insect in amber, since these are prized for jewelry. However, your local university may have a few other fossils to spare, if you explain that you are teaching about fossils. These fossils are a valuable teaching tool.

# Sections Question Key

## Section One: The Agents of Evolution

- 1. State an accurate definition of evolution, as given by an evolutionist.*
- 2. Define devolution and evolution. What is the evolutionists' name for devolution?*
- 3. Name and define the six processes believed to interact to cause evolution.*
- 4. Since both creationists and evolutionists agree that these things occur, why do evolutionists and creationists disagree? For example, how does the evolutionists' view of mutations differ from that of creationists'?*
- 5. How does geographic isolation affect genetic isolation in a population? What does it do to the gene pool of separate populations over time?*

6. *How does migration affect the gene pool of a population?*

7. *Define divergent evolution, convergent evolution, and adaptive radiation.*

## **Section Two: Spontaneous Generation**

1. *What element prevents the components of life from combining?*

2. *What elements and compounds did Oparin believe were present in the early atmosphere?*

3. *What would provide the energy needed for these elements and compounds to combine into organic compounds?*

4. *What would these organic compounds then do?*

5. *What do evolutionists believe the first cell (protocell) probably resembled?*

## **Section Three: Miller's Experiment**

1. *What compounds and elements did Miller use in the experiment?*

2. *What provided the energy needed for the chemical reactions to occur?*

3. *What captured the compounds after they were formed?*

4. *What did Miller find in the liquid that was formed?*

#### **Section Four: Two Examples of Evidence for Evolution**

1. *Briefly describe the example of the peppered moth.*

2. *Briefly describe the changes in the Galapagos finches after changes in the weather.*

3. *Define punctuated equilibrium and gradualism? What is the main difference between these two theories?*

#### **Section Five: Evolutionists' Evidence for Evolution from Other Disciplines**

1. *How does comparative embryology seem to support evolution?*

*2. How does comparative homology seem to support evolution?*

*3. Give one example of how comparative biochemistry seems to support evolution.*

### **Section Six: What is a Fossil?**

*1. Name and describe each of the types of fossils described above.*

### **Section Seven: Evolutionists' Evidence from the Fossil Record**

*4. Give an example of a possible link fossil and explain why evolutionists considered it to be one.*

*5. Describe the two fossil series given in the text.*



# Section 1

## Agents of Evolution

Fill in the blanks to explain the processes which are believed to lead to evolution and devolution.

Meiosis and \_\_\_\_\_

plus

\_\_\_\_\_

plus

\_\_\_\_\_

plus

genetic drift

plus

Migration



Devolution

(due primarily to a loss of information)

Meiosis and \_\_\_\_\_

plus

\_\_\_\_\_

plus

\_\_\_\_\_

plus

genetic drift

plus

\_\_\_\_\_



\_\_\_\_\_

(due primarily to a gain of information)

Unscramble the words to fill in the blanks.

1. \_\_\_\_\_ is the elimination of genes from a population due to chance.  
teencig tifrd

2. The “reshuffling of genes that occurs each generation is \_\_\_\_\_ .  
someisi

3. Any time a natural barrier such as a river or mountain range comes between members of a population, \_\_\_\_\_ occurs.  
phocirageg nolasotii

4. \_\_\_\_\_ refers to a change from one type of creature into a different type, due to a gain of genetic information.  
vloetuoin

5. A \_\_\_\_\_ is a spontaneous change in a gene or chromosome.  
tineceg nottimua

6. \_\_\_\_\_ is often defined simply as change over time.  
tuloovein

7. Very small changes within a genus or species are sometimes referred to as microevolution but might be more correctly called \_\_\_\_\_.  
ratiavino

8. \_\_\_\_\_ occurs when population members cannot interbreed.  
neegict lanoositi

9. \_\_\_\_\_ is movement of organisms into or out of a population.  
notigrima

10. When organisms best adapted to their environment survive longer and reproduce more than those less adapted, \_\_\_\_\_ has occurred.  
aturlan noleetsic

11. Scientists call the process of organisms becoming less alike \_\_\_\_\_.  
tivreegdn onutileov

12. This refers to organisms adapting to different environments and becoming less alike. \_\_\_\_\_ is often used almost synonymously with divergent evolution.  
vitedapa nodaitiar

13. Scientists also believe that organisms become more alike as a result of adapting to similar environments. They call this \_\_\_\_\_.  
onrgevcent ovetuniol

14. \_\_\_\_\_ in different organisms are similar in form but evolutionists believe they evolved differently.  
souaangol serrtstucu

## Section 2

# Spontaneous Generation

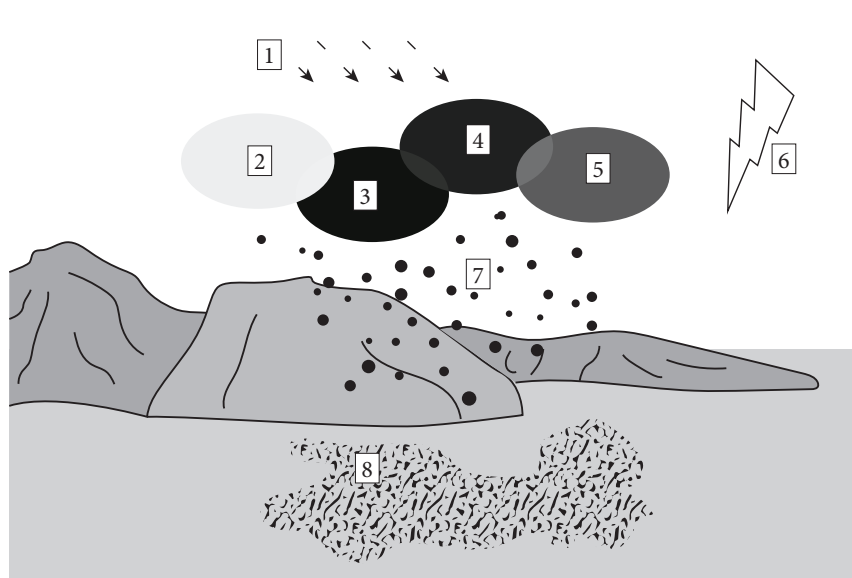
*Oparin's Theory: Use the following terms in the proper locations on the illustration of Oparin's early Earth below.*

methane  
hydrogen  
ammonia

water vapor  
organic soup  
organic molecules

ultraviolet rays  
lightning

*I. Fill in the blanks to make the following true statements according to the text.*



1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_
4. \_\_\_\_\_
5. \_\_\_\_\_
6. \_\_\_\_\_
7. \_\_\_\_\_
8. \_\_\_\_\_

1. Because \_\_\_\_\_ will not form in the presence of \_\_\_\_\_, Oparin knew the atmosphere must be very different from today's atmosphere.

2. The first cell is often called a(n) \_\_\_\_\_.

3. Many scientists believe the first cell resembled a(n) \_\_\_\_\_.

*II. On the back of this page, list the five parts of Oparin's Theory.*

*Oparin's Theory:*

1. The early atmosphere consisted of \_\_\_\_\_  
with no \_\_\_\_\_
2. Energy from \_\_\_\_\_  
\_\_\_\_\_
3. Oparin hypothesized that \_\_\_\_\_ to form an  
\_\_\_\_\_
4. In this soup the \_\_\_\_\_ would gradually combine into \_\_\_\_\_
5. These \_\_\_\_\_ would then combine to form the \_\_\_\_\_

## Section 3

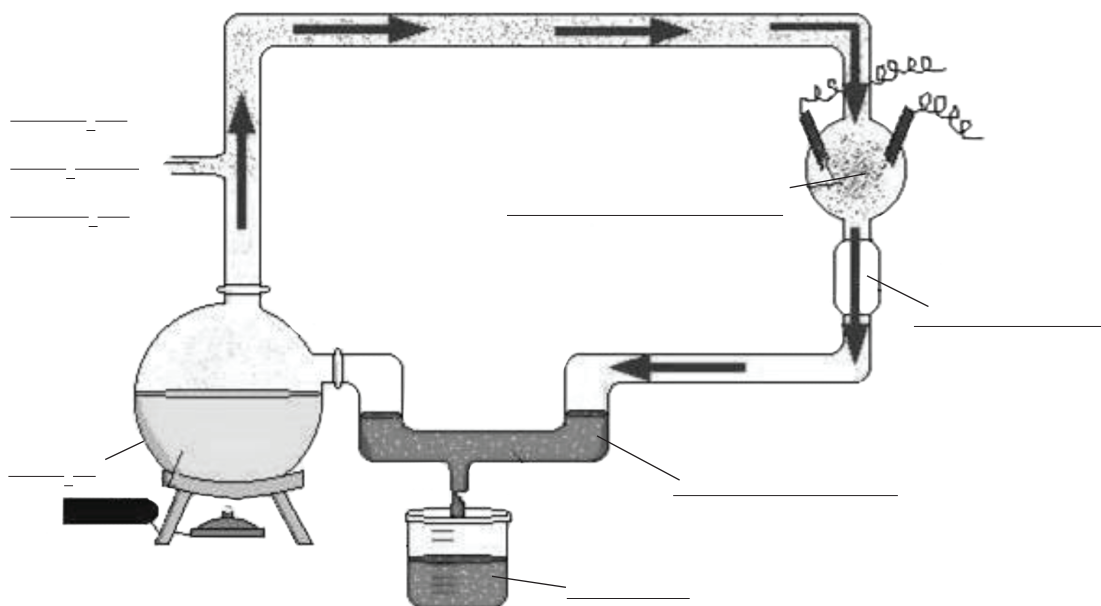
# Miller's Experiment

*Label the following illustration with the proper terms to show the reactants, equipment, and products of Miller's experiment. Use the terms below.*

methane  
spark chamber  
ammonia

water vapor  
amino acids  
trap

hydrogen  
condenser



*Explain the purpose of each of these things below.*

1. Methane, ammonia, hydrogen, water vapor
2. Spark chamber
3. Condenser
4. Amino acids
5. The trap

## Section 4

# Two Examples of Evidence for Evolution

*Use the following words to fill in the blanks of the paragraphs below them. One word will be used three times. Three words will be used twice.*

punctuated equilibrium	up	state
gradualism	fossil record	many
for	against	air pollution
natural selection	birds	abundant
Darwinian	industrial revolution	changes
few	example	intermediate organisms
disadvantage	rapid	millions
predators	tree trunks	lichens
dark	link	blended
length	event	finches
mutation	catastrophic	beak
light	reptiles	macroevolution
peppered moth	moths	environment
eaten	characteristics	

Evolutionists believe that \_\_\_\_\_ occurs primarily because of the interaction of \_\_\_\_\_ and \_\_\_\_\_. A very common example is that of the \_\_\_\_\_. In England in the nineteenth century these moths were \_\_\_\_\_. Most were \_\_\_\_\_ in color, while a small percentage was \_\_\_\_\_. Evolutionists believe that the dark color of these moths was as a result of a genetic mutation. Since the tree trunks were light at that time, the dark colored moths were at a \_\_\_\_\_ if they landed on them. They could be easily seen and \_\_\_\_\_ by \_\_\_\_\_. Natural selection would thus be selecting against them. However, the \_\_\_\_\_ brought \_\_\_\_\_ to the area. The polluted air killed many of the \_\_\_\_\_ which grew on the \_\_\_\_\_ and turned the trunks darker. Now the dark peppered moths \_\_\_\_\_ in while the lighter ones did not.

Over the next several years, natural selection selected \_\_\_\_\_ the light moths and \_\_\_\_\_ the dark moths. The percentage of light \_\_\_\_\_ went down, while the percentage of dark moths went \_\_\_\_\_. Evolutionists point to this \_\_\_\_\_ as

an \_\_\_\_\_ of a beneficial mutation and natural selection working together to cause evolution. They feel that \_\_\_\_\_ beneficial mutations together with natural selection will bring about major change. This particular type of evolution is called \_\_\_\_\_ evolution or \_\_\_\_\_.

Evolutionists also point to the \_\_\_\_\_ of the Galapagos Islands as examples of evolution. The finches show a variation in \_\_\_\_\_ size and \_\_\_\_\_ after changes in the \_\_\_\_\_. The changes in moths and finches occur over a short period of time, but evolutionists believe such changes occurring over much longer periods, with \_\_\_\_\_ and \_\_\_\_\_ at work, would produce the major changes needed for \_\_\_\_\_ to occur.

The process of \_\_\_\_\_ would be very slow, and there would have to be \_\_\_\_\_ of \_\_\_\_\_ fossils. For example, if \_\_\_\_\_ evolved from \_\_\_\_\_ there would have had to be many \_\_\_\_\_ which possessed some \_\_\_\_\_ of both reptiles and birds.

Another theory of evolution is called \_\_\_\_\_. Proponents of this theory \_\_\_\_\_ that \_\_\_\_\_ events led to \_\_\_\_\_ genetic \_\_\_\_\_. Thus, very \_\_\_\_\_ link fossils would survive in the \_\_\_\_\_.

## Section 5

# Evolution Evidence from Other Disciplines

*Define each of the following and tell why evolutionists believe the first four support evolution.*

**1. Comparative embryology**

**2. Comparative biochemistry**

**3. Homologous Structures**

**4. Analogous Structures**

**5. Convergent evolution**



## Section 6

# What Is a Fossil?

*Match the following words with their definitions.*

Fossils

Original Remains

Carbon film fossil

Mold

Imprints

Petrified fossils

Cast

1. \_\_\_\_\_ occur when soft body structures, such as leaves or flowers, are pressed into developing rock and leave an impression of their shape.
2. \_\_\_\_\_ created when minerals gradually replace the hard parts of an organism, such as bones.
3. \_\_\_\_\_—the remains of once living organism.
4. \_\_\_\_\_ occurs when a leaf becomes buried in sediments, and the weight of the upper sediments causes the leaf to turn to carbon.
5. \_\_\_\_\_ occurs when minerals fill in a mold.
6. \_\_\_\_\_ is formed when hard body parts or pieces of wood are completely covered by sediments and then decompose, forming a hollow that is shaped like the original organism.
7. \_\_\_\_\_—larger organisms preserved in ice or tar, which prevents their decay.

**Why do scientists search for, dig up, and examine fossils so carefully?**

## Section 7

# Evidence from Fossil Record

1. Describe Archaeopteryx and explain why evolutionists believe it to be a link fossil between the reptiles and the birds.

2. Briefly describe the proposed whale ancestors.

*Pakicetus*

*Ambulocetus*

*Rodhocetus*

*Basilosaurus*

3. Why are the mesonychids no longer considered the whale's first land ancestor?

Student Name: \_\_\_\_\_ Teacher: \_\_\_\_\_ Period: \_\_\_\_\_

*4. Briefly describe how the five members of the horse series listed in the book are different.*

## Group Activity

# Punnet Square

**Please note: If you have not dealt with Punnet squares in a while, consult your student's high school biology book. There should be a good explanation of Punnet squares in it.**

A *Punnet square* is a chart used to determine possible combinations of genes in the offspring of two organisms. Following is a Punnet Square with letters listed on the side and top. These letters represent three traits found in two imaginary animals we will call "gorks". These gorks have been bred together. Both the male (we will call him Fido) and the female (let's call her Duchess) have dominant and recessive genes for each trait.

The letters across the top represent all the possible gametes which Fido could produce. Along the side are all the possible gametes that Duchess could produce.

C = dark colored coat  
c = light colored coat

N = long nose  
n = short nose

E = long ears  
e = short ears

**Directions:** Fill in the chart by listing all the possible combinations. You will do this by looking first at the letters listed above the column where a particular square is located and then at the letters listed next to the row in which the same square is located. Then combine these letters in the square. Put the dominant letters first for each trait. The second block has been done for you as an example. After you have finished, complete the questions listed on the next page.

	CNE	cNE	CnE	CNe	Cne	cNe	cnE	cne
CNE		CcNNEE						
cNE								
CnE								
CNe								
Cne								
cNe								
cnE								
cne								

*Answer the following questions in complete sentences.*

**1. What does it mean to be heterozygous for a trait? Explain, please.**

**2. The term “genotype” refers to the actual combination of genes in an organism. When you are dealing with three genes only, how many possible genotypes are there? (Hint: What is  $3 \times 3 \times 3$ ?)**

**Now, using colored pencils, lightly color all the squares in the following ways:**

Blue—offspring with long ears, long noses, and dark coats

Yellow—offspring with short ears, long noses, and dark coats

Pink—offspring with long ears short noses, and dark coats

Green—offspring with short ears, short noses, and dark coats

Orange—offspring with long ears, long noses, and light coats

Red—offspring with long ears short noses, and light coats

Violet—offspring with short ears, long noses and light coats

Leave white the offspring with short ears, short noses and light coats

**Remember: Where a gork is hybrid for a trait, the dominant gene will control the trait.**

**3. The term “phenotype” refers to the traits that are actually expressed in an organism. How many different phenotypes are possible when you are dealing with three genes only? Hint: look at the different colors in your Punnet square.**

**4. Once again, where there are dominant/recessive combinations, which gene controls the trait?**

**5. Does this mean the recessive trait gradually disappears from the population?**

**6. What happens to the recessive trait?**

**7. When does the recessive trait show up in the phenotype?**

**8. With humans, how can a blond-haired, blue-eyed child suddenly show up in a family that has had only dark-haired, dark-eyed people for several generations on both sides? (The genes for dark hair and eyes are dominant.)**

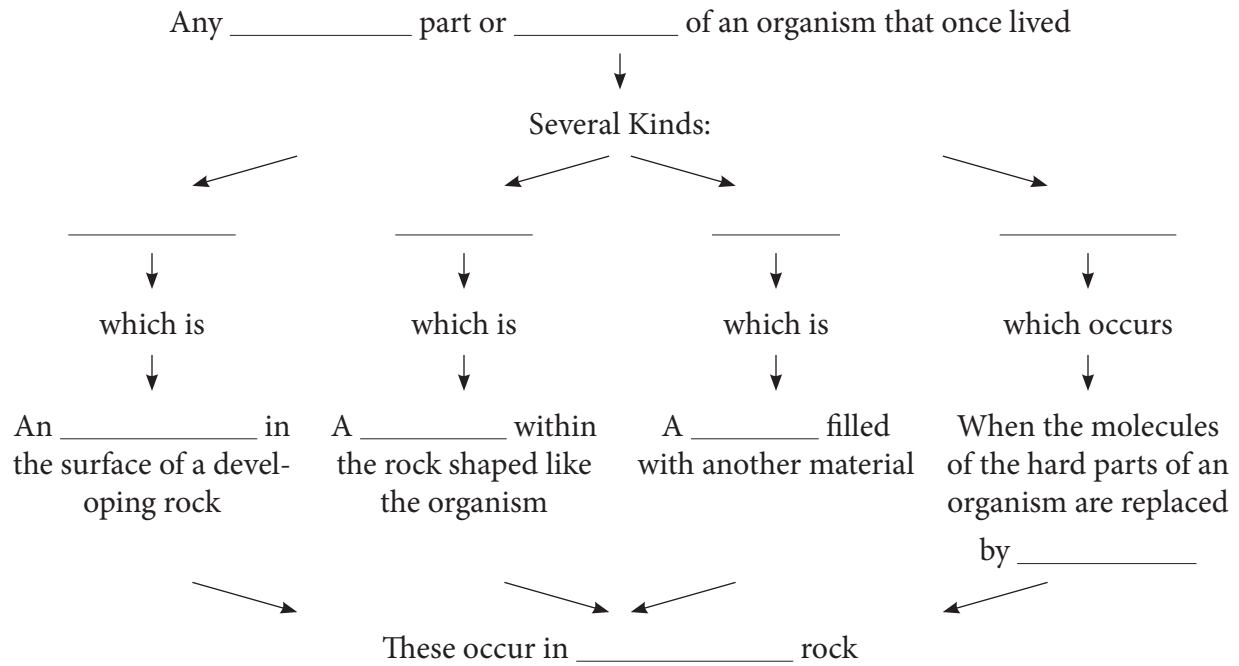
**9. Suppose only one individual carried the recessive genes for light hair and eyes in a family and he never had children. What would happen to the genes for light hair and eyes in that family?**

**10. What would have to happen to return the genes for light hair and eyes to the family mentioned above?**

**Add to this the phenomenon of pleiotropy.**

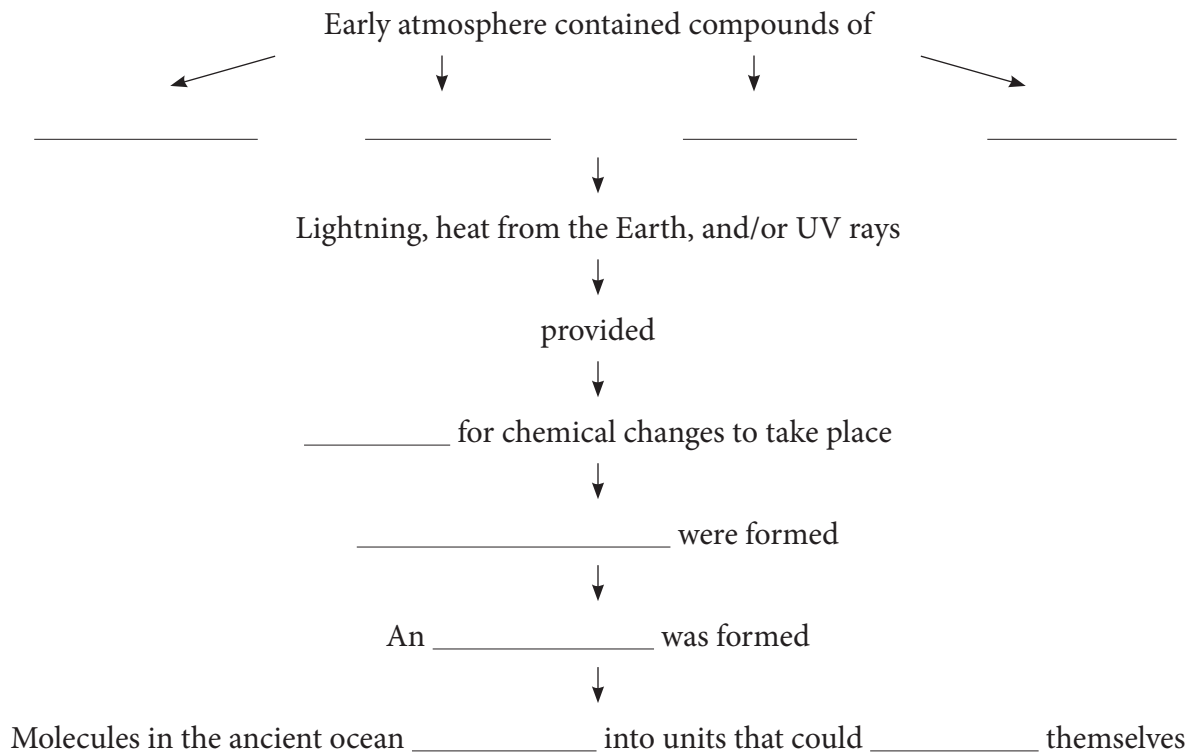
# Concept Map One

## What are fossils?



## Concept Map Two

# Oparin's Theory of chemical evolution





# Vocabulary

*In the spaces provided write in the words that fit the definitions that are given to you. Then use the letters in the highlighted boxes to spell out the answer to the problem below.*

1. A study of the embryos of different species to see in what ways they are alike.

==-----

2. Occurs when populations of the same species cannot interbreed because of geographic barriers such as mountains or wide rivers.

-----==-----

3. Hardened tree sap which traps and preserves insects.

==-----

4. An impression left in a rock formed by soft structures such as leaves or feet before the rock hardens.

-----==-----

5. A cavity within a rock which has been formed by the body of an organism.

-----==-----

6. Formed when hard body parts of a fossil are gradually replaced by minerals and turned into rock.

-----==-----

7. Occurs when members of the same species cannot interbreed—often due to geographic isolation.

-----==-----

8. Deoxyribonucleic acid; the building blocks of life on Earth. It makes up our genetic material and contains all instructions for cell activity and growth which it passes on from generation to generation.

==-----

9. Occurs when plant leaves and sometimes other organisms are buried and decay only partially, leaving much of the carbon from their bodies.

-----==-----

10. The developing form of an organism.

-----==-----

11. He performed a famous experiment to test Oparin's theory.

-----==-----

12. Rapid evolutionary changes in a species, followed by long periods of stability and little change.

\_\_\_\_\_

13. Formed when material fills in a cavity after the body of the organism which formed the cavity decays.

\_\_\_\_\_

14. A protein used in aerobic respiration and present in many different species.

\_\_\_\_\_

15. Body parts of different organisms that have the same basic structure, even though they may be used for different functions.

\_\_\_\_\_

16. The type of nuclear division in which the chromosome number is reduced to one half the original cell; it occurs in the sex cells.

\_\_\_\_\_

17. Formed when organisms become trapped and preserved in tar, ice, or tree sap.

\_\_\_\_\_

18. Movement into or out of a population.

\_\_\_\_\_

19. Considered by some scientists to be a link fossil between reptiles and birds.

\_\_\_\_\_

20. Bacteria which do not require oxygen; believed to have been the first cells on Earth.

\_\_\_\_\_

21. The change in the frequency of different genes in a small population due to chance.

\_\_\_\_\_

22. Change over time, from a single cell to man.

\_\_\_\_\_

23. The first cell on Earth.

\_\_\_\_\_

24. The remains of a once-living organism.

\_\_\_\_\_

25. Any random change in a gene or chromosome.

\_\_\_\_\_

26. Those organisms best adapted to their environment will survive and reproduce more often than those which are not.

\_\_\_\_\_

27. Change in a genus or species due to meiosis, genetic isolation, genetic drift, and natural selection.

\_\_\_\_\_

28. Change which goes beyond the genus; it is believed to be caused by mutation and natural selection. It is also believed to be influenced by genetic isolation and genetic drift.

\_\_\_\_\_

29. He proposed a theory as to how life could have arisen spontaneously on Earth.

\_\_\_\_\_

**This has had a great impact on the scientific communities of the nineteenth and twentieth centuries:**

\_\_\_\_\_



**5. Describe *Archaeopteryx* and explain why evolutionists believe it to be a link fossil between reptiles and birds.**

**6. Name and briefly describe the four proposed whale ancestors described in this book.**

**7. Explain how specimens of the fossil horse series differ.**

**8. How do convergent evolution, divergent evolution, and adaptive radiation differ?**

**9. Explain why the peppered moth is considered by many evolutionists to be a classic example of evolution.**

**10. Why do evolutionists consider the changes in the beaks of the Galapagos finches important?**

# Test

Place the letter in the space provided that best completes the sentence.

Worth 1 point each

- \_\_\_\_\_ 1. Which of the following is a proposed ancestor of the whales?
- |                       |                        |
|-----------------------|------------------------|
| A. <i>Pakicetus</i>   | C. <i>Basilosaurus</i> |
| B. <i>Ambulocetus</i> | D. all of these        |
- \_\_\_\_\_ 2. Hardened tree sap which traps and preserves insects is
- |          |                     |
|----------|---------------------|
| A. mold  | C. cast             |
| B. amber | D. original remains |
- \_\_\_\_\_ 3. Body parts of different organisms that have the same basic structure but are used for different functions are called
- |                 |                  |
|-----------------|------------------|
| A. homologous   | C. analogous     |
| B. evolutionary | D. none of these |
- \_\_\_\_\_ 4. This is created when minerals fill in a cavity after the organism that formed the cavity decays.
- |          |            |
|----------|------------|
| A. Mold  | C. Cast    |
| B. Amber | D. Imprint |
- \_\_\_\_\_ 5. Change within a genus or species due to meiosis, genetic isolation, genetic drift, mutation (loss of information) and natural selection is:
- |                         |               |
|-------------------------|---------------|
| A. evolution            | C. devolution |
| B. geographic isolation | D. mutation   |
- \_\_\_\_\_ 6. Movement into or out of a population is:
- |                      |                  |
|----------------------|------------------|
| A. mutation          | C. genetic drift |
| B. genetic isolation | D. migration     |
- \_\_\_\_\_ 7. This occurs when members of the same species cannot interbreed.
- |              |                      |
|--------------|----------------------|
| A. Migration | C. Meiosis           |
| B. Mutation  | D. Genetic isolation |

- \_\_\_\_\_ 8. He performed an experiment to test a theory of how the first cell was formed.
- |           |             |
|-----------|-------------|
| A. Miller | C. Darwin   |
| B. Oparin | D. de Vries |
- \_\_\_\_\_ 9. An evolutionary theory which states that in the past there were rapid changes in a species, followed by long periods of stability and little change:
- |                           |                  |
|---------------------------|------------------|
| A. gradualism             | C. genetic drift |
| B. punctuated equilibrium | D. both A and B  |
- \_\_\_\_\_ 10. Cytochrome C is:
- |  |   |
|--|---|
| A. a mutant gene                         | C. present in a wide variety of species |
| B. a protein used in aerobic respiration | D. both B and C                         |
- \_\_\_\_\_ 11. This is a hollow cavity in rock formed by the body of a dead organism.
- |         |            |
|---------|------------|
| A. Cast | C. Imprint |
| B. Mold | D. Amber   |
- \_\_\_\_\_ 12. This occurs when plants or plant leaves are buried and decay partially, leaving carbon from their bodies.
- |          |                       |
|----------|-----------------------|
| A. Amber | C. Carbon film fossil |
| B. Mold  | D. Cast               |
- \_\_\_\_\_ 13. The type of nuclear division in which the chromosome number is divided in half.
- |            |                      |
|------------|----------------------|
| A. Meiosis | C. Natural selection |
| B. Mitosis | D. Both A and B      |
- \_\_\_\_\_ 14. It is believed to be brought about primarily by mutation (adding information) and natural selection working together.
- |                  |                  |
|------------------|------------------|
| A. Genetic drift | C. Evolution     |
| B. Devolution    | D. None of these |
- \_\_\_\_\_ 15. He proposed a theory as to how the first cell on Earth could have arisen spontaneously.
- |           |            |
|-----------|------------|
| A. Miller | C. Oparin  |
| B. Redi   | D. Pasteur |
- \_\_\_\_\_ 16. This is often defined as “change over time”.
- |              |                      |
|--------------|----------------------|
| A. Evolution | C. Natural selection |
| B. Mitosis   | D. Genetic isolation |

- \_\_\_\_\_ 17. An impression left in a rock by a leaf or a foot before the rock hardens is:
- A. a carbon film fossil                      C. a mold  
B. a cast    D. an imprint
- \_\_\_\_\_ 18. Bacteria which do not require oxygen; believed to have been the first cells on Earth.
- A. Aerobic                                      C. Mutational  
B. Anaerobic                                  D. Nucleic
- \_\_\_\_\_ 19. A random change in a gene or chromosome is:
- A. meiosis                                      C. mutation  
B. mitosis                                        D. natural selection
- \_\_\_\_\_ 20. Fossils can be trapped and preserved in:
- A. tar    C. tree sap  
B. ice     D. all of these

### Modified True and False

*If, according to the text, the statement is true, circle T. If it is false, circle F and then change the underlined word to correct the statement in the space provided.  
(One point for each correct true answer; two points for each corrected false answer.)*

- T F 1. Change within species or genus due to lost information is devolution.

\_\_\_\_\_

- T F 2. Comparative homology is the study of similarities between embryos.

\_\_\_\_\_

- T F 3. Miller's experiment produced proteins.

\_\_\_\_\_

- T F 4. Comparative biochemistry includes the study of Cytochrome C.

\_\_\_\_\_

- T F 5. According to evolutionists, organisms becoming more alike as a result of adapting to similar environments is an example of divergent evolution.

\_\_\_\_\_



T F 6. According to evolutionists, organisms becoming less alike as a result of adapting to different environments is an example of convergent evolution.

---

T F 7. When the hard parts of a fossil are gradually replaced by minerals and turned to stone, the fossil is referred to as petrified.

---

T F 8. The change in frequency of different genes in a small population due to chance is called genetic isolation.

---

T F 9. Evolutionists call the first cell on Earth the protocell.

---

T F 10. *Natural* selection refers to organisms best adapted to their environments surviving and reproducing more often than those that are not.

---

## Essay Questions

*Instructions: Answer the following questions in complete sentences.*

*Three points per question*

**1. Explain why the peppered moth is considered to be a classic example of evolution.**

**2. Explain Oparin's theory of the development of the first cell. Include the compounds in the early atmosphere, the chain of events, and the assumed results.**

**3. Choose one of the following and why evolutionists believe it supports evolution: comparative biochemistry, comparative embryology, or comparative homology.**

*Comparative biochemistry*

*Comparative embryology*

*Comparative homology*

## Chapter 3

# Suggestions for Beginning

**B**egin this chapter by displaying a large picture of a member of the ape family along with a picture of a teenage girl or boy. (You might also want to use the cover of National Geographic, August, 2002, as an example of the “common ancestor” between these two, but this is not absolutely necessary.) Lead a discussion with your pupil(s), using the following questions.

1. Compare these two pictures. Evolutionists believe that these two “organisms” evolved from a common ancestor. Would you consider this small scale or large scale change? Why?
2. Is it likely this type of change could be brought about primarily by a loss of genetic information?
3. If it is true that they came from a common ancestor, would they consider the differences demonstrated here to be caused primarily by devolution or by evolution?
4. Explain to your student(s) that Chapter 3 is demonstrating the evolutionist position that man and the ape family came from a common ancestor.

# Sections Question Key

## Section One: Important Evolutionary Terms

- 1. Name and define the specialties of the following scientists: paleontologists, paleoanthropologists, geologists.*
- 2. What are different names for paleoanthropologists, out of Africa model, and regional continuity model?*
- 3. Explain the difference between the out of Africa model and the regional continuity model.*
- 4. Define the following terms: primates, bipedalism, hominid, cranial capacity.*

## Section Two: Early Hominids:

- 1. When, where, and by whom was Ardipithecus ramidus found?*  
*A. ramidus*

2. Give three characteristics of *A. ramidus*.

3. To whom is *Ardipithecus kadabba* assumed to be related?

### **Section Three: Early Australopithecines**

1. When, where, and by whom was *A. anamensis* found?

2. How much of the fossil was found? Was it all in the same place?

3. By what method was it dated, and how old is it believed to be?

4. What features does it have which appear to be ape-like, and what features does it have which appear to be human?

5. When, where, and by whom was *A. afarensis* found?

6. How much of the fossil was found? Were all the parts found at the same time and together?

7. Name two characteristics that Johanson believes *A. afarensis* (Lucy) possessed.

## Section Four: Later Australopithecines

1. *When, where, and by whom was Kenyanthropus platyops found?*
2. *Give three characteristics of K. platyops.*
3. *Because K. platyops and A. afarensis appear to have lived at the same time, some paleontologists have changed their minds about how man evolved. What do they now believe?*
4. *How is A. africanus different from A. afarensis?*
5. *What ape-like and human-like characteristics do evolutionists believe A. africanus has?*
6. *The australopithecines are described as bipedal. What does this mean?*

## Section Five: The First of the Genus *Homo*

1. *When, where and by whom was Homo habilis found?*
2. *What does the name Homo habilis mean, and why was the fossil given this name?*

3. *How old is Homo habilis believed to be?*

4. *Name two human characteristics Homo habilis is believed to have possessed.*

### **Section Six: Archaic *Homo sapiens***

1. *Where was the first specimen of Homo erectus found, and why was it given this name?*

2. *What evidence shows some of his behavior to be similar to modern humans?*

3. *Give two characteristics of Homo ergaster that resemble modern humans.*

4. *What do most paleoanthropologists consider H. ergaster to be?*

5. *Give at least two characteristics of Homo heidelbergensis' behavior that resemble that of modern humans.*

6. *What physical characteristics of H. heidelbergensis resemble that of modern humans?*

7. *Why did scientists at first consider Neanderthal to be a link fossil? What changed their minds?*

*8. How were the Neandertals like modern humans, and how long ago were they believed to have lived?*

## **Section Seven: Modern Humans**

*1. Describe the Cro-Magnon.*

*2. What did the Cro-Magnon do that was typical of humans?*

*3. What was the agricultural revolution? When do scientists believe it occurred?*

*4. How did the agricultural revolution help humanity?*

*5. What has happened to the Earth's population since that time?*



## Section 1

# Important Evolutionary Terms

Match the following words with their definitions.

- |                                      |                              |                            |
|--------------------------------------|------------------------------|----------------------------|
| A. geologist                         | F. paleoanthropologist       | J. physical anthropologist |
| B. <i>Australopithecus afarensis</i> | G. regional-continuity model | K. bipedalism              |
| C. primates                          | H. multi-regional model      | L. single origin model     |
| D. out of Africa model               | I. paleontologist            |                            |
| E. link fossil                       |                              |                            |

- \_\_\_\_\_ 1. Many scientists place man, apes, chimpanzees, orangutans, etc. in this taxonomic order.
- \_\_\_\_\_ 2. The remains of a common ancestor between two taxonomic groups.
- \_\_\_\_\_ 3. A scientist who studies rock formations to help determine the history of the Earth.
- \_\_\_\_\_ 4. A proposed link fossil between man and the apes.
- \_\_\_\_\_ 5. Scientists who study fossils of all kinds.
- \_\_\_\_\_ 6. Scientists who study primarily human fossils.
- \_\_\_\_\_ 7. Another name for physical anthropologists.
- \_\_\_\_\_ 8. Proposes that modern man evolved in Africa and then left the continent to replace other, less evolved hominids.
- \_\_\_\_\_ 9. Walking on two legs.
- \_\_\_\_\_ 10. Proposes that groups of *H. erectus* left Africa, dispersed into many areas, and fathered several lines of modern humans.
- \_\_\_\_\_ 11. Another name for the regional-continuity model.
- \_\_\_\_\_ 12. Another name for the out of Africa model.

Answer the following question in complete sentences:

- 1. Explain why it is much harder to believe in the multi-regional theory than to believe in the out of Africa theory.**

## Sections 2 & 3

# Early Hominids & Early Australopithecines

Place the following terms in the proper blank. Read carefully.

<i>Ardipithecus kadabba</i>	bones	4.1
<i>A. afarensis</i>	40%	several
<i>A. anamensis</i>	4.4	3
Ardi	Lucy	disagree
300–350	3.18	jawbone fragments
skull	branches	<i>Ardipithecus ramidus</i>
female	ancestor	jaw
tibia	humans	mandible
bipedal	ground	
chinless	5.6–5.8	

In 1992 in the Afar Depression of Ethiopia paleoanthropologist Timothy White discovered a mandible, some teeth, and some arm \_\_\_\_\_ of a creature he thinks was \_\_\_\_\_. He has dated it at \_\_\_\_\_ million years old and named it \_\_\_\_\_. Nicknamed \_\_\_\_\_, the fossil is believed to be that of an 110 pound \_\_\_\_\_. It had a brain size of only \_\_\_\_\_ cubic centimeters. Dr. White believes the fossil was bipedal on the \_\_\_\_\_ but had a big toe that could grasp \_\_\_\_\_ when climbing trees.

In 1997 members of another group of paleoanthropologists discovered a \_\_\_\_\_, a mandible, some teeth, and several other fragments. These were located in \_\_\_\_\_ sites. White is now proposing that it be classified as a separate species, \_\_\_\_\_. This specimen has been radiometrically dated to be \_\_\_\_\_ million years old.

Some scientists believe the oldest known australopithecine is \_\_\_\_\_ which was discovered by Meave Leakey. Dr. Leakey found a \_\_\_\_\_, an upper \_\_\_\_\_, parts of a \_\_\_\_\_, and skeletal fragments in \_\_\_\_\_ locations. She has dated the bones radiometrically and assigned an age of \_\_\_\_\_ million years to her specimen. Dr. Leakey believes the specimen to be a hominid because the tibia fragments demonstrated bipedalism, while the mandible (lower jawbone) showed the creature was \_\_\_\_\_, an apelike characteristic.

Donald Johanson had found another specimen in 1974. Approximately \_\_\_\_\_ of the skeleton was found. He gave it the scientific name of \_\_\_\_\_ but nicknamed the female skeleton \_\_\_\_\_ after a popular song of the times. Johanson used both geologic time

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scale dating and radiometric dating and assigned it an age of \_\_\_\_\_ million years old. Because he had no complete \_\_\_\_\_ with the skeleton, Johanson returned to Africa in 1992 in order to find one. He found one that he believes belongs to this species. Johanson believes *A. afarensis* to be an early \_\_\_\_\_ of humans, but Mary and Richard Leakey \_\_\_\_\_.

## Sections 4 & 5

# Later Australopithecines & the First of the Genus *Homo*

*In the blanks in front of each phrase, put the names, A. africanus, H. habilis or K. platyops, if the phrase applies to that hominid. Some phrases may apply to two hominids. If so, put both names in the blank. If the phrase does not apply to any of the hominids, put "does not apply" in the blank.*

- \_\_\_\_\_ 1. Was found with artefacts that led evolutionists to believe they were toolmakers.
- \_\_\_\_\_ 2. Scientists believe it had a thumb similar to humans.
- \_\_\_\_\_ 3. Were earliest known hominids.
- \_\_\_\_\_ 4. Consists of a badly abraded skull and partial jawbone.
- \_\_\_\_\_ 5. Found by Louis and Mary Leakey.
- \_\_\_\_\_ 6. Believed to be 1.5 to 2.2 million years old.
- \_\_\_\_\_ 7. Has some features that resemble a chimpanzee.
- \_\_\_\_\_ 8. Is believed to have lived at the same time as *A. afarensis*.
- \_\_\_\_\_ 9. Some scientists believe it was bipedal.
- \_\_\_\_\_ 10. Some scientists consider this specimen to be another species of australopithecine.
- \_\_\_\_\_ 11. Southern ape-man of Africa.
- \_\_\_\_\_ 12. Is believed to have used tools, lived in groups, and eaten meat.
- \_\_\_\_\_ 13. Its condition has caused much controversy.
- \_\_\_\_\_ 14. Name means "handy human".
- \_\_\_\_\_ 15. The skull appears to have been affected by materials entering small holes in the bones and expanding them.
- \_\_\_\_\_ 16. Believed to have lived 2.5–3 million years ago.

## Section 6

# Archaic *Homo sapiens*

*Homo ergaster*, *Homo erectus*, *Homo heidelbergensis*, and *Homo neanderthalensis* are all classified as archaic humans. In the spaces below, compare each specimen in the given area. In some cases, details about a particular specimen may not be in the book. In this case, write "not available" on that line.

### I. Cranial Capacity:

1. *H. ergaster* \_\_\_\_\_
2. *H. erectus* \_\_\_\_\_
3. *H. heidelbergensis* \_\_\_\_\_
4. *H. neanderthalensis* \_\_\_\_\_

### II. Body Size and structure:

1. *H. ergaster* \_\_\_\_\_
2. *H. erectus* \_\_\_\_\_
3. *H. heidelbergensis* \_\_\_\_\_
4. *H. neanderthalensis* \_\_\_\_\_

### III. Use of tools:

1. *H. ergaster* \_\_\_\_\_
2. *H. erectus* \_\_\_\_\_
3. *H. heidelbergensis* \_\_\_\_\_
4. *H. neanderthalensis* \_\_\_\_\_

### IV. Social rituals (human behavior):

1. *H. ergaster* \_\_\_\_\_
2. *H. erectus* \_\_\_\_\_
3. *H. heidelbergensis* \_\_\_\_\_
4. *H. neanderthalensis* \_\_\_\_\_

**Short Answer:**

1. What is the meaning of the term, *Homo sapiens*?
  
2. Why are archaic *Homo sapiens* classified as such? What about their brain capacity—what does that tell you about them?

## Section 7

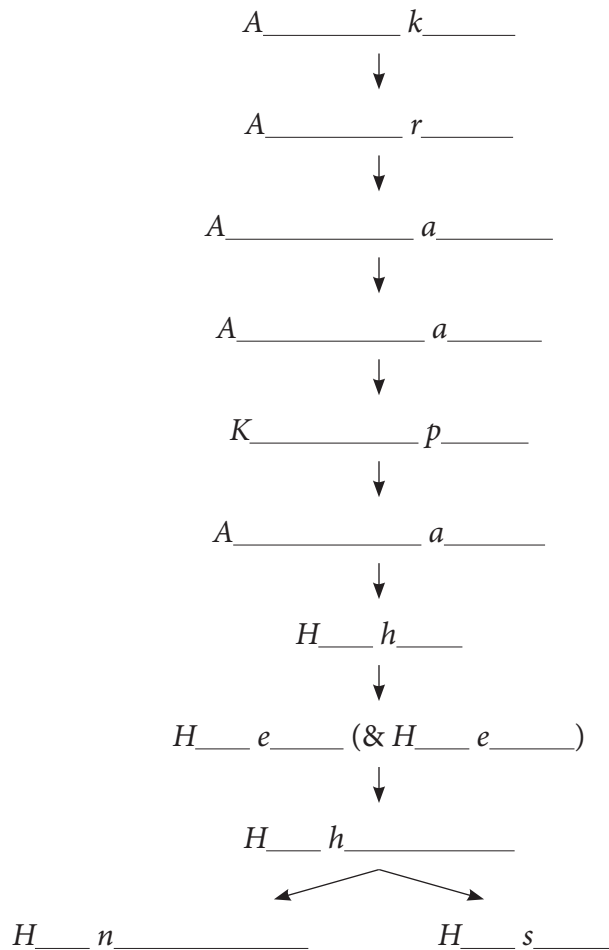
# Modern Humans

Following is a series of statements. If, according to Chapter 3, the statement is true about Cro-Magnon, put a "C" in that column; if it is true of Modern humans, put an "M" in that column. If it does not apply to either group, put a "D" in that column. See if you can figure out the group to whom the "D" column applies.

D	C	M	
			Several specimens had a slightly larger brain capacity than modern humans.
			They produced beautiful cave paintings which showed a great deal about their lives.
			They are considered to have been the first to practise agriculture.
			They were believed to have lived from 130,000 to 35,000 years ago.
			They are believed to be <b>most</b> closely related to modern man.
			They made and used tools.
			They practiced rituals and ceremonies.
			They made war.
			They hunted and also gathered wild plants for food.
			They had thick skulls, with heavy brows and slanting foreheads.
			Some scientists still categorize them as a separate species.
			The first specimen of this group was discovered in a cave in Germany.
			The first skeleton that was found of this group was at first believed to be a link fossil between the apes and humans.
			The first specimens of this group were found in a cave in France.
			The first specimen of this group was an individual who suffered from a disease such as arthritis.
			They had rounded skulls, even teeth, high foreheads, and protruding chins like modern man.
			They are believed to have lived on Earth within the last 40,000–50,000 years.

# Concept Map

## Evolutionary Timeline: Evolution of Man





## Group Activity

# Brainstorming: What Makes a Good Hominid?

### Definition

“A *hominid* is a human-like species, a link fossil between man’s ape-like ancestors and modern humans.”

**Your job is to come up with some basic qualifications that a fossil must possess in order to legitimately and scientifically be considered a hominid.**

Consider the following questions in making your list of qualifications:

1. What *physical characteristics* should a hominid possess?
2. What conditions of discovery should exist before a fossil is considered a legitimate hominid?  
In other words, *where, how, and how much of the fossil should be found?*

### Qualifications:

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_
4. \_\_\_\_\_
5. \_\_\_\_\_
6. \_\_\_\_\_
7. \_\_\_\_\_

# Vocabulary

Match the words with their definitions

A. <i>A. afarensis</i>	K. Hominid	T. Physical anthropologist
B. <i>A. africanus</i>	L. <i>Homo erectus</i>	U. Primates
C. <i>A. anamensis</i>	M. <i>Homo habilis</i>	V. <i>H. ergaster</i>
D. Agricultural revolution	N. <i>Homo sapiens</i>	W. <i>H. heidelbergensis</i>
E. <i>Ardipithecus ramidus</i>	O. Link fossil	X. regional-continuity model
F. <i>Australopithecus</i>	P. Paleoanthropologist	Y. Out of Africa model
G. Bipedal	Q. <i>A. kadabba</i>	
H. <i>K. Platyops</i>	R. <i>H. neanderthalensis</i> (Neanderthals)	
I. Cro-Magnon	S. Paleontologist	
J. Geologist		

- \_\_\_\_\_ 1. Human-like species: considered bipedal with both ape-like and human characteristics.
- \_\_\_\_\_ 2. Humans believed to have lived 130,000 to 35,000 years ago.
- \_\_\_\_\_ 3. The genus and species of modern humans.
- \_\_\_\_\_ 4. Forty percent of skeleton found; nicknamed Lucy.
- \_\_\_\_\_ 5. Discovered by the Leakeys; believed to be 1.5 to 2.2 million years old; “handy human”.
- \_\_\_\_\_ 6. Scientists who study ancient human bones.
- \_\_\_\_\_ 7. Believed to have had a rounded skull and a broad, flat thumb similar to humans.
- \_\_\_\_\_ 8. Physically identical to modern humans.
- \_\_\_\_\_ 9. Discovered by Meave Leakey; believed to have walked upright but also to have been “chinless”; specimen dated radiometrically to be 4.1 million years old.
- \_\_\_\_\_ 10. The genus to which the earliest known hominids may have belonged; some specimens classified in this genus are *A. anamensis* and *A. afarensis*.
- \_\_\_\_\_ 11. Fossil of a creature which is supposed to be intermediate between two groups, such as an ancestor of both apes and man. It possesses some characteristics of each group.
- \_\_\_\_\_ 12. Another term for paleoanthropologist.
- \_\_\_\_\_ 13. A badly abraded skull and a partial upper jaw believed to be between 3.2 and 3.5 million years old.
- \_\_\_\_\_ 14. Studies fossils of all kinds.

- \_\_\_\_\_ 15. Use fossils to study the Earth's history.
- \_\_\_\_\_ 16. The period of time when modern humans turned to farming.
- \_\_\_\_\_ 17. The order in which man and the apes are placed.
- \_\_\_\_\_ 18. Walks on two legs.
- \_\_\_\_\_ 19. Java Man
- \_\_\_\_\_ 20. Discovered by Timothy White; he believes it to be older than the Australopithecines—4.4 million years.
- \_\_\_\_\_ 21. A jawbone fragment, a mandible, some teeth, a collarbone, and some fragments of hand, foot, and arm bones dated between 5.6 million and 5.8 million years old. Believed to have been an ancestor of *Ar. ramidus*.
- \_\_\_\_\_ 22. A model of human evolution that proposes that modern humans evolved in Africa and then came out of the continent and replaced other, less-evolved hominids.
- \_\_\_\_\_ 23. A proposed hominid that was was similar to *H. erectus* but had thinner skull bones and a different brow ridge; believed to have existed between 2 and 1.7 million years ago.
- \_\_\_\_\_ 24. A model of human evolution that proposes that groups of *Homo erectus* left Africa and dispersed into many areas of the old world; then each group fathered a line that gave rise to modern humans.
- \_\_\_\_\_ 25. Is considered to have given rise to two different species: the Neanderthals and modern man. Some specimens have been found that exhibit a broca's cap and other well-developed speech areas.

# Review

*Below are a list of names. After referring to your books (if necessary), give at least four pieces of information about each one. You may use words and phrases.*

**1. *Ardipithecus ramidus*** (Need only two pieces of information for this one)

**2. *Ardipithecus kadabba***

**3. *Australopithecus anamensis***

**4. *Australopithecus afarensis***

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**5. *Kenyanthropus platyops***

**6. *Australopithecus africanus***

**7. *Homo habilis***

**8. *Homo ergaster***

**9. *Homo erectus***

**10. *Homo heidelbergensis***

**11. *Homo neanderthalensis* (Neanderthals)**

## **12. Cro-Magnon**

### **Short answers**

*Answer the following in complete sentences.*

- 1. What is a link fossil? Give an example and tell why it is considered a link fossil.**
  
  
  
  
  
  
  
  
  
  
- 2. Contrast the “out of Africa” model with the “multi-regional model”.**
  
  
  
  
  
  
  
  
  
  
- 3. What is believed to have come first, walking upright or a growth in brain capacity?**
  
  
  
  
  
  
  
  
  
  
- 4. What hampers evolutionary scientists in their search for information on human origins?**
  
  
  
  
  
  
  
  
  
  
- 5. Why are Archaic humans classified as such?**

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**6. Who is believed to have started the agricultural revolution and what effect is it thought to have had on man?**



# Test

## Matching

Use the letters below to fill in the space provided. Two words will not be used.

- |                              |                        |                               |
|------------------------------|------------------------|-------------------------------|
| A. <i>A. afarensis</i>       | F. <i>Ar. ramidus</i>  | K. <i>K. platyops</i>         |
| B. <i>A. africanus</i>       | G. Cro-Magnons         | L. <i>H. ergaster</i>         |
| C. <i>A. anamensis</i>       | H. <i>Ar. kadabba</i>  | M. <i>H. neanderthalensis</i> |
| D. <i>Homo sapiens</i>       | I. <i>Homo erectus</i> |                               |
| E. <i>H. heidelbergensis</i> | J. <i>Homo habilis</i> |                               |

- \_\_\_\_\_ 1. Archaic humans believed to have lived between 130,000 and 35,000 years ago in Central Asia and Europe; had a brain capacity slightly larger than modern humans.
- \_\_\_\_\_ 2. They were identical to modern humans in physical appearance; left beautiful cave paintings.
- \_\_\_\_\_ 3. This hominid got its name because the first specimens were found with tools nearby.
- \_\_\_\_\_ 4. They made and used tools, were hunters, and were the first to use fire.
- \_\_\_\_\_ 5. Modern humans; they are believed to be the first to use agriculture.
- \_\_\_\_\_ 6. This archaic human was similar to *H. erectus* but had thinner skull bones and a different brow ridge.
- \_\_\_\_\_ 7. The best example of this species is a fossil of a female nicknamed Lucy, dated to be 3.18 million years old.
- \_\_\_\_\_ 8. Had a rounded skull, a larger brain capacity than *A. afarensis*, and a thumb similar to humans.
- \_\_\_\_\_ 9. Specimen consists of a mandible, upper jaw and the upper and lower parts of a tibia; has been dated at 4.1 million years old.
- \_\_\_\_\_ 10. Found by Tim White; believed to have been a 110 pound female; dated to be 4.4 million years old.
- \_\_\_\_\_ 11. Believed to be the ancestor of *Ar. ramidus*.

## Multiple Choice

*In the space provided, place the letter of the answer that best completes the sentence.*

- \_\_\_\_\_ 1. The name *Homo habilis* means:
- A. human-like
  - B. handy human
  - C. ape-like
  - D. none of these
- \_\_\_\_\_ 2. Neanderthals are noted for:
- A. using simple tools
  - B. walking upright
  - C. a large brain capacity
  - D. all of these
- \_\_\_\_\_ 3. A scientist who studies many types of fossils to learn about the Earth's history is a:
- A. geologist
  - B. paleontologist
  - C. physical anthropologist
  - D. paleoanthropologist
- \_\_\_\_\_ 4. A scientist who studies primarily human fossils is a(n):
- A. paleontologist
  - B. geologist
  - C. physical anthropologist
  - D. archaeologist
- \_\_\_\_\_ 5. *Homo erectus* appears to be much like modern man because:
- A. he had a brain capacity close to that of modern humans
  - B. he was as large as modern humans
  - C. he had a much smaller brain capacity
  - D. none of these
- \_\_\_\_\_ 6. *Homo erectus* also shows intelligence because:
- A. he used fire
  - B. he made and used simple tools
  - C. he used agriculture
  - D. both A and B
- \_\_\_\_\_ 7. The hominids are believed to have been bipedal. This means:
- A. they were able to do two things at once
  - B. they walked on two legs
  - C. they walked on four legs
  - D. none of these
- \_\_\_\_\_ 8. Humans, along with apes and several other creatures are placed in the order:
- A. primates
  - B. animalia
  - C. diptera
  - D. isoptera

\_\_\_\_\_ 9. *A. africanus* is different from *A. afarensis* because:

- |  |                                      |
|--|--------------------------------------|
| A. he is believed to have had legs like humans | C. he had larger, more rounded skull |
| B. he wore animal skins                        | D. both A and C                      |

\_\_\_\_\_ 10. *A. anamensis* is considered a hominid by its discoverer because:

- |  |   |
|--|---|
| A. she found a complete skeleton   | C. both the mandible and the tibia appeared to be similar to humans |
| B. the mandible she found appeared ape-like, but the tibia she found demonstrated bipedalism | D. she found forty per cent of the fossil                           |

\_\_\_\_\_ 11. Archaic humans are classified as such because:

- |   |                                   |
|---|-----------------------------------|
| A. they are dated to be very old.       | C. their brain capacity is small. |
| B. their facial features are different. | D. they were small in stature.    |

\_\_\_\_\_ 12. In general hominids are:

- |  |   |
|--|---|
| A. considered bipedal but retain some ape-like characteristics | C. considered neither ape-like nor human-like |
| B. very easy to find.  | D. none of these                              |

### True and False

*If, according to the text, the statement is true, circle T. If it is false, circle F and then change the underlined word to correct the statement in the space provided.*

T F 1. Paleontologists and physical anthropologists all study fossils.

\_\_\_\_\_

T F 2. Broca's area of *H. heidelbergensis* indicates it may have used language.

\_\_\_\_\_

T F 3. Evolutionists believe the earliest known hominids belong to the genus Homo.

\_\_\_\_\_

T F 4. *A. afarensis* was dated using both the geologic time scale and radiometric dating.

\_\_\_\_\_

T F 5. Evolutionists generally believe bipedalism came before an increase in brain capacity.

---

T F 6. *A. africanus* is believed to have lived in groups and eaten vegetables.

---

T F 7. The first-discovered specimen of *Homo erectus* is also called Timor Man.

---

T F 8. Several specimens have been found of *Homo erectus*.

---

T F 9. The agricultural revolution is believed to have taken place around 50,000 years ago.

---

T F 10. *Homo erectus* was believed to have begun the agricultural revolution.

---

## Short Answers

Answer the following in complete sentences. Points are listed.

1. What is a link fossil? Define and give an example, explaining why it is considered a link fossil. (2 points)

2. What hampers evolutionary scientists in their search for information on human origins? (4 points)

3. Who is believed to have started the agricultural revolution and what effect is it thought to have had on man? (2 points)

Student Name: \_\_\_\_\_ Teacher: \_\_\_\_\_ Period: \_\_\_\_\_

**4. Contrast the “out of Africa” model with the “multi-regional model.” (4 points)**

# Relativism

Perhaps the greatest challenge you will have in teaching your student(s) about origins is to overcome their acceptance of the relativism that pervades our society. This is especially true if your student(s) have spent any time in a public school and heard evolution taught with deep conviction by their teachers. Many teens have trouble separating fact from theory. It is often difficult for them to think in terms of fact versus opinion in reference to science. Thus, it is well worth the time to have a discussion about the difference between fact and opinion.

Start by asking your student(s) to answer the questions on the next page and give reasons for their position. These should be written answers without your guidance. Save at least twenty minutes for a general discussion of the answers. Use your discussion to help your student(s) to differentiate between fact and opinion and to understand that truth—even scientific truth—is not decided by majority opinion.

**The best place to have this discussion is just before you introduce creationism in Chapter 4.**

## Chapter 4

# Suggestions for Beginning

**B**egin this chapter by showing your student(s) a picture of Miller's experimental apparatus shown in Chapter 4. Explain the purpose of each part of the apparatus, except for the trap. When you come to this part, ask them the following questions.

1. Why do you think the trap is there? (One good suggestion may be that the trap is there to collect the amino acids and examine them. This is one purpose.)
2. However, tell him there is another important reason. Ask your student what he thinks would happen if the amino acids were allowed to continue through the spark chamber again?
3. After discussing some suggestions, Read the following quotation from *Of Pandas and People* (p.4). Read it aloud. Then allow further discussion.

*When a chemist exposes a mix of chemicals to heat or electricity, some compounds may form but others will break down. Since the process of destruction is actually more likely to occur, the net result will be only a small amount of chemical compounds. Those that do form will generally be simple ones, since any complex molecules that might form would quickly break back down to their simpler components.*

Guide your student(s) to an understanding that the spark chamber would be destructive to the compounds after they formed.

4. Ask for suggestions as to where the trap could be in nature. Your student(s) may suggest the ocean or a lake or stream. Accept any seemingly reasonable suggestion. Then inform your student that Chapter 4 is going to deal with this question.

# Sections Question Key

## Sections One and Two: Redi & Pasteur

*1. Name the first individual to challenge the theory of spontaneous generation and describe his second experiment.*

*2. Who finally settled the question of spontaneous generation once and for all? Describe his laboratory experiment.*

*3. Briefly state the principle that came out of this research.*

## Section Three: In the Beginning

*1. Why does the absence of a trap in nature cause problems?*

*2. Why does the presence of other products in the experiment create problems?*



*3. If amino acids could somehow be isolated from the other experimental products, why couldn't they spontaneously form proteins?*

#### **Section Four: Additional Problems**

*1. Why does the spontaneous production of both right- and left-handed amino acids create a problem for the production of proteins?*

*2. What does the exclusive use of left-handed amino acids and right-handed sugars in living things indicate?*

*3. Why would it be difficult for DNA and protein to evolve separately and independently?*

*4. Why would it have been necessary for all the organelles to have been in the first cell?*

#### **Section Five: Photosynthesis**

*1. Briefly describe the structure and function of the parts of a chloroplast.*

*2. What is important about the reactants and the products of the two phases?*

3. *What is the role of enzymes in the 2nd phase?*

### **Section Six: A Reducing Atmosphere**

1. *What is a reducing atmosphere and why was it necessary in order for spontaneous generation to occur?*

2. *What have geologists found that indicates the early atmosphere did contain free oxygen?*

## Section 1

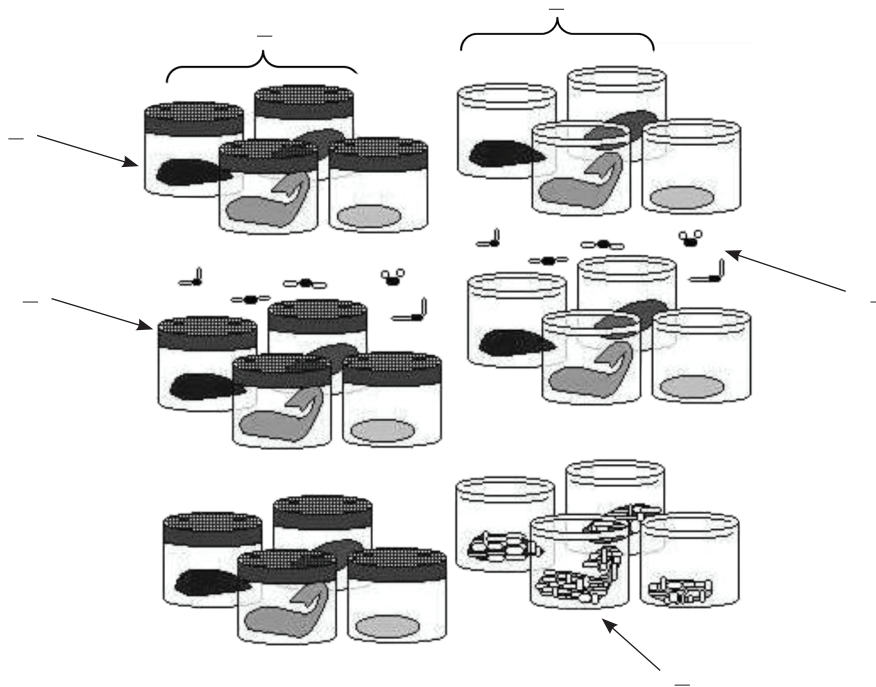
# Francisco Redi

*Below is a picture of the equipment used in Francisco Redi's second experiment. Label the different items for which there is a number. (Use the terms listed below.) Then briefly describe the experiment and how it helped to disprove spontaneous generation.*

1. experimental jars  
2. rotten meat

3. control jars  
4. cloth covering

5. maggots  
6. flies

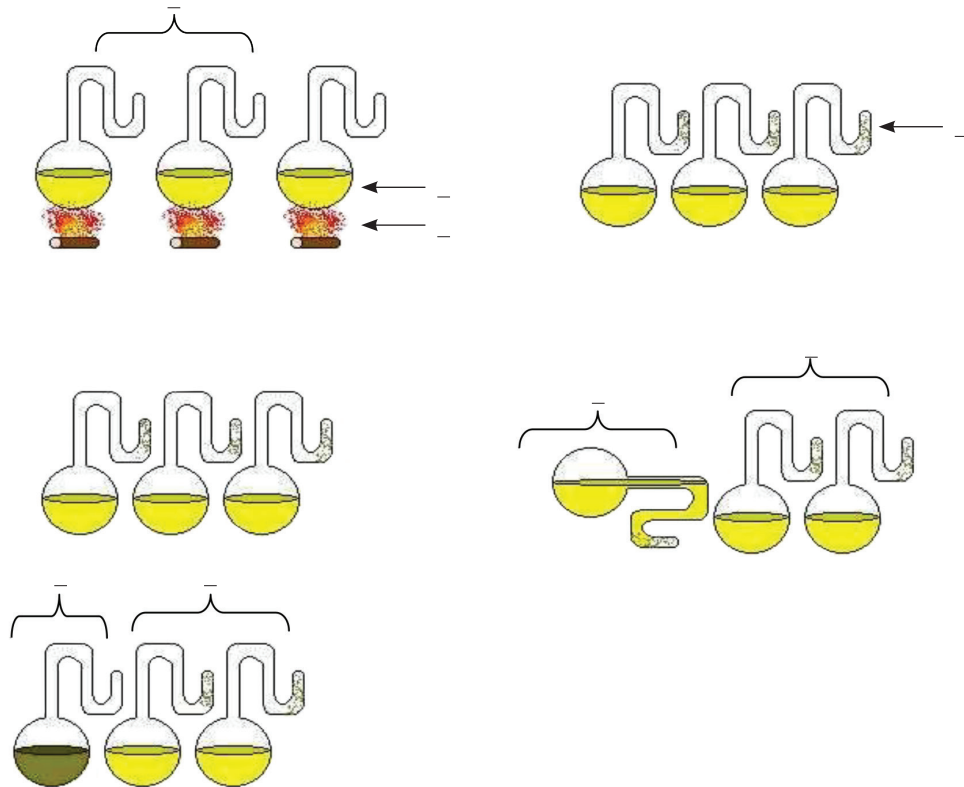


## Section 2

# Louis Pasteur

*Below is a picture of Louis Pasteur's famous experiment disproving spontaneous generation of microorganisms. Please label the picture, using the terms listed below. Then give a brief synopsis of the experiment itself on the lines below. Use the numbers of the terms on the drawing.*

- |   |                    |   |
|---|--------------------|---|
| 1. fire   | 4. broth           | 7. control flasks—second part of experiment     |
| 2. spoiled broth                                | 5. dust            | 8. experimental flask—second part of experiment |
| 3. experimental flasks—first part of experiment | 6. unspoiled broth |   |



Pasteur took several flasks, bent the necks into an S- shape, and filled them with broth. He then boiled the broth to kill all the microorganisms. The flasks allowed air to enter, but the dust in the air was trapped in the neck. No microorganisms formed in the broth, except in one flask that he tipped to allow the dust to mix with the broth.

## Section 3

# In the Beginning

*Correctly use the following words to fill in the blanks below.*

catalysts	proteins	ocean
compounds	combine	stumbling block
cell	failed	isolated
Stanley Miller	ultraviolet rays	theory
destroyed	prevented	upper
dissolve	trap	pre-existing
form	cross reactions	
Alexander Oparin	nature	

In the early part of the twentieth century a man named \_\_\_\_\_ developed a \_\_\_\_\_ about how the first \_\_\_\_\_ could have formed. However, he \_\_\_\_\_ to consider several things. This became apparent when \_\_\_\_\_ conducted his famous experiment. First of all, Miller's apparatus had a \_\_\_\_\_ to protect the amino acids that formed from being \_\_\_\_\_ by the energy that produced them. There is no trap in \_\_\_\_\_. The \_\_\_\_\_ could not serve as one because ultraviolet rays penetrate water.

Another theory was that the sun's \_\_\_\_\_ could have provided the energy to form amino acids in the \_\_\_\_\_ atmosphere. However, the UV rays would also break them down again, even if they reached the ocean. Thus, the absence of a trap is a major \_\_\_\_\_ to spontaneous generation.

It is much more difficult to see how \_\_\_\_\_ could have formed from amino acids even if an organic soup were created. Miller's experiment produced many other \_\_\_\_\_ besides amino acids. The amino acids would have been much more likely to \_\_\_\_\_ with these other substances than with each other. These \_\_\_\_\_ would have \_\_\_\_\_ the spontaneous formation of proteins.

In addition, if the amino acids were somehow \_\_\_\_\_ from the other products of the organic soup, proteins still would not \_\_\_\_\_. Water is the last place any organic chemist would try to make proteins, because water drives the reaction in the opposite direction. In addition to many other agents, enzymes are necessary for proteins to form. Without enzymes to act as \_\_\_\_\_, proteins cannot be produced. Since enzymes are also proteins, this means it takes \_\_\_\_\_ proteins to make other proteins.

## Section 4

# Additional Problems

*Fill in the blanks by unscrambling the words beneath them.*

One of the major problems with Oparin's \_\_\_\_\_ is one of \_\_\_\_\_.  
reotyh peedenninretdec

A true cell must have \_\_\_\_\_ in its nucleus in order to direct its \_\_\_\_\_ and  
NAD tiacsivtie

replication. However, before DNA can be formed, there must be pre-existing \_\_\_\_\_  
tnsropie

which are necessary in its \_\_\_\_\_. On the other hand, in order for a protein to  
doorpircun

be \_\_\_\_\_, there must be DNA to guide its formation.  
demfor

In much the same way, the cell's individual \_\_\_\_\_ are \_\_\_\_\_ upon  
eelorganls tedenenpd

each other for their purpose.

A third problem is that of \_\_\_\_\_ \_\_\_\_\_. When amino acids  
fomunir tatoniorein

were formed in Miller's experiment, they were produced in two types, \_\_\_\_\_  
tefl-dedanh

and \_\_\_\_\_. Yet living things use exclusively \_\_\_\_\_ amino acids.  
thirg-naddeh telf-dedanh

On the other hand, living things use only \_\_\_\_\_ sugars. Who did the sorting in  
thirg-naddeh

nature? Each of these problems points to the need of an \_\_\_\_\_ \_\_\_\_\_  
teligenint gerndesi

guiding the development of the first cell.

## Sections 5 & 6

# Photosynthesis and a Reducing Atmosphere

*I. In the spaces below put the term that best suits the statement following it.  
One answer will be used twice.*

- \_\_\_\_\_ 1. The two phases of this process produce  $O_2$  and carbohydrates.
- \_\_\_\_\_ 2. The small structures within the chloroplast; hold chlorophyll.
- \_\_\_\_\_ 3. These are released into the atmosphere during photosynthesis' 1st phase.
- \_\_\_\_\_ 4. These absorb light energy.
- \_\_\_\_\_ 5. Products of photosynthesis' 1st phase; used in 2nd phase.
- \_\_\_\_\_ 6. Products of photosynthesis' 2nd phase; used in 1st phase.
- \_\_\_\_\_ 7. In this cycle enzymes use energy from ATP, together with  $NADPH_2$  and  $CO_2$  and water from the air, to make simple carbohydrate molecules.
- \_\_\_\_\_ 8. Specialized proteins needed for highly specialized jobs in this process.
- \_\_\_\_\_ 9. This would have little or no oxygen.
- \_\_\_\_\_ 10. This has been found in deep layers of rock; points to the presence of free oxygen in the atmosphere when the rock was being deposited.
- \_\_\_\_\_ 11. This makes spontaneous generation of life on earth impossible.

### Short answer

*Answer the following questions in complete sentences.*

- 1. What important fact about the two phases of photosynthesis make the process an important piece of evidence against evolution?**

**2. What is the role of enzymes in the 2nd phase?**

**3. What important fact about enzymes also make them strong evidence against evolution?**

**4. What further statement did Clemmey and Badham make that also reduces the possibility of a reducing atmosphere on the early earth?**



## Group Activity Guide

# Spontaneous Generation

The aim of this activity is to demonstrate how impossible it would be for nature's use of exclusively left-handed amino acids and right-handed sugars to have occurred by blind chance. I selected poker chips simply because they are easily and cheaply obtained. You can also use marbles or make some cardboard examples of left-handed and right-handed amino acids. The only prerequisite is that each piece be identical except in color. They especially must **feel** the same.

# Group Activity

## Blind Chance

### Background:

Evolutionists will tell you that every living thing that exists on the Earth is a result of “blind chance.” They believe every protein that makes up these living things also came about in the same way. You have read that when Miller did his first experiment, he discovered that left- and right-handed forms of the different amino acids were produced in a roughly fifty/fifty ratio, as expected from chemical laws. Left-handed and right-handed amino acids are mirror images of each other. Yet living things use only left-handed amino acids. The opposite is true with sugars. Although sugars occur in both left- and right-handed forms, nature uses only right-handed sugars.

Could nature have come upon this system by chance? Today, we are going to try an experiment to see if “blind chance” is that effective. In this experiment you will be using poker chips to represent amino acids. Choose one color to represent left-handed and the other color to represent right-handed amino acids. With these “amino acids” you will be building a “protein” of only twenty amino acids.

### Materials:

- ▶ twenty each of two different colored poker chips, well mixed up in a flat container **These chips must be identical in every way except for color.** One color will represent left-handed and one color will represent right-handed amino acids.
- ▶ material for an **effective** blindfold
- ▶ small container containing at least 15 **extra** chips of each color
- ▶ smaller, empty container to hold the amino acids of your “protein”
- ▶ scientific calculator

### Procedure:

1. Choose one member of your group. This person must be willing to be totally blindfolded. Do a good job of covering his or her eyes. **NO PEEKING!**
2. Count the number of each color of chips in your flat container; make sure there are twenty of each color. Mix them up thoroughly.
3. Have your blindfolded student reach into the container and pick a chip. **Do not tell him what color he has chosen.**
4. Take the chip from him and place it in the smaller, **empty** “protein” container and set it aside.
5. **Then, before he has a chance to pick another chip,** replace the chip taken from the flat container with a chip of the same color from your supply of **extras**. You will now have twenty of each chip once again. Mix the chips thoroughly and have your blindfolded student choose another chip.

6. Place that chip in the protein container also, and then repeat the procedure until your student has chosen twenty chips from the large container. **Remember to place another chip of the same color in the large container each time one is chosen.**

**Questions:**

1. What does your blindfolded student represent?
  
2. Did the two of you produce a “protein” of entirely one color of chip?

**Answer the following questions, using your calculator wherever necessary.**

**3. What are the odds against his drawing the same color:**

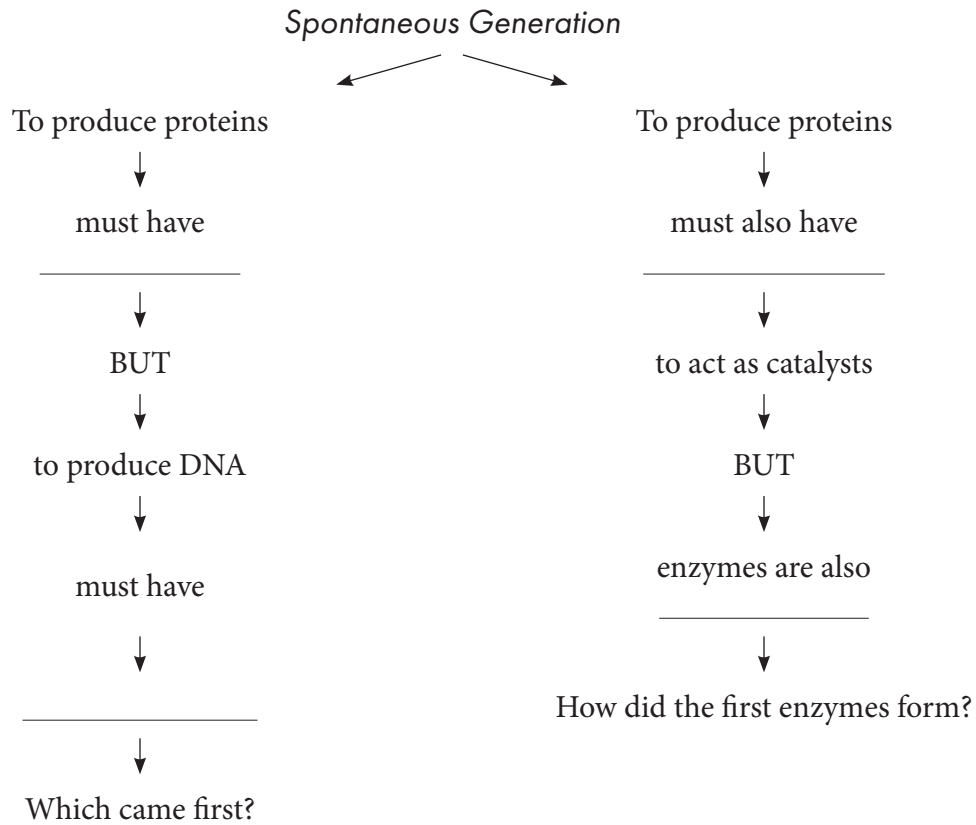
- 5 times in a row? \_\_\_\_\_
- 10 times in row? \_\_\_\_\_
- 15 times in a row? \_\_\_\_\_
- 20 times in a row? \_\_\_\_\_

4. As you can see, the odds were pretty much stacked against your choosing a mere 20 of the same color chips in a row. In a sense, choosing only chips of the same color is like picking only left-handed amino acids out of a large mixture of both left- and right-handed amino acids. *However, a protein of 100 amino acid units is considered small.* Calculate the odds against blind chance picking 100 left-handed amino acids out of a “soup” consisting of equal amounts of both right- and left-handed amino acids. Write as many numbers as your calculator is capable of giving you, or perhaps you might write it in terms of powers.

5. According to your text, what happens to a protein if even one incorrect amino acid is inserted into it?

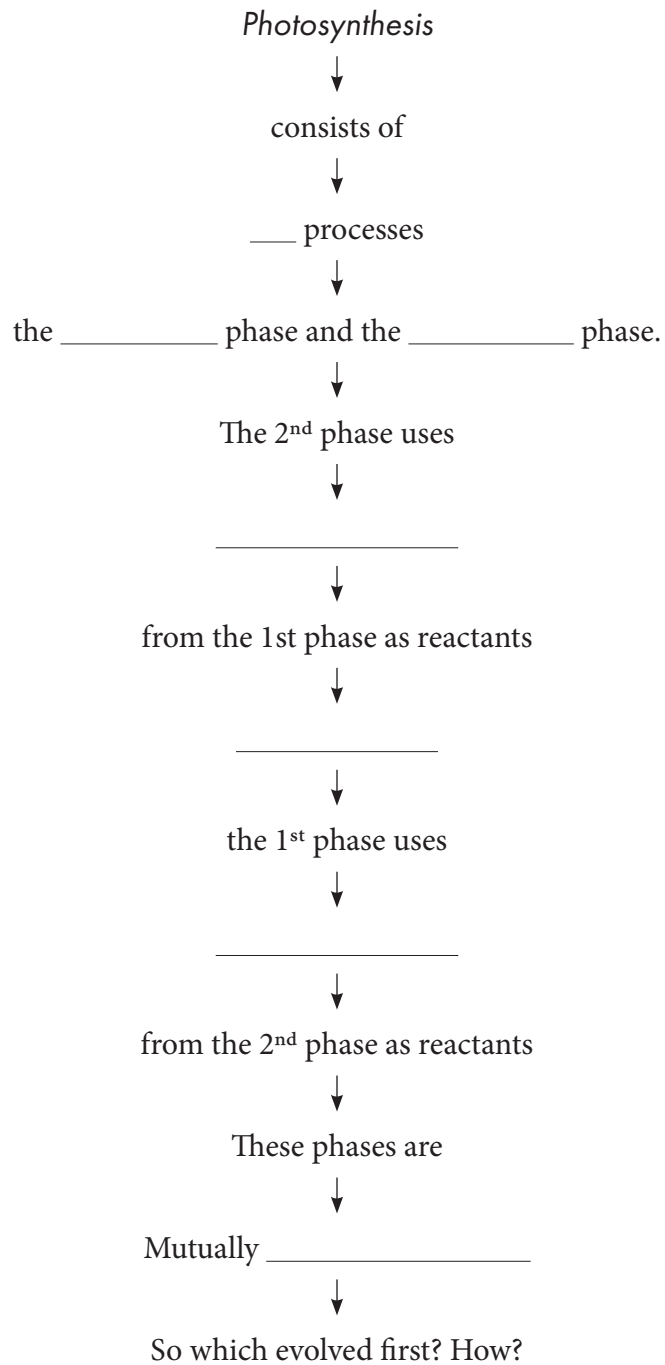
# Concept Map One

## Spontaneous Generation

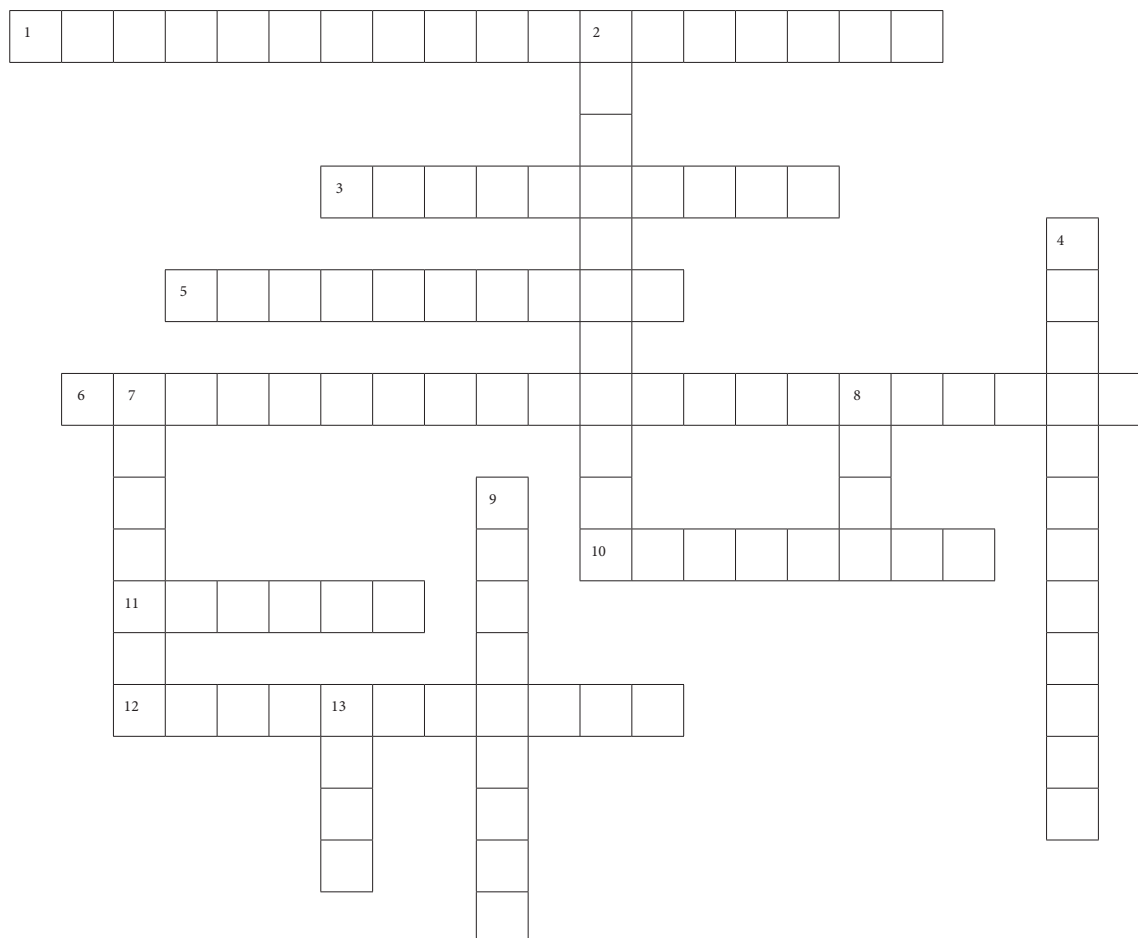


## Concept Map Two

# Spontaneous Generation



# Vocabulary Crossword Puzzle



## Across

1. Oparin said the early Earth had this. (*Two words*)
3. These are the only kind of amino acids living things use. (*Two words*)
5. This states that all living things must come from other living things: the principle of?
6. This has been disproved by science. (*Two words*)
10. These cannot spontaneously arise from amino acids.
11. Besides energy, this must be present for amino acids to combine into proteins.
12. These are the only kind of sugars living things use. (*Two words*)

## Down

2. This is supposed to have been where the first cell was formed. (*Two words*)
4. The powerhouses of the eukaryotic cell.
7. The French scientist who disproved the spontaneous generation of microorganisms.
8. The Italian scientist who disproved spontaneous generation of maggots from rotten meat.
9. A structure that performs a specific function within a cell.
13. Miller's experiment had this; nature does not.

# Review

## Modified True and False

*If, according to the text, the statement is true, circle T. If it is false, circle F and then change the underlined word to correct the statement in the space provided.*

T F 1. Francisco Redi was a French scientist who disproved the spontaneous generation of microorganisms.

---

T F 2. The principle of biogenesis states that living things can come only from other living things.

---

T F 3. Stanley Miller developed a theory about how the first cell could have spontaneously developed.

---

T F 4. Proteins have arisen spontaneously from amino acids in experiments.

---

T F 5. Amino acids are more likely to combine with other amino acids.

---

T F 6. Without enzymes to act as catalysts, proteins do not form.

---

T F 7. Living things use only right-handed amino acids.

---

T F 8. Living things use only right-handed sugars.

---

T F 9. The cell's individual organelles have no purpose without the presence of the other organelles.

---

T F 10. Miller's experiment produced only left-handed amino acids.

---

T F 11. The two phases of photosynthesis are mutually dependent on one another.

---

T F 12. The chemical reactions necessary to form proteins occur easily.

---

T F 13. A reducing atmosphere would have little or no free oxygen.

---

T F 14. The 2<sup>nd</sup> phase of photosynthesis requires several enzymes.

---

T F 15. Organic molecules will react with each other in the presence of free oxygen.

---

T F 16. Photosynthesis is a relatively simple process.

---

T F 17. Louis Pasteur was an Italian scientist who proved that maggots could not arise spontaneously from rotten meat.

---

## Short Answers

*Answer the following questions with complete sentences  
(with the exception of number 3).*

### 1. Describe Redi's second experiment



- 2. How did Pasteur disprove spontaneous generation of microorganisms?**
  
  
  
  
  
  
  
  
  
  
- 3. What did Stanley Miller's experimental apparatus contain that is absent in nature?**
  
  
  
  
  
  
  
  
  
  
- 4. Why is this (see #3) so important?**
  
  
  
  
  
  
  
  
  
  
- 5. Give two reasons why it would be impossible for proteins to arise spontaneously in Oparin's "organic soup".**
  
  
  
  
  
  
  
  
  
  
- 6. What important fact about DNA and proteins makes it impossible for them to have evolved independently?**
  
  
  
  
  
  
  
  
  
  
- 7. What important fact about the organelles of the cell makes it impossible for them to have evolved independently?**
  
  
  
  
  
  
  
  
  
  
- 8. What does nature's use of only left-handed amino acids and right-handed sugars indicate?**
  
  
  
  
  
  
  
  
  
  
- 9. Why couldn't photosynthesis have easily evolved?**
  
  
  
  
  
  
  
  
  
  
- 10. What does the presence of oxidized iron in very old rocks indicate, and why is this important?**

# Test

## Multiple Choice

*Place the letter in the space provided that best completes the sentence. Each question is worth one point.*

- \_\_\_\_\_ 1. Louis Pasteur helped to disprove spontaneous generation by:  
A. showing that maggots could not arise spontaneously from rotten meat  
B. demonstrating that microorganisms could not arise spontaneously  
C. testing Oparin's theory  
D. none of these
- \_\_\_\_\_ 2. Francisco Redi helped to disprove spontaneous generation by:  
A. Boiling beef broth in a jar  
B. performing an experiment on amino acids  
C. showing that maggots could not arise spontaneously from rotten meat  
D. helping Stanley Miller test Oparin's theory
- \_\_\_\_\_ 3. In the experiment on rotten meat, maggots formed  
A. in all the jars  
B. in none of the jars  
C. in the covered jars only  
D. in the uncovered jars only
- \_\_\_\_\_ 4. In the experiment on beef broth, microorganisms formed  
A. only in the flasks contaminated by dust  
B. in all the flasks  
C. in none of the flasks  
D. only in the flasks uncontaminated by dust
- \_\_\_\_\_ 5. "Living things can come only from other living things" is  
A. the principle of biogenesis  
B. the second law of thermodynamics  
C. a description of spontaneous generation  
D. none of these
- \_\_\_\_\_ 6. Oparin's theory:  
A. attempted to explain the principle of biogenesis  
B. attempted to explain Stanley Miller's experiment  
C. took into account all the chemical processes of life  
D. attempted to explain how spontaneous generation of the first cell could take place

- \_\_\_\_\_ 7. Stanley Miller attempted to test Oparin's theory, but the experimental apparatus contained one thing not present in nature. This was:
- |                     |                  |
|---------------------|------------------|
| A. a condenser      | C. a trap        |
| B. an energy source | D. a heat source |
- \_\_\_\_\_ 8. The ocean could not protect amino acids because
- |  |                     |
|--|---------------------|
| A. the sun's ultraviolet rays could still destroy them | C. neither of these |
| B. other chemicals would destroy them                  | D. both A and B     |
- \_\_\_\_\_ 9. In order to form proteins from amino acids \_\_\_\_\_ are absolutely necessary.
- |                 |                  |
|-----------------|------------------|
| A. lactic acids | C. UV rays       |
| B. enzymes      | D. none of these |
- \_\_\_\_\_ 10. Enzymes are:
- |             |                        |
|-------------|------------------------|
| A. proteins | C. inorganic molecules |
| B. sugars   | D. proteinoids         |
- \_\_\_\_\_ 11. One major difficulty with Miller's experiment is that it
- |   |   |
|---|---|
| A. had no available heat source                                 | C. had no way to turn the gases back into liquids |
| B. produced a great deal of other compounds besides amino acids | D. produced only left-handed amino acids          |
- \_\_\_\_\_ 12. In an organic soup the amino acids would be more likely to combine with
- |                      |                  |
|----------------------|------------------|
| A. other amino acids | C. proteins      |
| B. other substances  | D. none of these |
- \_\_\_\_\_ 13. Nature uses exclusively:
- |                            |                                       |
|----------------------------|---------------------------------------|
| A. right-handed sugars     | C. left- and right-handed amino acids |
| B. left-handed amino acids | D. both A and B                       |
- \_\_\_\_\_ 14. Photosynthesis could not evolve because:
- |  |   |
|--|---|
| A. It has one phase that is very complicated                     | C. both its phases are very complicated |
| B. It has two phases which are mutually dependent on one another | D. both B and C                         |

- \_\_\_\_\_ 15. Without a trap, amino acids that were produced would:
- A. combine to form proteins
  - B. combine with other substances
  - C. be destroyed by the energy that formed them
  - D. be unaffected
- \_\_\_\_\_ 16. Oparin's theory stated that the early Earth had a reducing atmosphere. This was absolutely necessary because:
- A. Organic molecules will not combine in the presence of free oxygen
  - B. DNA requires free oxygen in order to combine
  - C. the organic soup had to be protected from the sun's UV rays
  - D. water vapor was not important to his theory

## Matching

*Use the letters below to fill in the space provided. (One point each)*

- |                          |                            |                           |
|--------------------------|----------------------------|---------------------------|
| A. A reducing atmosphere | E. Organelles              | I. Proteins               |
| B. Amino acids           | F. Organic soup            | J. Right-handed           |
| C. Left-handed           | G. Photosynthesis          | K. Spontaneous generation |
| D. Mitochondria          | H. Principle of biogenesis | L. Trap                   |

- \_\_\_\_\_ 1. Structures that perform specific functions within the cell.
- \_\_\_\_\_ 2. The powerhouses of eukaryotic cells.
- \_\_\_\_\_ 3. Living things arising from non-living compounds.
- \_\_\_\_\_ 4. A structure to protect amino acids from energy.
- \_\_\_\_\_ 5. The only kind of sugars living things use.
- \_\_\_\_\_ 6. The only kind of amino acids living things use.
- \_\_\_\_\_ 7. The first cell is supposed to have formed in this.
- \_\_\_\_\_ 8. These have never been spontaneously produced in a laboratory experiment.
- \_\_\_\_\_ 9. This contains little or no oxygen.
- \_\_\_\_\_ 10. This states that living things can come only from other living things.
- \_\_\_\_\_ 11. These were one of the products in Miller's experiment.
- \_\_\_\_\_ 12. This is a very complicated process; scientists can offer no explanation of how it could have evolved.

## Essay Questions

*Answer the following questions with one or more complete sentences. Points vary per question.*

- 1. What important fact about DNA and proteins makes it impossible for them to have evolved independently? (2 points)**
  
- 2. What does the presence of oxidized iron in very old rocks indicate, and why is this important? (2 points)**
  
- 3. Give two reasons why it would be impossible for proteins to arise spontaneously from Oparin's "organic soup." (4 points)**
  
- 4. Why couldn't photosynthesis have easily evolved? (2 points)**

## Chapter 5

# Suggestions for Beginning

Show a picture of Ernst Haeckel's drawings of embryos. Any secular high school biology textbook will have them. Or you may use the top half of Figure 5-1. Ask your student(s) the following questions and write his answers on a sheet of paper:

**1. Do these drawings appear to give good evidence for evolution? Why?**

Your student(s) will probably respond that they look alike, and appear to be much the same size, even though they are of widely different species.

**2. What kind of facts would make this "evidence" seem false?**

Spend some time discussing this with your student(s). Some of the things that should come up are as follows:

- A. The drawings being false
- B. The sizes of the embryos being different
- C. The shapes of the embryos being different
- D. The parts of the embryos growing into different things as adults

Explain to your student(s) that the true facts about comparative embryology will be explained to him in Chapter 5, along with information about the other so-called evidences for evolution.

# Sections Question Key

## Section One: Genetics

1. *DNA has been described as highly compressed information. What problem does this create for evolutionists?*
2. *The presence of editing enzymes also presents a problem for evolutionists. What is it?*
3. *What is pleiotropy? How common is it?*
4. *What did Hardy and Weinberg's research prove? Why is this a problem for evolutionists?*
5. *How many genetic mutations are believed not to be harmful? Are all of these beneficial?*
6. *It has been estimated that five beneficial genes would have to occur at the same time to cause a change in an organism. Why do some scientists think this makes it impossible for mutations to be the source of new genes for macroevolution?*

*7. To what does mutation generally lead—the gain or the loss of genetic information?*

*8. Name two other things mutation can cause.*

## **Section Two: Comparative Embryology**

*1. What did Ernst Haeckel do to create support for evolution?*

*2. What happened to his drawings?*

*2. Who discovered that there was something wrong with the drawings in current comparative anatomy books? How did he prove it?*

*3. Name two parts of the human embryo which evolutionists once thought were vestigial structures and describe their actual uses.*





## Section Five: Examples of Evolution in Action

*1. What do the examples of the peppered moth and the Galapagos finches actually demonstrate?*

## What Does the Evidence Show?

*1. For what do each of the sciences mentioned above actually provide evidence?*

## Section 1

# The Scientific Facts—Genetics

*Match the following terms with the statements describing them. One blank will require four answers.*

- |                           |                     |                        |
|---------------------------|---------------------|------------------------|
| A. 5 beneficial mutations | F. Gene frequencies | K. Pleiotropy          |
| B. Adenine                | G. Guanine          | L. Start & stop codons |
| C. Chromosomes            | H. Genes            | M. Thymine             |
| D. Cytosine               | I. Mutations        | N. Watson & Crick      |
| E. DNA                    | J. Nucleotide       | O. Codon               |

- \_\_\_\_\_ 1. The “punctuation” of DNA.
- \_\_\_\_\_ 2. This is made up of a base, a sugar molecule and a phosphate group.
- \_\_\_\_\_ 3. The “sentences” of DNA.
- \_\_\_\_\_ 4. These are composed of proteins and DNA.
- \_\_\_\_\_ 5. The phenomenon of a gene affecting more than one organ system.
- \_\_\_\_\_ 6. These tend to remain stable over long periods of time.
- \_\_\_\_\_ 7. The odds of this occurring in the same organism are one in one thousand billion.
- \_\_\_\_\_ 8. The “language” of life.
- \_\_\_\_\_ 9. Mistakes in the genetic code.
- \_\_\_\_\_ 10. They discovered the structure of DNA.
- \_\_\_\_\_ 11. The four bases of DNA.
- \_\_\_\_\_ 12. The “words” of DNA.

### Short Answers

*Answer the following questions in complete sentences.*

- 1. How can DNA most accurately be described?**

- 2. What is pleiotropy? How common is it? Give an example.**
  
  
  
  
  
  
  
  
  
  
- 3. What important fact about genetic stability did the Hardy–Weinberg Principle disclose?**
  
  
  
  
  
  
  
  
  
  
- 4. What is the problem with mutations providing the genetic variety for evolution?**
  
  
  
  
  
  
  
  
  
  
- 5. How is devolution primarily achieved—through the addition or loss of genetic information?**
  
  
  
  
  
  
  
  
  
  
- 6. How must evolution be primarily achieved—through the addition or loss of genetic information?**

## Section 2

# Comparative Embryology

*Use information from the text to fill in the blanks.*

Evolutionists often cite information from \_\_\_\_\_ as proof that evolution has occurred. Most biology books show pictures of \_\_\_\_\_ of different \_\_\_\_\_ drawn at the same stage of \_\_\_\_\_. These pictures look amazingly \_\_\_\_\_. However, there is a major problem. These drawings are \_\_\_\_\_. They are the result of the \_\_\_\_\_ work of a man named \_\_\_\_\_. He took drawings of the embryos of various species and \_\_\_\_\_ them to make them look more \_\_\_\_\_. When other scientists confronted him, he did not apologize or correct his work. The drawings \_\_\_\_\_ for over twenty years then reappeared in a comparative anatomy book. Since that time, they have continued to be \_\_\_\_\_ in books teaching \_\_\_\_\_.

However, Michael Richardson, at that time an \_\_\_\_\_ and teacher at St. George's Hospital in London, noticed something was \_\_\_\_\_. He assembled a panel of \_\_\_\_\_ to photograph embryos of the same species and at an \_\_\_\_\_ comparable to that depicted by Haeckel. The embryos look remarkably \_\_\_\_\_.

It is also true that corresponding parts of embryos of different \_\_\_\_\_ often do not develop into \_\_\_\_\_ body parts. For example, because of Haeckel's deception, the neck portion of the human embryo is still called \_\_\_\_\_. However, no slits are ever present in the human embryo. This area, more correctly called \_\_\_\_\_ pouches, develops into the \_\_\_\_\_ tonsils, the middle ear canals, the \_\_\_\_\_ and the \_\_\_\_\_ glands.

Other parts of the human embryo have been compared to the embryos of different species. Scientists sometimes consider these parts vestigial (useless) because they do not play the same role in the human embryo. For example, the \_\_\_\_\_ has often been cited as vestigial in humans, a "leftover" part from our \_\_\_\_\_ with the \_\_\_\_\_. However, the yolk sac actually produces \_\_\_\_\_ until the bone marrow can take over this function. The so-called \_\_\_\_\_ tail is nothing more than the end of the \_\_\_\_\_ before the \_\_\_\_\_ begin to grow. Comparative embryology gives little support to evolution.

## Section 3

# Comparative Homology

*In the blanks at left, put an "X" next to the statements that agree with the book. Leave the other statements blank.*

- \_\_\_\_\_ 1. Homology is used selectively by evolutionists.
- \_\_\_\_\_ 2. Evolutionists believe the arms and legs of man evolved from the pectoral fins of fish.
- \_\_\_\_\_ 3. If evolution is true, man's arms and legs had to have evolved independently from two different types of fins to form structures with identical patterns.
- \_\_\_\_\_ 4. The same pentadactyl pattern exists in the front and hind legs of many vertebrates.
- \_\_\_\_\_ 5. Homologous parts of embryos always develop into the same types of structures in adults.
- \_\_\_\_\_ 6. Structures which are considered homologous in adults of various species often develop from nonhomologous parts of their embryos.
- \_\_\_\_\_ 7. The kidney in fish and amphibians develops from the same embryonic tissue as the kidneys of reptiles and mammals.
- \_\_\_\_\_ 8. Homologous organs in insects are often developed in radically different ways.
- \_\_\_\_\_ 9. The genes that control homologous structures are always found on the same chromosomes in different species.
- \_\_\_\_\_ 10. Pleiotropy is an argument against evolution.
- \_\_\_\_\_ 11. Because of the phenomenon of pleiotropy, non-homologous genes are involved in the expression of so-called homologous structures.
- \_\_\_\_\_ 12. Evolutionists believe the hind legs of vertebrates (or man's legs) evolved from the pelvic fins of fish.
- \_\_\_\_\_ 13. Evolutionists use hind legs as examples of homologous structures.
- \_\_\_\_\_ 14. Charles Darwin defined homology as the "relationship between parts which results from their development from corresponding embryonic parts".
- \_\_\_\_\_ 15. Using Darwin's definition, there appear to be many homologous structures.

## Section 4

# Comparative Biochemistry

*Circle the term that correctly completes the sentence.*

1. Comparative biochemistry is often mentioned as supporting (*evolution, devolution*).
2. Cytochrome C is a protein involved in the production of (*nitrogen, energy*).
3. Cytochrome C occurs in (*few, many*) organisms.
4. Evolutionists point out that man's cytochrome C is (*close to, very different from*) that of a monkey.
5. Other research has revealed that the different species could be classified using Cytochrome C, and they fell into (*very different, the same*) categories than they did using Linnaeus's method.
6. Indisputable transitional or intermediate classes are (*very common, completely absent*).
7. If all organisms evolved from bacteria, the percentage of difference in the Cytochrome C of bacteria and insects should be (*greater than, smaller than*) the difference between the Cytochrome C of bacteria and humans.
8. In reality, the difference in the Cytochrome C of bacteria and insects is (*almost the same as, much smaller than*) that of bacteria and humans.
9. According to cytochrome C research, (*no, several*) species (*is, are*) intermediate to others.

*In the blanks provided, write in the percentage of difference between bacteria and the other organisms.*

bacteria \_\_\_\_\_ human  
 bacteria \_\_\_\_\_ bird  
 bacteria \_\_\_\_\_ reptile  
 bacteria \_\_\_\_\_ amphibian  
 bacteria \_\_\_\_\_ jawless vertebrate

bacteria \_\_\_\_\_ fish  
 bacteria \_\_\_\_\_ insect  
 bacteria \_\_\_\_\_ plant  
 bacteria \_\_\_\_\_ yeast

## Section 5

# Evolution Examples and What the Evidence Shows

*I. The peppered moth and the Galapagos finches have an important thing in common. What is it?*

The changes in the peppered moth and the Galapagos finch populations both demonstrate minor variations caused by natural selection acting on their existing gene pools. They remain moths and finches.

*II. Why do creationists think genetics supports creation?*

DNA is a language, complete with sentences, synonyms, and editors. Something this complex does not arise by accident. It is extremely accurate. Then there is pleiotropy which is the influence of a gene over structures not under their immediate control. How could this have evolved? The Hardy Weinberg research showed that gene frequencies tend to remain stable over long periods of time. Yet evolution requires a great deal of change. Mutations cause the loss of genetic information not its gain. Yet evolution requires the gain of massive amounts of genetic information.

*III. For the following section you will need to look back at Chapter 2 as well as Chapter 4 to do the exercise. Following are the names of four "sciences" that evolutionists cite as support for evolution. Under the term, evolutionist, state briefly why they think it supports their position. Under the term, creationist, state briefly why creationists think it does not.*

### **1. Comparative Embryology**

*Evolutionist*

*Creationist*

### **2. Comparative Homology**

*Evolutionist*



Student Name: \_\_\_\_\_ Teacher: \_\_\_\_\_ Period: \_\_\_\_\_

*Creationist*

### **3. Comparative Biochemistry**

*Evolutionist*

*Creationist*

## Group Activity

# The DNA Code

**D**NA is the living blueprint that directs the development of all organisms. The purpose of this activity is to show a *simplified* model of how DNA and its messenger RNA work.

DNA is very similar to Morse code, which operates using a series of dots and dashes to represent letters. However, DNA uses groups of three bases. These are called triplets. Because there are four bases in DNA—cytosine, thymine, adenine, and guanine—there are 64 possible triplets—AAA, AGT, AGC, GTC, and so forth. These triplets are the “letters” of DNA. They are used to “write” out the instructions for creating the next generation. This replication is incredibly accurate. Nevertheless, mistakes can occasionally occur. However, the cell has specialized enzymes whose function is to “proofread” and repair these errors. Thus, the error rate is kept extremely low—only one per billion nucleotides. DNA triplets are also used to direct the production of the cell’s needed proteins from the twenty amino acids. During this second process, the double strands of DNA separate. Then each base on the DNA strand pairs up with its RNA partner (See Figure 1). Once all the RNA bases are in place and attached to each other, they separate from the DNA strand and move into the cell’s cytoplasm with the “written instructions” for making proteins out of amino acids. There are 64 possible triplets of RNA. These triplets are called *codons*. Below is a chart with each RNA base written on the top and on both sides. Use this information to write in each codon in the boxes given you. The first box has been done for you as an illustration. In determining the letters in each triplet, *start with the top row (marked 1<sup>st</sup> base), then the left side (marked 2<sup>nd</sup> base) and finally the right side (marked 3<sup>rd</sup> base).*

→ 1 <sup>st</sup> Base	G	A	U	C	3 <sup>rd</sup> Base
↓ 2 <sup>nd</sup> Base G 3 <sup>rd</sup> Base →	GGG GGA GGU GGC				G A U C
A					G A U C
U					G A U C
C					G A U C

You have just written all the possible triplet combinations that code for amino acids. Some of these codons are “synonyms” which code for the same amino acid. Each amino acid has at least two triplet combinations that code for it. Some amino acids, such as leucine, have as many as six different triplets that are able to produce it. However, suppose we used only **half** the possible RNA triplet combinations and set them up to code for letters of the alphabet instead of amino acids. Then you would be able to use the DNA and RNA codes to translate a message from DNA to English. This is what you are going to do next.

### Procedure:

**1. Below is a DNA sequence. Using a pencil, break the sequence into triplets by putting a diagonal slash (/) after every three letters.**

G C C T T G C C C G G G C T A A A C G G G C C C G G G C T G C C C T A C T A T C C T  
G T A A T G C A T A A C A G A G G G G T A C T A T A T C T A T T G A C T G G G G T A  
C C C T T G A C T C A T C C C A C T C C T T G G

**2. Use Figure 1 to “translate” the DNA into RNA (working from *left to right*). For example GCC in DNA code would “translate” into CGG in RNA code.**

RNA code:

---



---



---

**3. Use the information in Figure 2 to “translate” the RNA into English. Do this by finding the first letter of the triplet across the top of the chart. For example, if the mRNA codon is CGG, the C indicates that the English letter they want is in the fourth column.**

**4. Next, find the second letter of the codon on the left side of the chart. For example with CGG, the G tells you that the English letter is in the first row. You now know that the letter you want is in the fourth column of the second row.**

**5. Finally, use the last G of CGG and go to the right of the chart to tell you which letter you need from that box. In this case, the letter is “D.” Thus, the DNA triplet, CGG is translated here to mean “D.”**

**6. Put the English translation of the RNA triplet code (from #2) on the lines below.**

IF ENOUGH TIME REMAINS, DO THE FOLLOWING:

7. Now that you have “deciphered” the DNA code, reverse the process. Write a simple sentence in English *on a separate sheet of paper*.

8. Use *Figure 2 (next page)* to “translate” the English letters of your sentence into the RNA code. Put your RNA code on the paper with your English sentence.

9. Finally, use *Figure 1 (next page)* and work from right to left to “translate” the RNA code into the DNA code on the lines below on this page. Once you have completed this translation, hand your lab to your parent/teacher and have him translate the message you have written, using the same method you used. Then compare your answer to his.

DNA sentence:

---

NOTE: Harvard University recently translated a book into DNA and then translated it back into English. They wanted to see if this would work. It did. DNA can store information so much more efficiently and take up so little space! In your cells, the information density is 1,000 terabytes per cubic millimetre (Tb/mm<sup>3</sup>). Outside the constraints of the cell, the storage capacity could be million Tb/mm<sup>3</sup>.

**Use the chart below to translate the DNA code into the RNA code.**

*Figure 1*

DNA	RNA
Cytosine (C)	Guanine (G)
Thymine (T)	Adenine (A)
Adenine (A)	Uracil (U)
Guanine (G)	Cytosine (C)

**Use the chart below to translate the RNA code into English. In determining the English letters represented by each triplet, start with the top row (marked 1st base), then the left side (marked 2nd base) and finally the right side (marked 3rd base) to determine which of the two letters in the box is the correct one.**

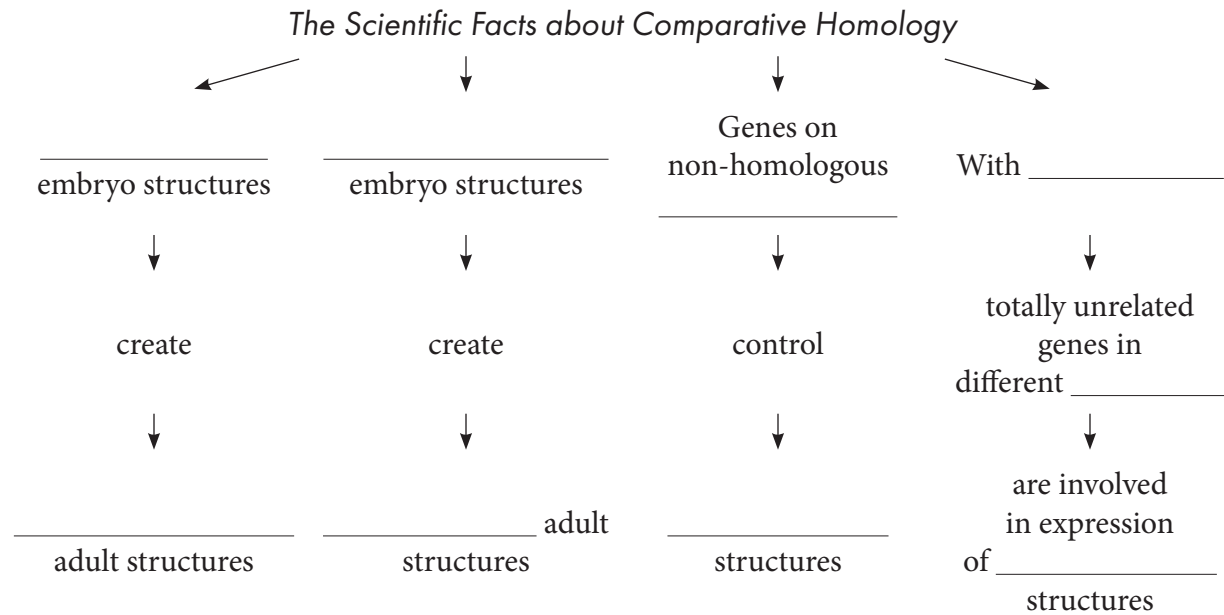
*For example: GGG = A.*

*Figure 2*

1 <sup>st</sup> Base →	G	A	U	C	3 <sup>rd</sup> Base
2 <sup>nd</sup> Base ↓	A	B	C	D	G A
G 3 <sup>rd</sup> Base →	E	F	G	H	
A	I	J	K	L	U C
	M	N	O	P	
U	Q	R	S	T	G A
	U	V	X	X	
C	Y	Z	,	;	U C
	.	!	?	space	

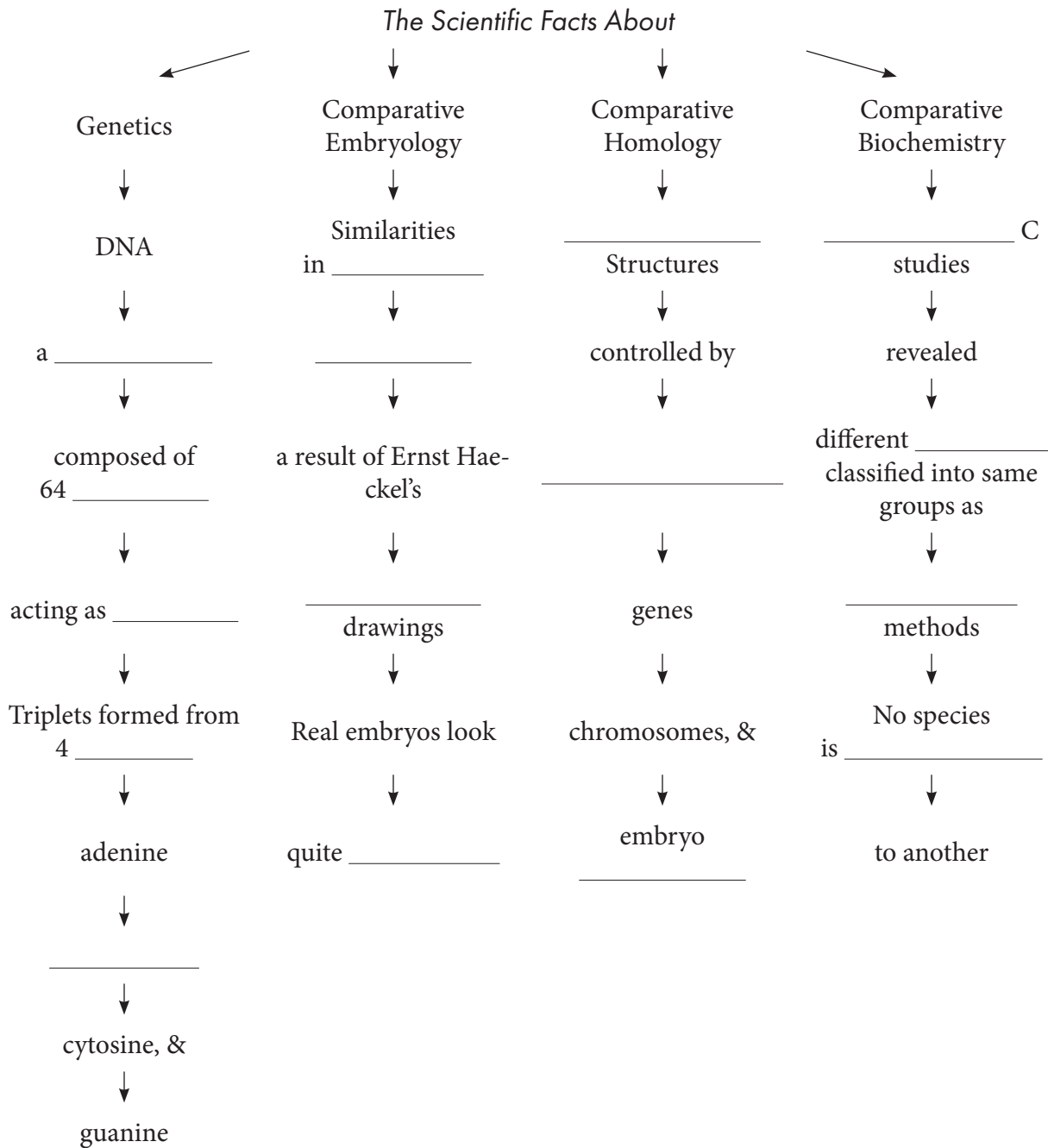
# Concept Map One

## The Scientific Facts



# Concept Map Two

## The Scientific Facts



# Vocabulary

Fill in the blanks with the words whose definitions are below. Then copy the letters in the highlighted boxes to spell out a message.

1. One unit of hereditary information located on a chromosome, it controls the production of a specific protein; the “sentence” of DNA.

\_\_\_\_\_

2. Body parts of different organisms whose similarities suggest they may have had a common ancestor.

\_\_\_\_\_

3. The end of the embryo's spine before the legs begin to grow.

\_\_\_\_\_

#### 4. The language of life.

\_\_\_\_\_

5. The source of the embryo's red blood cells before the bone marrow is formed.

[illegible]

6. This is change within species or genus; achieved primarily through a loss of genetic information.

\_\_\_\_\_

7. Organic compounds made up of chains of amino acids; the building blocks of living things.

\_\_\_\_\_

8. These are often called gill slits in human embryos even though there is no opening and they do not develop into the respiratory system.

\_\_\_\_\_

9. A protein used in aerobic respiration which is found in a wide number of organisms.

\_\_\_\_\_

10. The phenomenon of a gene affecting the development of organs not under its specific control.

\_\_\_\_\_

11. This is made up of a sugar, a base and a phosphate group; a building block of nucleic acid.

\_\_\_\_\_



12. The relative number of a specific gene that exists in a population.

----- =-----

13. A mistake in the copying of the DNA.

----- =--

14. This states that gene frequencies tend to remain stable over long periods of time.

----- =-- -----

15. The “punctuation” of DNA.

----- ==-----

16. This is a result of intelligent action.

----- =---

**Puzzle answer:**

----- RWIN

**In the space below, please state the three ways that bacteria are known to acquire immunity to certain antibiotics.**

1. \_\_\_\_\_

2. \_\_\_\_\_

3. \_\_\_\_\_

# Review

*Complete the following sentences from your knowledge of the text. It is possible to have more than one correct answer to some of these questions.*

1. Chromosomes are made up of \_\_\_\_\_

2. In order for evolution to have occurred, there must have been the addition of \_\_\_\_\_

3. The drawings of embryos in textbooks are based on Ernst Haeckel's drawings and \_\_\_\_\_

4. The same parts of embryos of different species \_\_\_\_\_

5. Evolutionists never mention human legs or the hind legs of vertebrates as \_\_\_\_\_

6. So-called homologous structures in adults of different species \_\_\_\_\_

7. The genes which control homologous structures in different species \_\_\_\_\_

8. When scientists tried to link species through the study of Cytochrome C, they discovered: \_\_\_\_\_

## Short Answers

*Answer the following questions in complete sentences.*

**1. Why is pleiotropy a strong argument against comparative homology?**

**2. Why is genetic stability a problem for those who believe in evolution?**

**3. Explain two (2) problems that prevent comparative embryology from supporting evolution.**

**4. What are vestigial organs? Name two embryonic organs once thought to be vestigial and tell what their functions are.**

**Reminder: you are also responsible for the information on bacterial evolution for this test, as well as for the vocabulary.**

# Test

## Modified True and False

*If, according to the text, the statement is true, circle T. If it is false, circle F and then change the underlined word to correct the statement in the space provided. (One point for each correct true answer; two points for each corrected false answer)*

T F 1. DNA is the “language” of life.

---

T F 2. Chromosomes are made up of proteins and DNA.

---

T F 3. An intron is a series of nucleotides that controls the production of a specific protein.

---

T F 4. Pleiotropy is a spontaneous change in a gene or chromosome.

---

T F 5. Information is sometimes the result of intelligent action.

---

T F 6. The Hardy–Weinberg principle states that gene frequencies tend to remain stable over time.

---

T F 7. Devolution is achieved primarily through an addition of genetic information.

---

T F 8. In order for evolution to occur, there must have been the addition of great amounts of genetic information.

---

T F 9. The drawings of embryos seen in comparative embryology textbooks today are accurate.

---

- T F 10. When classifying organisms using Cytochrome C, several species appeared to be intermediate to the others.
- 

## Multiple Choice

*Place the letter in the space provided that best completes the sentence. (One point each)*

- \_\_\_\_\_ 1. These form the “punctuation” of DNA.
- |                        |                |
|------------------------|----------------|
| A. Start & stop codons | C. Nucleotides |
| B. Proteins            | D. Genes       |
- \_\_\_\_\_ 2. DNA has often been compared to:
- |              |                  |
|--------------|------------------|
| A. a factory | C. a language    |
| B. a gene    | D. none of these |
- \_\_\_\_\_ 3. It has been said that the probability of five favorable mutations occurring within a single life cycle of an organism is:
- |                     |                            |
|---------------------|----------------------------|
| A. very likely      | C. not likely but possible |
| B. effectively zero | D. moderately likely       |
- \_\_\_\_\_ 4. Michael Richardson has shown that the same parts of embryos of different species:
- |                         |                        |
|-------------------------|------------------------|
| A. do not look alike    | C. vary widely in size |
| B. look very much alike | D. Both A and C        |
- \_\_\_\_\_ 5. The same parts of the embryos of different species often:
- |   |                      |
|---|----------------------|
| A. do not develop into similar body parts in adults | C. look very similar |
| B. always develop into similar body parts in adults | D. both A and C      |
- \_\_\_\_\_ 6. What evolutionists call “gill slits” in humans are more accurately called:
- |               |                       |
|---------------|-----------------------|
| A. the throat | C. pharyngeal pouches |
| B. the coccyx | D. all of these       |
- \_\_\_\_\_ 7. The yolk sac was once thought to be vestigial. This means:
- |  |                                 |
|--|---------------------------------|
| A. it is too large                           | C. it is too small to be useful |
| B. it is reduced in size and has no function | D. it has a use only in adults  |

- \_\_\_\_\_ 8. The yolk sac:
- A. is truly vestigial
  - B. is marginally useful
  - C. is useful late in the pregnancy
  - D. supplies red blood cells early in the pregnancy
- \_\_\_\_\_ 9. These are never mentioned as homologous structures by evolutionists.
- A. The fingers
  - B. The legs of humans
  - C. The hind legs of most vertebrates
  - D. Both B and C
- \_\_\_\_\_ 10. So-called homologous structure in adult organisms:
- A. often develop from different parts of their respective embryos
  - B. always develop from the same parts of their respective embryos
  - C. always develop from the same parts of respective vertebrate embryos
  - D. never develop from the same parts of their respective embryos
- \_\_\_\_\_ 11. The genes that control so-called homologous structures:
- A. are always homologous
  - B. are frequently found in different locations and on different chromosomes
  - C. are always found on the same chromosomes
  - D. none of these
- \_\_\_\_\_ 12. Pleiotropy is :
- A. the phenomenon of one gene affecting multiple traits
  - B. a strong argument against homology
  - C. both A and B
  - D. neither A nor B
- \_\_\_\_\_ 13. Scientists are trying to use a protein which is present in many organisms to determine which are intermediate or link species. This protein is:
- A. leucine
  - B. praline
  - C. glutamine
  - D. cytochrome C
- \_\_\_\_\_ 14. When evolutionists tested different organisms using this protein (see # 13), they found that:
- A. different species appeared to be equidistant from bacteria
  - B. there were several species which could be considered intermediate
  - C. there were one or two species that could be considered intermediate
  - D. most of the species could not be considered intermediate

- \_\_\_\_\_ 15. Which of the following provides evidence that supports evolution?
- |                           |                             |
|---------------------------|-----------------------------|
| A. Genetics               | D. Comparative biochemistry |
| B. Comparative embryology | E. none of these            |
| C. Comparative homology   |                             |

### Essay Questions

*Answer the following questions in complete sentences. Points vary per question.*

- 1. What is pleiotropy and why is it a strong argument against comparative homology. (4 points)**
  
  
  
  
  
  
  
  
  
  
- 2. Why is genetic stability a problem for those who believe in evolution? (2 points )**
  
  
  
  
  
  
  
  
  
  
- 3. Explain two problems that prevent comparative embryology from supporting evolution. (4 points)**
  
  
  
  
  
  
  
  
  
  
- 4. Name two parts of the embryo once considered vestigial and tell what their function really is. (4 points)**
  
  
  
  
  
  
  
  
  
  
- 5. The discussion of bacterial immunity that you read gave three reasons why bacteria have immunity to antibiotics. List them here.**

## Chapter 6

# Suggestions for Beginning

**E**ngage your student(s) in discussion using the following questions. As they give input, draw a rough “geologic column” on a computer or blackboard and write in what should be found in each layer.

1. Evolutionists state that the first cell arose by spontaneous generation and that all the organisms we have today arose gradually over time from that cell. They also say the fossil record supports evolution. If this were the case, how would you expect the fossils to be deposited? For example, what kind of fossils would you expect to find in Precambrian rock—the rock evolutionists say was laid down when life was just beginning on Earth?

2. What would we expect to find in Cambrian rock—the layer just above the Precambrian?

3. Continue on with subsequent layers. You do not need to name each individual layer. However, if your student(s) are following the “pattern” of evolution, they should be filling each higher layer with progressively more “advanced” forms of life. Since students tend to think primarily in terms of the animal kingdom, the drawing below generally reflects this. You may need to consult a drawing of a geologic column, just in case they do bring in the plants, etc. When you have completed your “geologic column,” save it for comparison later, after your student(s) have read this chapter. Tell them the structure of the geologic column is discussed in Chapter 6.

4. What also should be in the rocks in great quantities if Darwinian evolution is true? (Link fossils or intermediate forms)

*Sample “geologic column”:*

Man  
Link fossils, link fossils  
Mammals  
Link fossils  
Birds  
Intermediate forms  
Reptiles  
Link fossils, link fossils, link fossils  
Amphibians  
Intermediate forms  
Fish  
Link fossils  
Worms, etc.  
Anaerobic bacteria



# Sections Question Key

## Section One: The Creation & Structure of the Geologic Time Scale

1. *How is a geologic column for an area put together?*
  
  
  
  
  
  
  
  
  
  
2. *What method did scientists use for determining an old age for most sedimentary rock strata?*
  
  
  
  
  
  
  
  
  
  
3. *What is wrong with using the principle of uniformity to determine the ages of rocks?*
  
  
  
  
  
  
  
  
  
  
4. *What is an index fossil and how is a fossil determined to be one?*
  
  
  
  
  
  
  
  
  
  
6. *Describe one discrepancy creation scientists have discovered?*

## **Section Two: The Fossil Record**

- 1. Describe four main characteristics of the fossil record. Give details.*
- 2. Describe punctuated equilibrium. Why is it a poor substitute for Darwinian evolution?*

## **Section Three: How Do We Interpret the Facts about Fossils?**

- 1. What major factor influences how scientists view the facts?*
- 2. Give at least three questions an individual should keep in mind as he reads of a fossil find?*

## Section Four: Link Fossils?

1. *What did some scientists believe the coelacanth to be? What happened to change their minds?*

2. *What do some scientists consider Archaeopteryx to be?*

3. *Why is Archaeopteryx considered a link fossil by some scientists?*

4. *Why is Archaeopteryx not considered to be a link fossil by others?*

## Section Five: Evolutionary Series?

1. *What is one problem with the position of the horse fossils in the fossil record?*

2. *If "Eohippus" is excluded from the series, what do some scientists believe the horse series to be?*

3. *Briefly describe Pakicetus, Rodhocetus, Basilosaurus and Ambulocetus and tell why they are questionable as ancestors of the whales.*

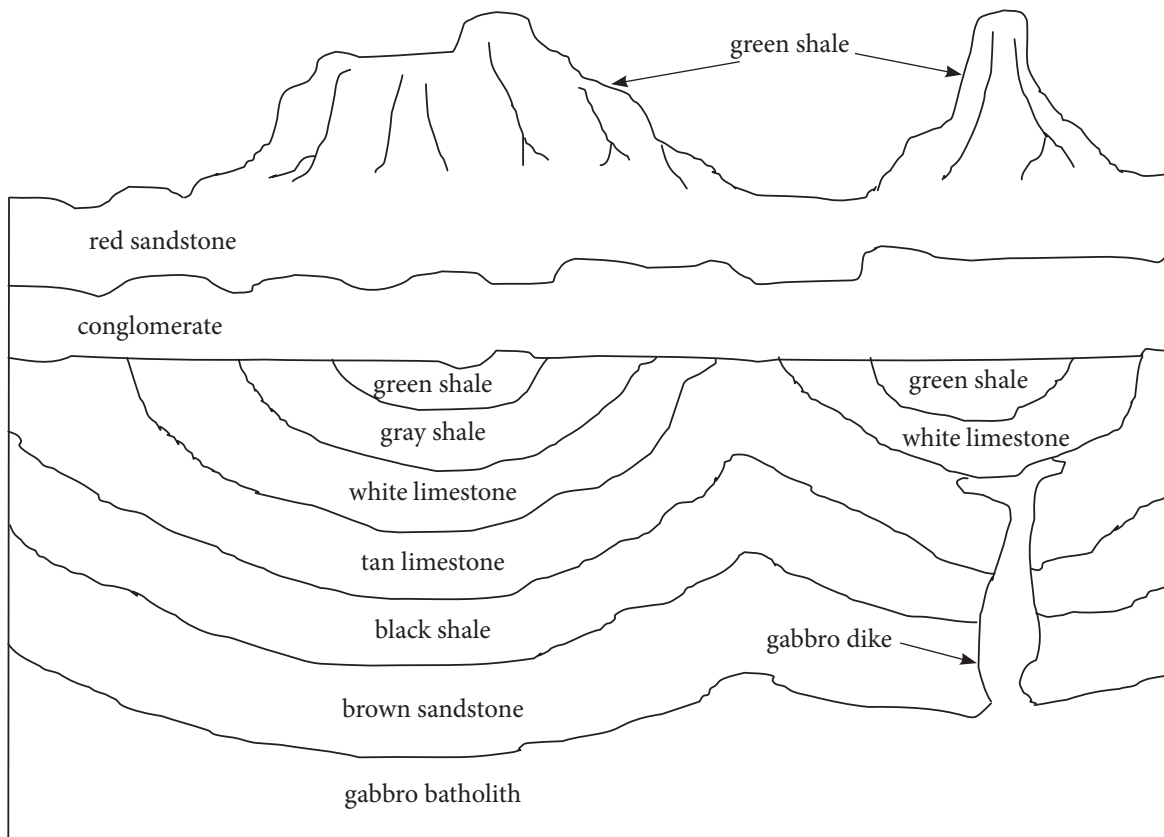
*4. Name at least four major changes that would have to take place in order for whales to evolve from land animals.*

### **Section Five: What Does the Evidence Show?**

*1. What major problem prevents scientists from really looking at the scientific facts and perhaps drawing different conclusions?*

## Section 1

# The Structure of the Geologic Time Scale



After reading and gaining an understanding of how scientists study rock strata, examine the cross sectional view of the rock layers in the diagram above. Then put the following events in chronological order from the earliest (#1) to the latest (#12). Remember the Law of Superposition states that generally the lowest layer of rock was deposited first. **The batholith and dike are igneous and were not laid down, as the other layers were.** Remember also what the uneven lines below and above the conglomerate indicate.

- \_\_\_\_\_ A. The green shale was laid down.
- \_\_\_\_\_ B. The tan limestone was deposited.
- \_\_\_\_\_ C. The white limestone was deposited.
- \_\_\_\_\_ D. The black shale was laid down.
- \_\_\_\_\_ E. The shales, sandstone, and limestones were folded.
- \_\_\_\_\_ F. The brown sandstone was deposited.
- \_\_\_\_\_ G. The gray shale was laid down.
- \_\_\_\_\_ H. The red sandstone was deposited and partially eroded.
- \_\_\_\_\_ I. The conglomerate was partially eroded.
- \_\_\_\_\_ J. The conglomerate was laid down.
- \_\_\_\_\_ K. The folded strata were eroded.

Generally, batholiths form when igneous material is forced up from deep in the Earth under great pressure. Given this information and the information in this picture, what is the likely cause of the folding of the layers? Also, why is it likely that the gabbro dike (intrusion) occurred at approximately the same time as the folding of the sedimentary layers?

Geologists say that an *unconformity* has occurred when several layers of rock strata have been laid down and then tilted by some force within the Earth. This is followed by upper parts of the rock layers being eroded and new layers of sedimentary rock strata being deposited on top of the original layers. Write down the layers that are nearest the unconformity pictured in the diagram above.

**The law of superposition states that in an undisturbed rock layer (one that hasn't been turned over), the oldest rocks will be on the bottom and the youngest rocks will be on the top. Does this law tell you anything about the actual age of the rocks?**

**You will learn in this chapter that the principle of uniformity is not reliable as a basis for determining the ages of rocks. Without employing the principle of uniformity, can scientists still attempt to assign an approximate age to these rock strata? If so, what would they use? Name one possibility.**

## Section 2

# The Fossil Record

Use the following words correctly to fill in the blanks below.

rapid	very few	today
punctuated equilibrium	stasis	transitional
same	intermediate	evidence
exploration	long	dinosaur
expected	transitional forms	tissue
gradual transition	first	60 million
95%	true structure	protein
uncontested	last	ten thousand
complex	explosion	leg
geologic column	millions	blood vessels
species	absence	

The typical \_\_\_\_\_ in a museum or textbook shows a \_\_\_\_\_ from simple to \_\_\_\_\_ as one moves from the bottom to the top. If evolution is true, this is to be \_\_\_\_\_ because the bottom layers were laid down \_\_\_\_\_ and the top layers were laid down \_\_\_\_\_. However this is not the \_\_\_\_\_ of the fossil record. In fact, there is a sudden \_\_\_\_\_ of highly complex forms in Cambrian rock. Representatives of \_\_\_\_\_ of all the phyla found in the fossil record show up here.

In addition, the \_\_\_\_\_ which died and were buried in this rock are essentially the \_\_\_\_\_ as the species we have \_\_\_\_\_. More than anything else, the fossil record demonstrates \_\_\_\_\_, a state of equilibrium with very little change.

Also, if Darwinian evolution is true, there should be \_\_\_\_\_ of link fossils that represent the \_\_\_\_\_ between the species we have today. However, after extensive \_\_\_\_\_ and study of the fossil record, scientists have found \_\_\_\_\_ fossils which they consider \_\_\_\_\_ and none of these are \_\_\_\_\_.

Because of the absence of transitional forms, well-known paleontologists, Stephen J. Gould and Niles Eldredge, developed an alternative theory called \_\_\_\_\_. They believe that species remain in a state of stasis for \_\_\_\_\_ periods of time until some event triggers \_\_\_\_\_ evolution. This does not allow time for link fossils to be trapped and preserved. However, the only evidence for this theory is an \_\_\_\_\_ of evidence—no link fossils! This theory seems to be simply a way to explain the absence of \_\_\_\_\_ forms in the fossil record.



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Finally \_\_\_\_\_ and \_\_\_\_\_ have been found in a *T. rex* \_\_\_\_\_ bone previously dated to be over \_\_\_\_\_ years old. Yet prior to that time evolutionists had insisted that soft \_\_\_\_\_ like this could not survive more than \_\_\_\_\_ years. This is only one finding of such tissue in \_\_\_\_\_ bones. The \_\_\_\_\_ points to the probability that the bones are not that old.

## Sections 3 & 4

# Interpreting the Facts and Link Fossils

*Fill in the blanks in the following sentences by unscrambling the words beneath the blanks.*

1. Most link fossils are \_\_\_\_\_.  
deestonct
2. This occurs because transitional fossils are often found to be \_\_\_\_\_ entirely.  
thomegins seel
3. A good example of this is the \_\_\_\_\_.  
loncaecaht
4. This creature was once thought to be a link fossil between fish and \_\_\_\_\_.  
binasphami
5. It was also thought to be \_\_\_\_\_.  
nittecx
6. Then a fisherman caught two \_\_\_\_\_ coelacanths and brought them to scientists to study.  
vilign
7. Once scientists had the soft parts, they found the coelacanth was merely a \_\_\_\_\_.  
hifs
8. Michael Denton points out in his book that because scientists do not have the soft parts, the status of even the most convincing intermediates is \_\_\_\_\_.  
senucier
9. Yet this practice of assigning \_\_\_\_\_ still continues today.  
klin sisofl tutsas
10. Often scientist make assumptions about link fossils based on two or three \_\_\_\_\_.  
senbo
11. Another proposed link fossil, \_\_\_\_\_ is believed to be a transitional form between \_\_\_\_\_ and \_\_\_\_\_.  
xrAcyrehoetap  
seprtile                      dridb
12. Since this bird has \_\_\_\_\_ on its wings and also \_\_\_\_\_, some consider these features reptilian.  
scawl                                      etteh

13. However, baby \_\_\_\_\_ and \_\_\_\_\_ also have this trait.

14. *Archaeopteryx* also has a flat \_\_\_\_\_, but many other birds possess this trait.  
 rebbeasont

15. In addition, *Archaeopteryx* has heett, but icchknes have a gene for teeth,

as did some extinct birds; the gene for tooth expression in this modern bird is simply turned off.

16. Perhaps the most important thing to remember is that evolutionists and creationists have a different view of the world, a reconstruction of how the world operates, and

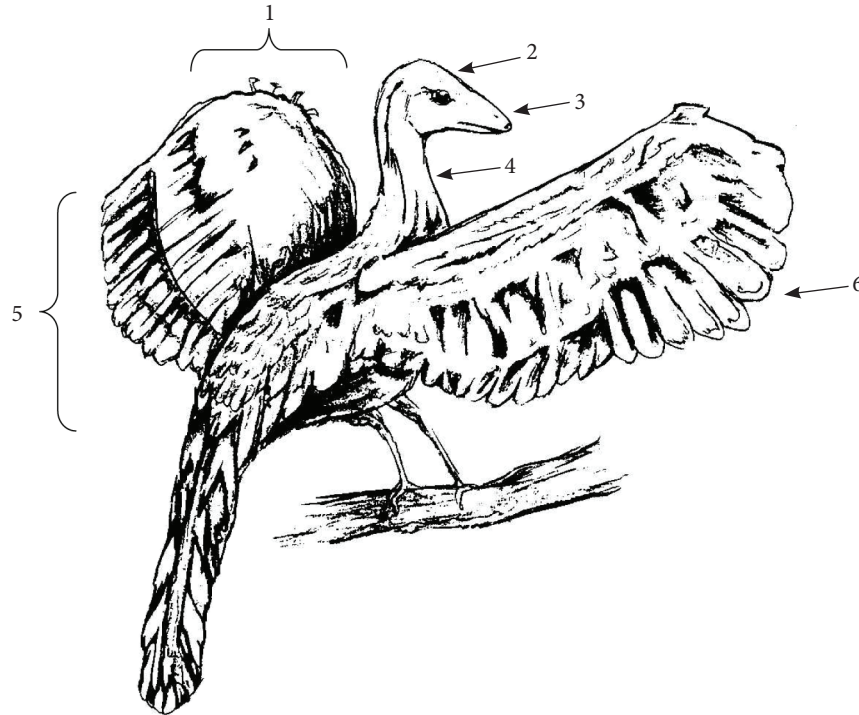
they all use this to \_\_\_\_\_ them in their work. This is especially true in the study of  
degui

the                      record. To get an                      picture of the                     , it is wise to

keep certain \_\_\_\_\_ in mind as one reads of a new fossil \_\_\_\_\_.  
teuqssnoi ndif

## Section 4

# Archaeopteryx



*Archaeopteryx*

*In the drawing above, several body parts of Archaeopteryx are numbered. In the spaces below list the body part and explain why the evolutionists feel three of the parts indicate it is a link fossil. Why don't creationists feel this way? (Creationists have something to say about all six parts.)*

Body Part	Evolutionist Position	Creationist Position
1. Claws on wings		
2. Brain		
3. Teeth		
4. Flat breastbone		
5. Wing		
6. Feather		

*What do creationists think Archaeopteryx is?*

---

## **Short Answers**

*Answer the following questions with complete sentences:*

**1. What did paleontologist Sankar Chatterjee find and how does this affect *archaeopteryx*'s status as a bird ancestor?**

**2. Why is it difficult to determine the exact nature of *archaeopteryx*?**

## Sections 5 & 6

# Evolutionary Series & What Does the Evidence Show?

I. Put an "X" in front of each statement that agrees with the textbook.

- \_\_\_\_\_ 1. Scientists, being human, are often prone to admit that ... undetected biases can creep in.
- \_\_\_\_\_ 2. The horse series looks like a good example of evolution.
- \_\_\_\_\_ 3. Perhaps excluding *Eohippus*, the horse series could be an example of devolution.
- \_\_\_\_\_ 4. The specimens of the horse series have been found all together in the right order.
- \_\_\_\_\_ 5. The specimens of the horse series have been found out of the proper order.
- \_\_\_\_\_ 6. Variety in the horses' toes could be explained by the fact that genes can be turned "on" or "off" by other genes.
- \_\_\_\_\_ 7. Evolutionists believe that whales evolved from an ancient marine mammal.
- \_\_\_\_\_ 8. There would have to have been thousands of transitional organisms in whale evolution.
- \_\_\_\_\_ 9. One proposed example of a whale ancestor is *Pakicetus*.
- \_\_\_\_\_ 10. *Pakicetus* lived on land.
- \_\_\_\_\_ 11. Often specimens are put in the whales' ancestry because they appear to have one or two traits in common with whales.
- \_\_\_\_\_ 12. Evolutionists believe *Rodhocetus* was a "walking whale".
- \_\_\_\_\_ 13. *Rodhocetus* is a large, marine creature.
- \_\_\_\_\_ 14. The fossil of *Pakicetus* shows features of both land and marine mammals.
- \_\_\_\_\_ 15. *Ambulocetus* is described as a "walking whale".
- \_\_\_\_\_ 16. *Ambulocetus* is defined as a whale based on the assumption that it has an ancestor in common with the whales.
- \_\_\_\_\_ 17. There are thousands of link fossils in the fossil record tracing the evolution of the whales.

*II. List at least three evolutionary changes that would have to occur in order for a land mammal to evolve into a whale.*

*III. In the spaces below, summarize the significance of the fossil record and the geologic time scale. Refer to "What Does All This Mean?" at the end of the chapter.*

**1. Fossil record**

**2. Geologic time scale**

# Group Activity

## Making Geologic Columns

If geologists want to develop a geologic column for a given area, they may look for exposed sections of rock layers. Often they find these in canyons or cliffs, or in areas where construction crews have exposed rock strata while building roads. Today, you are going to look at two imaginary cliffs that have been drawn for you on an attached paper. Using your text and the information from these cliffs, you will construct a geologic column for the area.

### Materials:

- ▶ Pictures of two sections of rock strata
- ▶ Group activity sheet
- ▶ Pen or pencil

### Procedure:

- 1. Reviewing the principle of superposition will help you in this activity. Look up this principle in your textbook and write it in the space below.**

2. Look at the pictures of the rock strata demonstrated for you on the last sheet of your group activity. Develop a geologic column for the area of these imaginary cliffs. Write it in on the spaces below. Make sure the lowest rock layer is on the bottom line and work your way up. Then answer the questions given below.

**Topmost layer:**

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

red sandstone

**Bottom layer:** \_\_\_\_\_  
Geologic column for the area

- ### 3. Which layer of rock was laid down first?

- 4. Which layer of rock was laid down last?**



**5. Given information from both cliffs, what can you assume the uneven lines between the tan limestone and pink sandstone and between the red sandstone and green shale signify?**

---

**6. In order to create the column, what did you assume once went between the pink sandstone and the tan limestone in cliff #2?**

---

**7. What does the black area in the middle of cliff #2 signify?**

---

**8. Based on the information you have, can you accurately determine the last geologic event to occur in these cliffs?**

---

*Why or why not?*

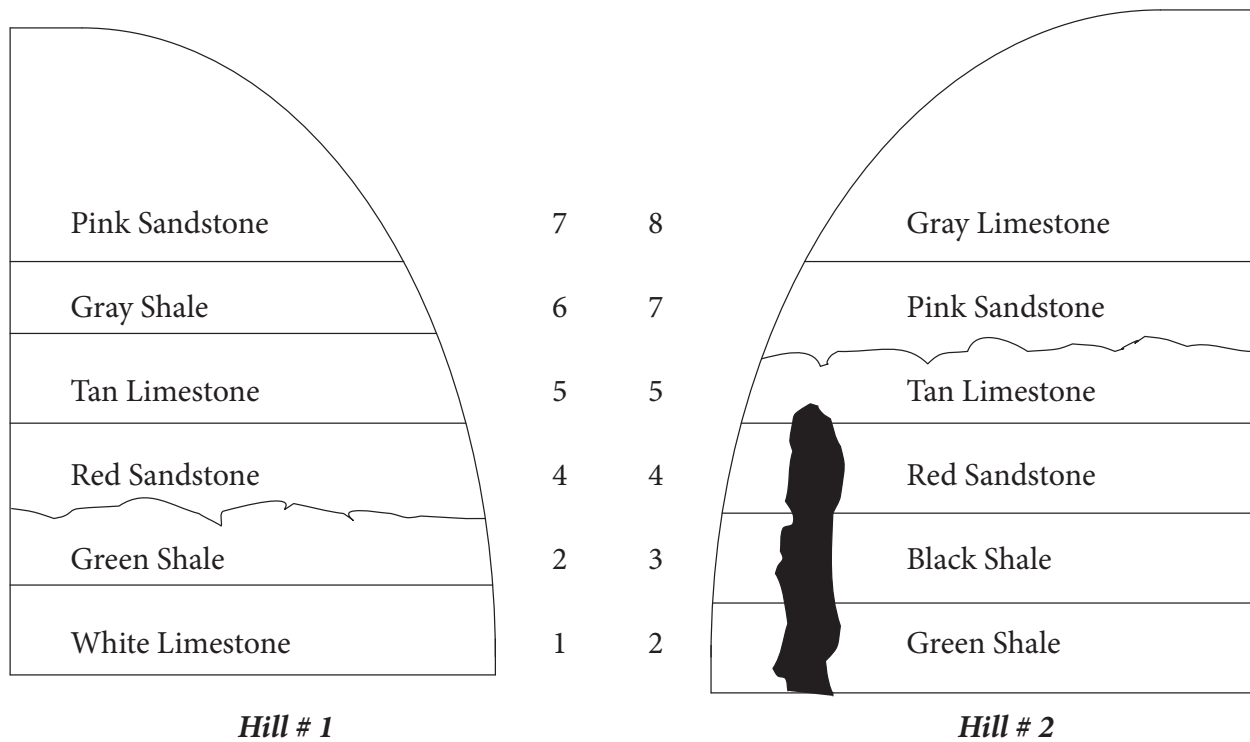
**9. What does it mean to correlate rocks?**

**10. What is the principle of uniformity, and how was it used to determine an old age for sedimentary rocks?**

**11. Why is using this principle an unreliable way of determining the ages of rocks?**

**12. Early geologists assigned an old age to much of the Earth's sedimentary rock using the principle of uniformity. Then they started earmarking index fossils whose ages they had determined from the rocks in which they were found. They used these index fossils to date other**

**rocks. What problem occurs when using the rocks to give ages to the fossils and then using the fossils to assign an age to other rocks?**



# Concept Map One

## Geologic Time Scale

Scientists use the \_\_\_\_\_ time scale to determine the \_\_\_\_\_ of rocks.



BUT



They developed the time scale using the \_\_\_\_\_ of \_\_\_\_\_



This states that the same \_\_\_\_\_ processes we see at work today  
also operated in the \_\_\_\_\_



HOWEVER



The principle of \_\_\_\_\_ does not allow for the \_\_\_\_\_ events  
that also occur



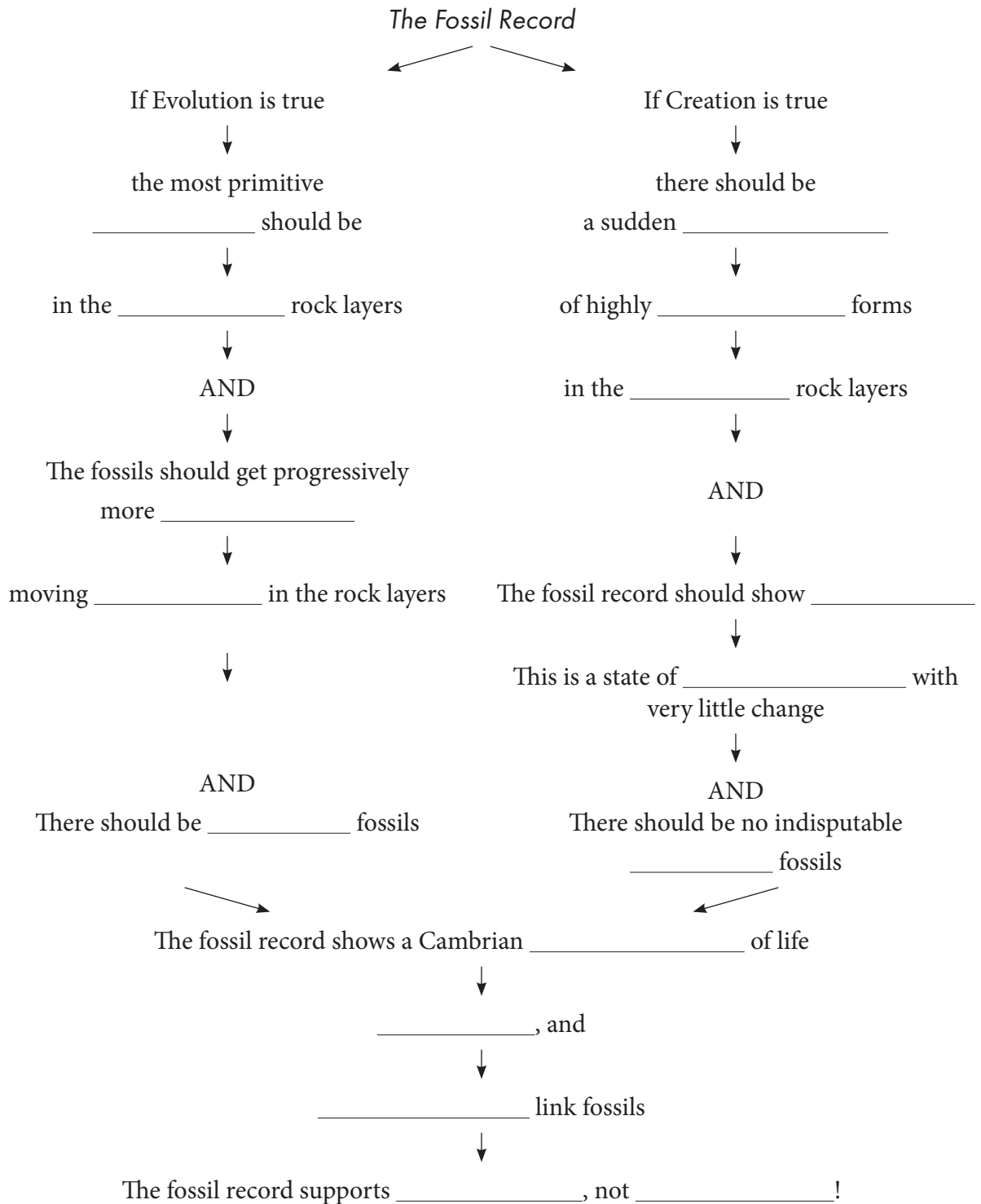
SO



The geologic time scale is \_\_\_\_\_ for determining the ages of \_\_\_\_\_

# Concept Map Two

## The Fossil Record



# Vocabulary

*Using the letters provided, match the following words with their definitions.*

- |                         |                            |                            |
|-------------------------|----------------------------|----------------------------|
| A. Ambulocetus          | G. Circumstantial evidence | M. Pakicetus               |
| B. <i>Archaeopteryx</i> | H. coelacanth              | N. Principle of uniformity |
| C. Assumption           | I. Correlating the rocks   | O. Stasis                  |
| D. Basilosaurus         | J. Eohippus                | P. Transitional Form       |
| E. Chicken              | K. Extinct                 |                            |
| F. Circular reasoning   | L. Rodhocetus              |                            |

- \_\_\_\_\_ 1. \_\_\_\_\_ is a proposed ancestor of the whales which has hind limbs that do not connect to the rest of its skeleton.
- \_\_\_\_\_ 2. When scientists examine rock strata in different locations and determine through the character of the rocks and the fossils they contain that they are of the same age, this is called \_\_\_\_\_.
- \_\_\_\_\_ 3. The \_\_\_\_\_ is a modern bird which has genes for teeth.
- \_\_\_\_\_ 4. The \_\_\_\_\_ states that the processes that we see at work today were at work in the past at the same rate of speed.
- \_\_\_\_\_ 5. Organisms which have no living examples are said to be \_\_\_\_\_.
- \_\_\_\_\_ 6. The fossil record shows that organisms remain stable over long periods of time; this is called \_\_\_\_\_.
- \_\_\_\_\_ 7. \_\_\_\_\_ is a proposed horse ancestor that resembles the bones of a hyrax.
- \_\_\_\_\_ 8. Scientists admit that \_\_\_\_\_ relationship to the whales is uncertain but assume it is related.
- \_\_\_\_\_ 9. \_\_\_\_\_ also had some ear bones that were considered similar to those of whales. One species exhibited such features as a large pelvis fused to the vertebrae, hind legs, and differentiated teeth.
- \_\_\_\_\_ 10. \_\_\_\_\_ is another term for link fossil.
- \_\_\_\_\_ 11. A proposed link fossil between fish and amphibians, the \_\_\_\_\_ was discovered to be simply a fish, when two were caught alive.
- \_\_\_\_\_ 12. \_\_\_\_\_ is a proposed bird ancestor because it has some features which some scientists consider reptilian.
- \_\_\_\_\_ 13. Known facts that are hard to explain otherwise are known as \_\_\_\_\_.

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- \_\_\_\_\_ 14. An individual who accepts something as fact without proof is making an \_\_\_\_\_.
- \_\_\_\_\_ 15. \_\_\_\_\_ is a proposed ancestor of the whales which is a land mammal.
- \_\_\_\_\_ 16. Using rocks to date fossils and then using the fossils to date other rocks is an example of \_\_\_\_\_.

# Review

*Answer the following questions in complete sentences.*

- 1. How does devolution primarily occur?**
  
  
  
  
  
  
  
  
  
  
- 2. Why is the principle of uniformity a poor method of determining the age of a rock?**
  
  
  
  
  
  
  
  
  
  
- 3. In looking at a typical geologic column in a museum, the fossils appear to start out simple on the bottom and get progressively more complex as one goes to younger rock. What does the fossil record really look like?**
  
  
  
  
  
  
  
  
  
  
- 4. Give one recent discovery about fossils that supports creation and a young earth.**
  
  
  
  
  
  
  
  
  
  
- 5. Why did Stephen Gould and Niles Eldredge feel it was necessary to come up with the theory of punctuated equilibrium? What is wrong with this theory?**
  
  
  
  
  
  
  
  
  
  
- 6. List two pieces of information from the book that indicate the horse series is a poor example of an evolutionary series.**

**7. What appears to be a common reason that evolutionary scientists place certain fossils in the ancestry of the whale?**

**8. Give at least 3 reasons why it would be difficult for a land animal to evolve into a whale.**

**9. List two major problems associated with fossil study.**

**10. List three reasons why some evolutionary scientists consider *Archaeopteryx* to be a link fossil between reptiles and birds.**

**11. List three reasons why creationists consider *Archaeopteryx* to be simply a bird.**

**12. Give at least 3 questions a thinking person asks himself on hearing of a new fossil find.**



**13. You will also be asked to develop a geologic column for an area, based on information from three hills. Use the worksheet on the geologic column that you did earlier in the unit as your guide. You may want to attach it to this review sheet.**

**14. You are also responsible for the vocabulary worksheet which you did earlier.**

# Test

## Matching

*Use the letters below to fill in the space provided.*

- |                         |                            |                            |
|-------------------------|----------------------------|----------------------------|
| A. Ambulocetus          | G. Circumstantial evidence | M. Rodhocetus              |
| B. <i>Archaeopteryx</i> | H. Coelacanth              | N. Pakicetus               |
| C. Assumption           | I. Correlating the rocks   | O. Principle of uniformity |
| D. Basilosaurus         | J. Eohippus                | P. Stasis                  |
| E. Chicken              | K. Extinct                 | Q. Transitional form       |
| F. Circular reasoning   | L. Hoatzin                 |                            |

- \_\_\_\_\_ 1. A proposed horse ancestor that looks like a hyrax.
- \_\_\_\_\_ 2. Using the rocks to date the fossils and the fossils to date the rocks.
- \_\_\_\_\_ 3. Organisms which have no living examples.
- \_\_\_\_\_ 4. A proposed ancestor of the whales with hind limbs that do not connect to its skeleton.
- \_\_\_\_\_ 5. A modern bird which lives in South America and has teeth.
- \_\_\_\_\_ 6. Had some ear bones that were considered similar to those of whales. One species exhibited such features as a large pelvis fused to the vertebrae, hind legs, and differentiated teeth.
- \_\_\_\_\_ 7. The process of examining the rocks in different locations to determine if they are the same age.
- \_\_\_\_\_ 8. A proposed ancestor of the whales that is a land mammal.
- \_\_\_\_\_ 9. A proposed link fossil between fish and amphibians.
- \_\_\_\_\_ 10. It states that the processes we see at work today were at work in the past at the same speed.
- \_\_\_\_\_ 11. Known facts that are hard to explain otherwise.
- \_\_\_\_\_ 12. Stability over a long period of time.
- \_\_\_\_\_ 13. Its only relationship to the whales is based on a presumed ancestry.
- \_\_\_\_\_ 14. A proposed link fossil between reptiles and birds.
- \_\_\_\_\_ 15. Another term for link fossil.
- \_\_\_\_\_ 16. An idea accepted as fact without proof.

## Multiple Choice

*Place the letter in the space provided that best completes the sentence.*

- \_\_\_\_\_ 1. Devolution occurs primarily due to:
- |                                |                    |
|--------------------------------|--------------------|
| A. loss of genetic information | C. both A & B      |
| B. gain of genetic information | D. neither A nor B |
- \_\_\_\_\_ 2. Geologists use \_\_\_\_\_ to estimate the absolute age of rocks.
- |                                |                     |
|--------------------------------|---------------------|
| A. the principle of biogenesis | C. carbon-14 dating |
| B. the principle of uniformity | D. none of these    |
- \_\_\_\_\_ 3. Creationists have used another dating method to disprove geologic column dating. This is:
- |                       |                    |
|-----------------------|--------------------|
| A. uranium-lead       | C. isochron dating |
| B. rubidium-strontium | D. carbon-14       |
- \_\_\_\_\_ 4. Representatives of what percentage of the known phyla show up in Cambrian rock?
- |        |        |
|--------|--------|
| A. 15% | C. 95% |
| B. 50% | D. 75% |
- \_\_\_\_\_ 5. The phyla that died in the Cambrian period are essentially the same as those we have today. This means the fossil record exhibits:
- |             |                   |
|-------------|-------------------|
| A. stasis   | C. gradual change |
| B. mutation | D. none of these  |
- \_\_\_\_\_ 6. If birds evolved from reptiles, there should be \_\_\_\_\_ intermediate fossils in the fossil record.
- |                  |                    |
|------------------|--------------------|
| A. ten or twenty | C. one or two      |
| B. thousands of  | D. thirty or forty |
- \_\_\_\_\_ 7. Because of the lack of transitional forms, Stephen Gould and Niles Eldredge came up with another theory of evolution. This is called:
- |                       |                           |
|-----------------------|---------------------------|
| A. mutation           | C. punctuated equilibrium |
| B. circular reasoning | D. both A and C           |
- \_\_\_\_\_ 8. One of the major problems with fossil study is:
- |   |                          |
|---|--------------------------|
| A. too many fossils to choose from                        | C. a lack of soft tissue |
| B. too little of the fossil to give it link fossil status | D. both B and C          |

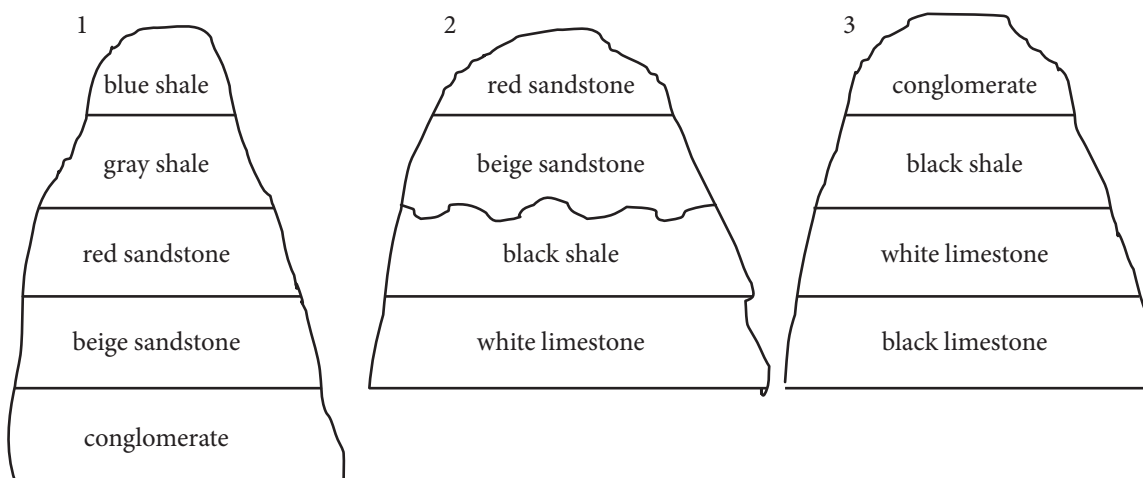
\_\_\_\_\_ 9. Creationists consider *Archaeopteryx* to be simply a bird because:

- A. some modern birds have claws on their wings
- B. some modern birds have flat breast-bones
- C. it has no halfway features between scales and feathers
- D. all choices are correct

\_\_\_\_\_ 10. One problem with the horse series is:

- A. the different specimens have been found out of order
- B. the specimens are too small for study
- C. there are too many specimens to work with
- D. the specimens make a good example of evolution

Below is a drawing of the layers of sedimentary rock on three neighboring hills. Use this information to make a geologic column for this area.



**Geologic Column for the Area:**

_____	Top layer
_____	
_____	
_____	
_____	
_____	
_____	
_____	Bottom layer

## Short Answers

*Answer the following questions in complete sentences:*

1. Why is using the principle of uniformity a problem in determining the ages of rocks?
  
  
  
  
  
  
  
  
  
  
2. Give two important facts about the fossil record which make it good circumstantial evidence for creation.
  
  
  
  
  
  
  
  
  
  
3. Why is the theory of punctuated equilibrium a poor explanation for the structure of the fossil record?
  
  
  
  
  
  
  
  
  
  
4. Give at least three questions an individual should keep in mind as he reads of a fossil find.

## Chapter 7

# Suggestions for Beginning

For this discussion you will need an apple and an orange or two other different kinds of fruit. You will also need six boxes wrapped in different colored paper. Label the boxes Rubidium, Strontium, Uranium, Lead, Potassium, and Argon. Ask the following questions to stimulate thinking and discussion.

1. Is there any way to turn this apple into an orange? (You may have some “serious” wisecracks with this one and can have some fun with it.)
2. Take the “uranium,” and “lead,” then the “potassium” and “argon,” and finally the “rubidium” and “strontium.” Show them successively to your student(s) and ask the same question. Many students may not know that radioactivity involves the changing of one element into another.
3. Explain that radioactive decay is actually the process of changing one element into another. Scientists use this decay process as a clock to measure how old the rock is. However, does this dating method work? Chapter 7 explains.

Later, you might also use the apple and orange demonstration as a concrete example of how radioactive dating takes place. For example, you could give as an illustration that you bought a basket of 32 unstable apples that began turning into oranges. Half the remaining apples turn into oranges each hour. There are now 2 apples left in the basket. Then ask your student(s) how long ago you bought the apples. (The answer is 4 hours. See below.)

After 1st hour—16 left

After 3 hours—4 left

After 2 hours—8 left

After 4 hours—2 left

**If you are unfamiliar with radiometric dating methods, please consult your local library or the internet. A basic understanding of how it works is all you need.**

# Sections Question Key

## Section One: How Does Radiometric Dating Work?

- 1. Why do unstable elements break down into stable ones?*
- 2. Explain how a radioactive sample is tested.*
- 3. Define parent element, daughter element, and half-life.*
- 4. What is one restriction on the use of radiometric dating?*

## Section Two: Three Assumptions of Radiometric Dating

- 1. State the three assumptions upon which radiometric dating is based, and explain what is wrong with them.*

### Section Three: Reviewing the Long Range Dating Methods

1. *Is it possible to determine how much uranium there was in a sample to begin with? Why or why not?*
2. *Is there any other problem that might make uranium-lead dating unreliable? Explain.*
3. *What two problems concerning argon gas in rocks make potassium-argon dating unreliable?*
4. *What can happen to both rubidium and strontium in a rock which can alter the apparent age?*
5. *Describe isochron dating.*
6. *What problems arise with this method?*
7. *What can happen when different dating methods are used on the same rock formation? Give an example.*



## **Section Four: The Most Common Short-range Method—Radiocarbon Dating**

- 1. What does radiocarbon dating measure?*
  
- 2. How is carbon-14 formed?*
  
- 3. What kinds of materials are tested by radiocarbon dating?*
  
- 4. What is the half-life of carbon-14 and what is its testing range?*
  
- 5. What is one problem with  $^{14}\text{C}$  dating?*
  
- 6. Is there any way that radiocarbon dating can be used with a degree of accuracy? Explain.*

## **Section Five: Other Short-range Methods**

- 1. What is dendrochronology? What problems occur with this method?*

*2. How does thermoluminescence work? Are there any problems?*

## **Section Six: Young Earth Indicators**

*1. How does the amount of salt in the ocean indicate a younger Earth.*

*2. What is special about the Dynamic Decay Theory of planetary magnetism, and what does it indicate about the age of the earth?*

*3. How does the presence of short period comets in our solar system indicate a young solar system?*

*4. Explain how the diffusion of helium from rock crystals indicates a much younger Earth than assumed by old Earth enthusiasts.*

*5. How does the presence of carbon-14 in coal, diamonds, and fossils indicate a young earth?*

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6. *Is there any totally reliable scientific method of dating the Earth's age?*

## Section 1

# How Radiometric Dating Works

*After reading Chapter 7, Section 1, use the words below to fill in correctly the blanks. One word will not be used; three words will be used twice.*

element	daughter	lead
nuclei	decay	foolproof
protons	sedimentary	4.5 billion
neutrons	unstable	stable
rocks	one half	estimate
igneous	remaining	geologic time scale
fossils	formed	date
intrusions	clock	error margin
parent	time	contamination
half-life	uranium	

Radiometric dating is used to date \_\_\_\_\_ and \_\_\_\_\_. However, scientists are at a disadvantage because fossils are found primarily in \_\_\_\_\_ rock, while radiometric dating is performed primarily on \_\_\_\_\_ rock. Scientists often date igneous rock \_\_\_\_\_ in sedimentary rocks. These occur when magma forces its way up through a crack in sedimentary rock.

Radiometric dating is possible because certain elements are \_\_\_\_\_. They break down over time into \_\_\_\_\_ elements. Certain elements are unstable because their nuclei have more \_\_\_\_\_ than \_\_\_\_\_ or their \_\_\_\_\_ are too large, or they have an excess of \_\_\_\_\_.

The radioactive element is usually called the \_\_\_\_\_ element, while the element it turns into is called the \_\_\_\_\_ element or the \_\_\_\_\_ element. The \_\_\_\_\_ is the time it takes for one half of a radioactive sample to break down into its daughter element. The concept of half-life is interesting. It is important to understand that during each half-life only \_\_\_\_\_ of the \_\_\_\_\_ radioactive element decays into its daughter element.

Scientists look on radioactive decay as a \_\_\_\_\_ which has kept track of \_\_\_\_\_ that has passed since the rock was \_\_\_\_\_. For example, if scientists were to find a rock which is one half \_\_\_\_\_ and one half \_\_\_\_\_, and he knows the half-life of uranium is \_\_\_\_\_ years, he might assume the rock is \_\_\_\_\_ years old. However, this method is not \_\_\_\_\_.

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A review of testing methods is enlightening. A scientist requesting that a sample be tested is asked to give his own \_\_\_\_\_ of the age of the rock based on \_\_\_\_\_ dating. If, after testing the sample, the lab comes up with a \_\_\_\_\_ which is close to the \_\_\_\_\_ of the scientist, it assigns this date to the sample. If the \_\_\_\_\_ is too great, the lab says there has been \_\_\_\_\_ which makes it impossible to date the rock correctly.

## Section 2

# Three Assumptions of Radiometric Dating

*I. Pick out the three assumptions of radiometric dating from those listed below. Put an "X" in front of these assumptions.*

- \_\_\_\_\_ The rate of decay has always been constant.
- \_\_\_\_\_ The rate of decay has fluctuated over time.
- \_\_\_\_\_ Radioactive material can be leached out of the rock.
- \_\_\_\_\_ The original composition of the rock is known.
- \_\_\_\_\_ Radioactive materials are stable.
- \_\_\_\_\_ Radioactive materials are unstable.
- \_\_\_\_\_ There is no other way that parent or daughter material has gotten out of the rock.

*II. Now that you have selected these assumptions, write a sentence telling what is wrong with the last two assumptions.*

*III. Why does the first assumption stretch scientific reasoning somewhat?*

**IV. Why is it virtually impossible to “set the radioactive clock”?**

## Section 3

# Long Range Dating Methods

*Briefly explain what each long-range method tests.*

**1. Uranium—lead**

**2. Potassium—argon**

**3. Rubidium—strontium**

**4. Isochron dating (Which isotopes are tested.)**

*Match each dating method with the problem(s) that plague it by putting the letter of the problem(s) (see below) it has on the line of the dating method.*

**Each dating method will have more than one letter in front of it. Each letter may be used more than once. Some will be used several times.**

**Methods:**

- |       |                       |
|-------|-----------------------|
| _____ | 1. Uranium—lead       |
| _____ | 2. Potassium—argon    |
| _____ | 3. Rubidium—strontium |
| _____ | 4. Isochron dating    |

**Problems:**

- |   |   |
|---|---|
| A. Daughter element can be forced up from the bottom to the top of the rock.  | G. It tests isotopes, but it is impossible to know how much of each isotope was present at the beginning. |
| B. Parent element can be leached out of the rock.                             | H. Daughter element can be absorbed from the air.   |
| C. Daughter element can be leached out of the rock.                           | I. Leaching of different isotopes occurs.   |
| D. Daughter material can be trapped in the rock.                              | J. There is no way to know the original composition of the rock.  |
| E. It gives dates that do not agree with other radiometric dating methods.    |   |
| F. It has given very old ages for igneous rock deposited in historical times. |   |

## Sections 4 & 5

# Short Range Dating Methods

*Match the words with the terms that fit them.*

- |                 |   |   |
|-----------------|---|---|
| A. 50,000 years | F. Dendochronology / tree-ring dating   | J. Radiocarbon dating                   |
| B. Artifacts    | G. Half-life of $^{14}\text{C}$         | K. Stabilized                           |
| C. Carbon-12    | H. Nitrogen                             | L. Thermoluminescence                   |
| D. Carbon-14    | I. One effective use of $^{14}\text{C}$ | M. This process creates $^{14}\text{C}$ |
| E. cosmic rays  |   | N. What $^{14}\text{C}$ dating tests    |

- \_\_\_\_\_ 1. Eight neutrons, six protons.
- \_\_\_\_\_ 2. In a steady state in the atmosphere; same amount all the time.
- \_\_\_\_\_ 3. A proton turning into a neutron.
- \_\_\_\_\_ 4. Six neutrons, six protons.
- \_\_\_\_\_ 5. Ratio of  $^{14}\text{C}$  to  $^{12}\text{C}$  in an artifact.
- \_\_\_\_\_ 6. 5730 years.
- \_\_\_\_\_ 7. The organic remains of once living things; a piece of cloth, for example.
- \_\_\_\_\_ 8. To determine if an artifact is younger or older than 50,000 years.
- \_\_\_\_\_ 9. Measures the light released from a cooling mineral.
- \_\_\_\_\_ 10. The element which is changed into carbon-14.
- \_\_\_\_\_ 11. Counting the growth rings in a tree trunk to determine its age.
- \_\_\_\_\_ 12. Another term for carbon-14 dating.
- \_\_\_\_\_ 13. No detectable  $^{14}\text{C}$  should remain in an artifact after this time.
- \_\_\_\_\_ 14. These things cause carbon-14 to be created.



## Section 6

# Young Earth Indicators

*Describe in your own words the six indicators of a young Earth given in the textbook and explain their significance.*

- 1. Salt in the ocean**
  
- 2. The Dynamic Decay Theory and the earth's magnetic field**
  
- 3. Short period comets**
  
- 4. Diffusion of helium from rock crystals**
  
- 5. Carbon-14 in fossils, coal, and diamonds**

# Group Activity

## Radiometric Dating

### Object:

To learn how radiometric dating specialists date radioactive rocks.

### Materials:

1. Two small boxes, each containing pieces of paper with the terms “radioactive element x” and “daughter element y” written on them. You are to consider the boxes to be your radioactive “rocks” and the pieces of paper to be **all** the atoms of that rock.  
(TEACHERS: Box 1 should contain 28 daughter atoms and 4 parent atoms. Box 2 should also contain 28 daughter atoms and 4 parent atoms.)
2. Lab Instruction Sheet

### Procedure:

1. Since your ability to do this lab depends on your understanding of half-life, renew its definition in your mind by looking it up in your textbook. Write the definition on the lines below.

Half-life: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

2. The half-life of “radioactive or parent element x” is **30 minutes**. Assume that **all of the atoms in the “rock” were radioactive to begin with**.

3. Open “rock” A and count your “atoms.” Total # of atoms: \_\_\_\_\_

4. Calculate the age of your “rock” based on this information. You may not need all the spaces for half-lives given below, or you may need more. If so, write them in.

- A. Number of atoms of parent element that were present in the beginning. **Remember what was said in number 2!** \_\_\_\_\_
- B. Number of atoms of parent element which should be left after one half life? \_\_\_\_\_ left.  
 After 2 half-lives? \_\_\_\_\_ left. After 3 half-lives? \_\_\_\_\_ left. After 4 half-lives? \_\_\_\_\_ left.
- C. How many radioactive atoms do you actually have left? \_\_\_\_\_  
 How many half-lives have occurred? \_\_\_\_\_ (Based on actual # of daughter atoms you have left and your calculations above)
- D. **Number of half-lives** \_\_\_\_\_ **x duration of each half-life (30 minutes) = age of rock:** \_\_\_\_\_ **minutes.**

5. Open “rock” B. Count the total number of all “atoms.” This time you are to assume that **half** of **all** the atoms in “rock” B were **daughter element to begin with**. The half-life of the radioactive element is still **30 minutes**. Based on this information, calculate how old the “rock” is. Total # of all atoms \_\_\_\_\_

- A. Number of radioactive atoms which were present at the beginning? **Remember what was said in #5!** \_\_\_\_\_
- B. Number of atoms of parent element which should be left after one half-life? \_\_\_\_\_ left.  
After 2 half-lives \_\_\_\_\_ left. After 3 half-lives? \_\_\_\_\_ left. After 4 half-lives? \_\_\_\_\_ left.
- C. How many radioactive atoms do you actually have left? \_\_\_\_\_  
Number of half-lives? \_\_\_\_\_
- D. Number of half-lives \_\_\_\_\_ x duration of each half-life (30 minutes) = age of rock: \_\_\_\_\_ minutes.

6. Answer the following questions based on what you have learned through this lab and **from the book**:

- A. You had the same number of radioactive “atoms” and daughter element “atoms” in both rocks. The “rocks” also had the same half-life. What did changing the assumption about the original composition of the rock do to the age of the rock?

---



---

- B. We have been dealing with half-lives of 30 minutes in this lab. In contrast, the elements which are tested in real rocks have half-lives of millions or billions of years. (Even carbon-14’s half-life is 5,700 years.) Suppose the half life of the “rocks” in our lab were millions of years instead of minutes. What would miscalculating the initial composition of the rock do to the age of the rock?

---



---

- C. Before you were told to assume what the initial composition of the rock was, did you have any way of finding out how many atoms had originally been radioactive?

---



---

- D. Suppose you had been asked to throw away half of the **radioactive** “atoms” before you started calculating half-lives. What would eliminating half the radioactive atoms do to the apparent age of the rock? **THINK!**

---



---



---



---

- E. What does this elimination of some of the radioactive atoms in the rock represent in nature?

---



---

- F. Suppose you had been asked to **add more atoms of daughter element** before you started calculating half-lives. What would adding atoms of daughter element do to the apparent age of the rock? **THINK!**

---

---

- G. In what method of radiometric dating is the addition of daughter element a problem?

---

---

- H. You were also to assume that the half-life of “radioactive element x” was 30 minutes. Which of the three assumptions about radioactive dating does this represent?

---

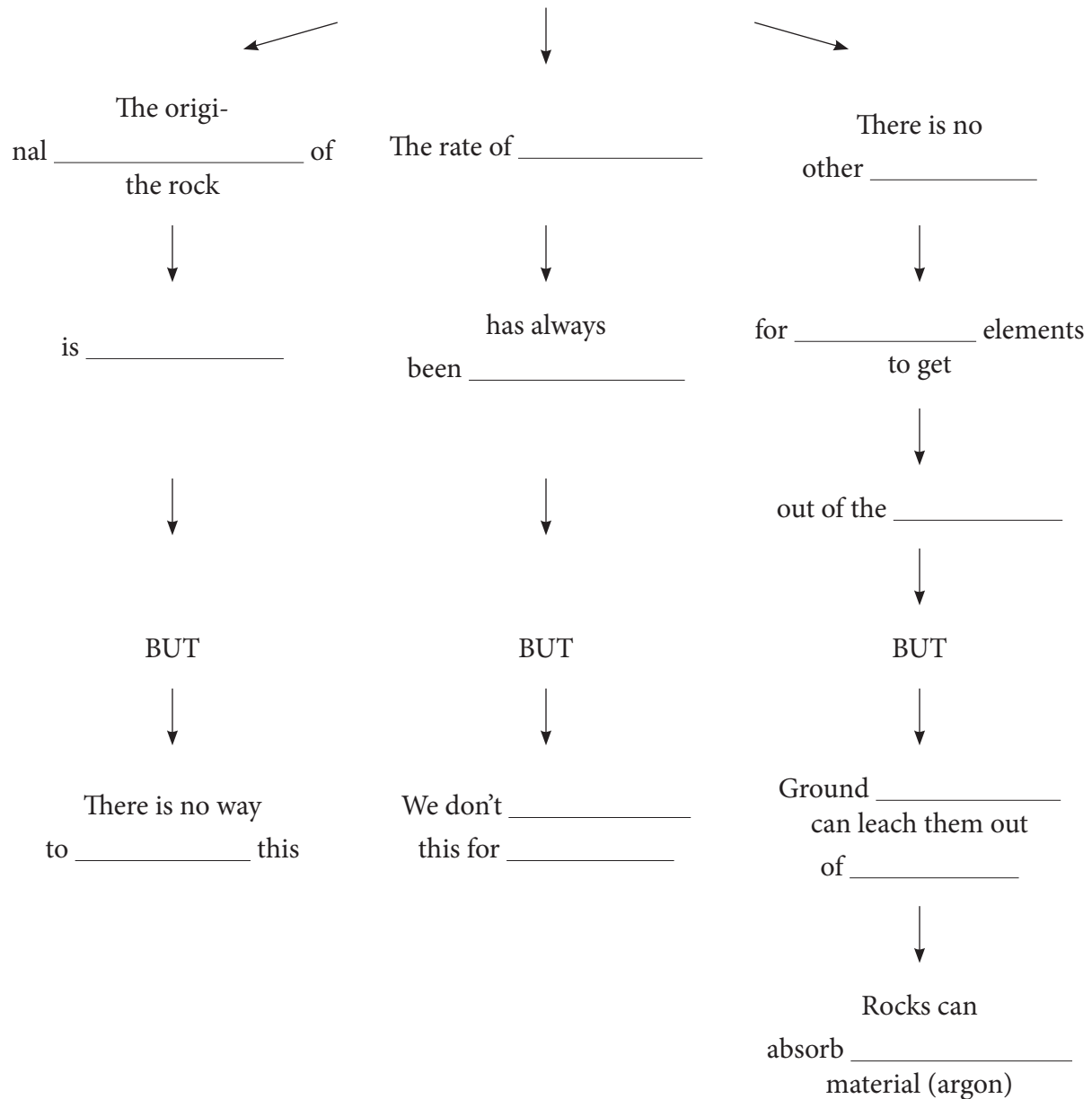
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**Remember:** If radioactive element is removed or if daughter element is added, the age of the rock is altered and appears to be much *older*. **THIS IS VERY IMPORTANT TO UNDERSTAND.** If you have any problems with any of these questions, check your book.

# Concept Map One

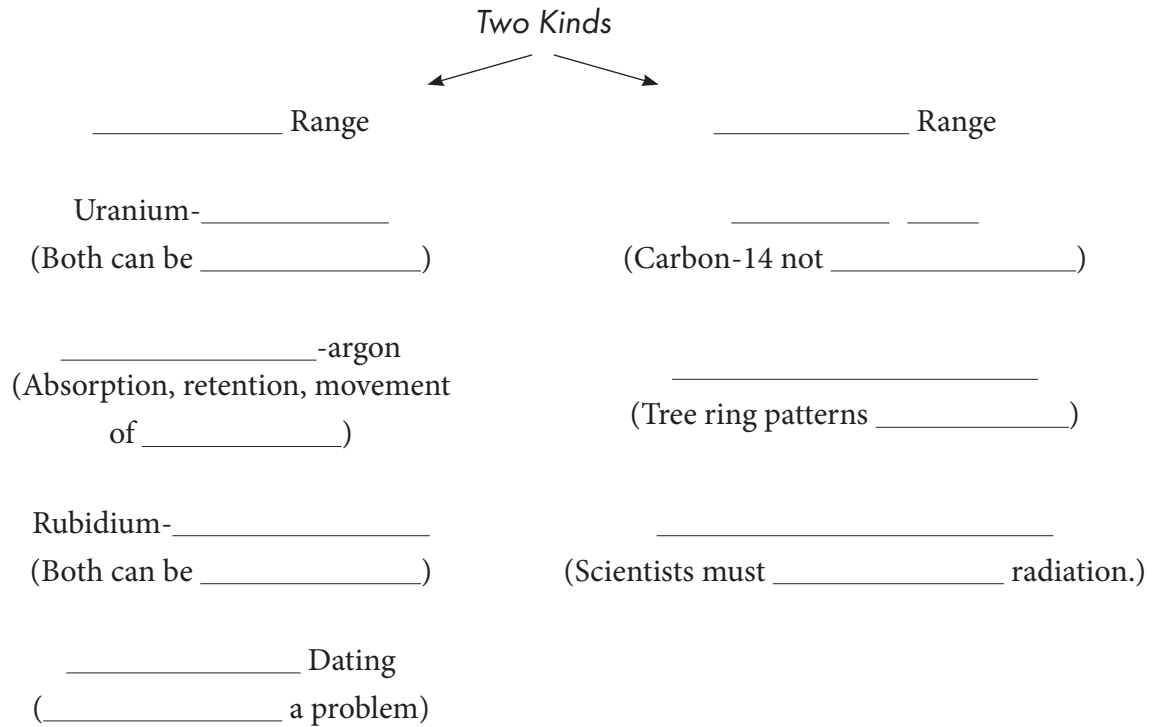
## Radiometric Dating

*Radiometric dating rests on three premises*

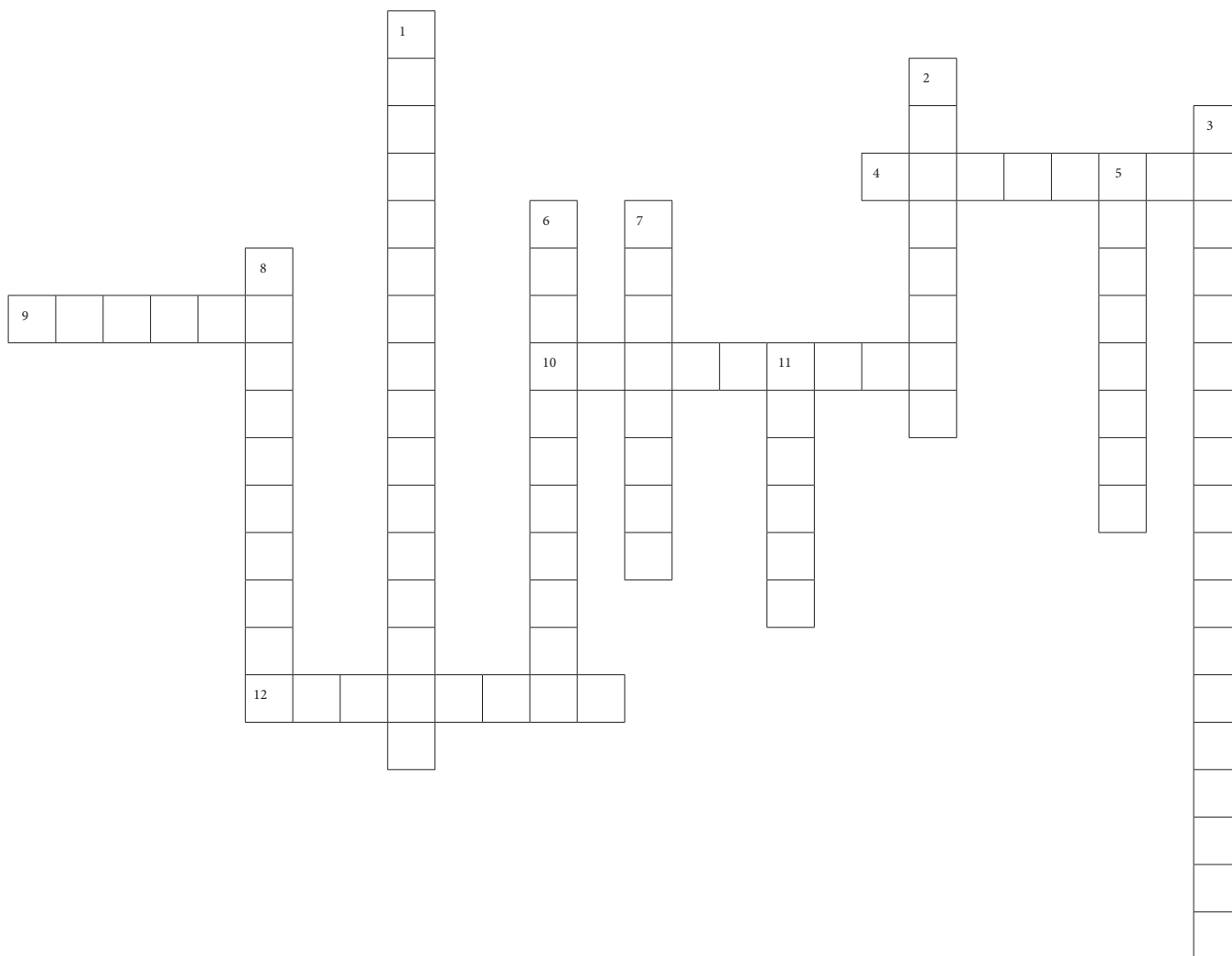


# Concept Map Two

## Radiometric Dating



# Vocabulary Crossword Puzzle



## Across

4. The time it takes for half the radioactive material in a rock to break down into a stable element.
9. In radiometric dating, the unstable, radioactive element is called the \_\_\_\_\_ element.
10. A section of igneous rock which pushes up into overlying rocks.
12. In radiometric dating the stable element which is the end product is called the \_\_\_\_\_ element.

## Down

1. Tree ring dating.
2. Washing out of a rock.
3. Method which tests the amount of light released from a heated mineral.
5. Elements that have the same number of protons but a different number of neutrons.
6. Elements that break down into other elements are \_\_\_\_\_.
7. When atoms have too many neutrons they are \_\_\_\_\_.
8. Having the same amount of Carbon-14 available over a long period of time.
11. Elements that do not decay into other elements are \_\_\_\_\_.

# Review

1. *What are three assumptions upon which all radiometric dating is based?*

2. *What is wrong with two of these assumptions?*

3. *The third assumption has some credibility. State which one this is and tell why. Does this mean it is totally acceptable? Why or why not?*

4. *What is half-life?*

5. *Determine the amount of radioactive material that will be left in each of the following situations. Use fractions. Assume the material was all radioactive in the beginning.*

**A. Element X has a half-life of 10 hours. How much will be left after 50 hours have passed? Use fractions!**

**B. Element Y has a half-life of 15 minutes. How much will be left after one hour?**

**C. Element Z has a half-life of 3 days. How much will be left after 6 days?**



6. Below are listed the different types of long-range dating that are used. We know the three assumptions affect their accuracy. Tell what each method measures and any additional problems each method has.

Method	Measures?	Problem(s)
Uranium-lead		
Potassium-argon		
Rubidium-strontium		
Isochron Dating		

7. In what type of rock are fossils found? What kind of rock is commonly tested radiometrically?

8. List three reasons why radioactive elements are unstable.

9. Give 2 examples of incorrect potassium-argon test results on rocks that were formed in historical times.

10. Give an example of incorrect rubidium-strontium test results on rock formations in the Grand Canyon.

11. Short range methods:

*A. Willard Libby, the developer of carbon14 dating, assumed that C14 was stabilized in the atmosphere. What does being stabilized mean?*

*B. Scientists now know that carbon-14 is not yet stabilized in the atmosphere. What effect would this have on artifacts that are tested?*

*C. On what kind of materials is carbon14 dating used? What is its half-life, and how old can the materials be?*

*D. Can carbon14 dating ever be used with a relative degree of accuracy? How?*

12. List 2 other short-range methods and explain how each works.

13. Explain in detail three evidences of a young Earth. What is significant about a young Earth?

Student Name: \_\_\_\_\_ Teacher: \_\_\_\_\_ Period: \_\_\_\_\_

# Test

## Multiple Choice

*Place the letter in the space provided that best completes the sentence.*

- \_\_\_\_\_ 1. Most radiometric dating relies on \_\_\_\_ assumptions.
- |      |      |
|------|------|
| A. 1 | C. 3 |
| B. 2 | D. 4 |
- \_\_\_\_\_ 2. We know that the rate of radioactive decay has been relatively constant for approximately:
- |                       |                         |
|-----------------------|-------------------------|
| A. the last 100 years | C. a few million years. |
| B. billions of years  | D. never                |
- \_\_\_\_\_ 3. The time it takes for 50% of the radioactive atoms in a sample rock to break down into its daughter element is called its:
- |                  |                          |
|------------------|--------------------------|
| A. decay element | C. parent element        |
| B. half-life     | D. none of these choices |
- \_\_\_\_\_ 4. The assumption about radiometric dating that has the most support is:
- |   |   |
|---|---|
| A. the original composition of the rock is unimportant                    | C. the rate of decay has always been constant     |
| B. there are several ways for radioactive material to get out of the rock | D. none of the assumptions has any support at all |
- \_\_\_\_\_ 5. Scientists testing different samples of the same radioactive rock formation get:
- |                                  |                           |
|----------------------------------|---------------------------|
| A. consistently the same results | C. widely varying results |
| B. fairly close results          | D. None of the above      |
- \_\_\_\_\_ 6. Radioactive elements are unstable because:
- |   |   |
|---|---|
| A. they have an excess of protons           | C. they have more neutrons than protons |
| B. their nuclei are too large for stability | D. all of these are correct             |
- \_\_\_\_\_ 7. Element x has a half-life of 5 minutes. This means that at the end of 15 minutes \_\_\_\_\_ will be left.
- |        |        |
|--------|--------|
| A. 1/8 | C. 1/3 |
| B. 1/4 | D. 1/2 |

- \_\_\_\_\_ 8. In order to use long-range dating methods scientists
- A. must use carbon-14 only
  - B. can use uranium-lead,
  - C. can use potassium-argon
  - D. can use rubidium-strontium
  - E. B, C, and D are correct
- \_\_\_\_\_ 9. Uranium—lead dating is based on the ratio of uranium to lead in a(an) \_\_\_\_\_ rock.
- A. sedimentary
  - B. igneous
  - C. metamorphic
  - D. shale
- \_\_\_\_\_ 10. The following material(s) can be removed from a rock through leaching by ground water.
- A. Rubidium
  - B. Strontium
  - C. Lead
  - D. Uranium
  - E. All of these
- \_\_\_\_\_ 11. One of the reasons the Potassium—Argon method of dating is inaccurate is that:
- A. potassium and argon can be leached out of rocks
  - B. rocks can absorb argon from the air
  - C. argon can be forced up to the surface of the rock from the rock's interior
  - D. argon can be trapped in the rock
  - E. B, C, and D are correct
- \_\_\_\_\_ 12. Using potassium-argon dating, rock samples taken from Hualalai, Hawaii, and from Mt. St. Helens were tested. Although both rock samples were formed in historical times, the samples gave dates of:
- A. 10,000 to 20,000 years
  - B. 50,000 to 100,000 years
  - C. 1 to 2 million years
  - D. 350,000 to 3 billion years
- \_\_\_\_\_ 13. Rubidium-strontium dating:
- A. is very accurate
  - B. is not affected by the problems that other methods have
  - C. gives dates which are out of line with other methods of dating
  - D. is relatively accurate
- \_\_\_\_\_ 14. Isochron dating is an attempt to date the age of rocks by measuring the ratio of different \_\_\_\_\_ within the rocks.
- A. minerals
  - B. isochrons
  - C. electrons
  - D. isotopes

- \_\_\_\_\_ 15. Isochron dating has problems because:
- A. it is impossible to determine the original ratio of isotopes
  - B. different isotopes of both rubidium and strontium can be leached out of the rock
  - C. neither A nor B
  - D. both A and B
- \_\_\_\_\_ 16. Carbon-14 dating is generally used by evolutionists to date material up to \_\_\_\_ years old.
- A. 10 million
  - B. 50,000
  - C. 10,000
  - D. 1 million
- \_\_\_\_\_ 17. Libby, the developer of Carbon-14 dating, assumed:
- A. carbon-14 is stabilized in the atmosphere
  - B. carbon-14 is not stabilized in the atmosphere
  - C. it didn't matter if Carbon-14 is stabilized or not
  - D. none of the above
- \_\_\_\_\_ 18. Carbon-14 dating is used to date:
- A. artifacts (organic materials)
  - B. minerals
  - C. rocks
  - D. none of these
- \_\_\_\_\_ 19. Being stabilized means:
- A. the same amount of the substance is constantly present
  - B. the  $^{14}\text{C}$  levels have fluctuated over time
  - C. the amount of carbon-14 in the upper atmosphere fluctuates, but the amount near the earth does not
  - D. the amount of carbon-14 is building up
- \_\_\_\_\_ 20. If  $^{14}\text{C}$  has not yet stabilized in the atmosphere, this means:
- A. carbon-14 is still building up in the atmosphere
  - B. test samples will appear to be older than they actually are
  - C. the fluctuation of carbon-14 does not matter
  - D. both A and B

## Modified True and False

*If, according to the text, the statement is true, circle T. If it is false, circle F and then change the underlined word to correct the statement in the space provided. (One point for each correct true answer; two points for each corrected false answer)*

T F 1. Some radiometric dating methods rest on premises (assumptions) which cannot be proved.

---

T F 2. Different samples of the same igneous rock will give different dates when dated radiometrically.

---

T F 3. Rubidium and strontium can be trapped in rocks.

---

T F 4. Rubidium is not in a steady state (stabilized) in the atmosphere.

---

T F 5. Intermediate isotopes of radioactive elements can be leached from rocks.

---

T F 6. When magma is forming underground, mixing of different elements occurs.

---

## Short Essay Questions

*Answer the following questions in complete sentences.*

**1. Explain in detail *three* assumptions upon which all radiometric dating is based. (6 points)**

**2. Explain why one of these assumptions has some credibility. (2 points)**

**3. Explain *in detail* what is wrong with the other two assumptions. (4 points)**

**4. Explain *in detail*, three evidences indicating a young earth. *If the Earth is young, what is significant about this fact?* (6 points)**



## Chapter 8

# Suggestions for Beginning

**N**ow is the time to bring out the group activity for Chapter 3 and review the characteristics that your student(s) believe a fossil should have in order to be considered a hominid. Discuss each characteristic along with the reasons for choosing that characteristic. Emphasize that it is important to have strict scientific standards for giving a fossil hominid status. Ask your pupil(s) to watch and see how many of the “hominids” in Chapter 8 actually meet the criteria they feel is scientifically necessary.

# Sections Question Key

## Section One: Paleontologists' Research Methods

*1. List three methods used by paleontologists in determining hominid status for a fossil and discuss why they would be unacceptable in any other branch of science.*

*2. What problem does a lack of articulated skeletons create for paleontologists?*

## Section Two: Some Hominids Disproved by Evolutionists

*1. How much of the original fossil of Ramapithecus was found?*

*2. What did paleoanthropologists later discover and how did this affect their opinion of Ramapithecus?*

*3. How much of P. boisei was originally found?*

*4. Explain two other problems with determining if the fossil belonged in man's ancestry.*

*5. What did the Leakeys finally decide about the status of P. boisei?*

### Section Three: Very Early Hominids

1. *How much of the original skeleton of Ar. ramidus was found?*
2. *How did Tim White and his colleagues put the fossil back together?*
3. *Why is the claim that A. ramidus walked upright so tenuous?*
4. *How much of Ar. kadabba was found? Where were the fossil parts found?*
5. *What are two major problems with including the toe bone with the other parts of the Ar. kadabba fossil?*
6. *What was the condition of the fossil?*

### Section Four: Later Hominids

1. *Name the parts of the A. anamensis specimen and explain where they were found.*

2. Give three reasons why thinking persons might question its authenticity.
  
  
  
  
  
  
  
  
  
  
3. Under what circumstances was *A. afarensis* found, and what important skeleton part was missing?
  
  
  
  
  
  
  
  
  
  
4. How did Johanson get a skull for *A. afarensis*? Were there any skeletal bones with the skull? What problem does this pose?
  
  
  
  
  
  
  
  
  
  
5. What is the Kanapoi hominid, and how does it affect the fossil status of *A. afarensis*?
  
  
  
  
  
  
  
  
  
  
6. How much of *Kenyanthropus platyops* was found, and what was the condition of the fossil?
  
  
  
  
  
  
  
  
  
  
7. Why was there a problem when the expedition members put the fossil skull together?
  
  
  
  
  
  
  
  
  
  
8. Were Dr. Leakey and her colleagues able to determine if *K. platyops* walked upright? Why or why not?

9. *What are two major problems with the Australopithecus africanus specimen?*

10. *What has happened to the holotype specimen of A. africanus, the Taung skull?*

### **Section Five: "Final" Hominid**

1. *Under what circumstances were the first Homo habilis specimens found?*

2. *How much of the fossil was found?*

3. *Give at least three problems with the bones of H. habilis that make it difficult to classify him as a human ancestor.*

4. *What is H. habilis more likely to be?*

### **Section Six: Archaic Humans**

1. *The term, holotype, refers to the original specimen from which the description of a new species is made. What is the main problem with the holotype specimen of H. ergaster?*

2. Describe specimen KNM-WT 15000. What does it appear to be?

3. What do the specimens of *H. ergaster* appear to be?

4. Under what conditions did Eugene DuBois discover the first specimen of *H. erectus*?

5. How did Mr. DuBois date his specimen?

6. What other species did *H. erectus* resemble?

7. List at least 3 characteristics of *H. erectus* that demonstrate his humanity.

8. What characteristics of *H. heidelbergensis* and *H. neanderthalensis* show them to be human?

## **Section Seven: The Lake Laetoli Footprints**

1. *According to Mary Leakey, what did the Lake Laetoli footprints closely resemble?*
2. *How were they dated and what age were they given?*
3. *Why do evolutionists say they were made by A. afarensis?*
4. *What did Richard Tuttle have to say about the footprints?*

## **Section Eight: What does All This Mean?**

1. *If the Laetoli footprints are modern human footprints and the Kanapoi hominid is a human fossil, where does this put modern humans on the evolutionary time scale—especially in relation to the hominids?*
2. *What questions should you ask before accepting a link fossil as genuine?*

## Section 1

# Paleontologists' Research Methods

*Use the following words to fill in the appropriate blanks, after you read the first section of this chapter.*

bipedal	link	different
unfamiliar	skull	evidence
found	aligned	hominid
few	articulated	together
Brontosaurus	incorrectly	fossil
<i>Apatosaurus</i>	man	assign
rock	methods	adjust
far	scientists	parts
lack	fragments	
debated	bones	

Perhaps no other area of evolution has been so widely \_\_\_\_\_ as the evolution of \_\_\_\_\_. There are several reasons for this debate. Many scientists question the \_\_\_\_\_ used by \_\_\_\_\_ in gathering \_\_\_\_\_. One of the problems is that relatively \_\_\_\_\_ fossil \_\_\_\_\_ remains have been \_\_\_\_\_. Another is that scientists often find only \_\_\_\_\_ of a fossil. It is very rare to find \_\_\_\_\_ skeletons. They often gather \_\_\_\_\_ from \_\_\_\_\_ locations and put them \_\_\_\_\_ to form one \_\_\_\_\_. These locations may be \_\_\_\_\_ apart and in different \_\_\_\_\_ strata. Scientists also \_\_\_\_\_ radiometric dates to fit their preconceptions about the fossil's age. Finally, there is a widespread \_\_\_\_\_ of \_\_\_\_\_ fossils. So scientists often \_\_\_\_\_ hominid status to fossil parts that are too few and too small.

One example of what can happen when scientists use fossil parts from different locations is \_\_\_\_\_. This creature did not exist. However, scientists mistakenly put the wrong \_\_\_\_\_ on the body of an \_\_\_\_\_. Scientists often put together bones from creatures with which they are \_\_\_\_\_. As a result, they can put them together \_\_\_\_\_. For example, if the \_\_\_\_\_ of a foot are not properly \_\_\_\_\_, the foot bones can be made to look as if the creature is \_\_\_\_\_, when it may not be.



## Section 2

# Some Early Men Disproved by Evolutionists

Decide whether each of the statements is true or false. If the statement is true, circle T. If the statement is false, circle F and then rewrite the statement so that it is true.

T F 1. One early man disproved by evolutionists is *A. afarensis*.

---

T F 2. The original fossil of *Ramapithecus* was found in India.

---

T F 3. The original fossil of *Ramapithecus* consisted of a few jaw fragments and teeth.

---

T F 4. The later fossil of *Ramapithecus* consisted of a complete skeleton.

---

T F 5. The fossil actually was actually that of a pig.

---

T F 6. *Paranthropus Boisei* was also known as Nutcracker Man.

---

T F 7. This fossil consisted of a complete skull and some skeletal bones.

---

T F 8. *Paranthropus boisei* was dated by its discoverers to be 2,000 years old .

---

T F 9. The fossil's brain case was large—about 1100 cubic centimeters.

---

Student Name: \_\_\_\_\_ Teacher: \_\_\_\_\_ Period: \_\_\_\_\_

*T F* 10. The fossils of both *H. habilis* and humans have been found at *P.boisei* sites.

\_\_\_\_\_

*T F* 11. *P. boisei* is still generally considered in the line of man.

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

## Section 3

# Very Early Hominids

I. On the page below, state the following facts about *Ar. ramidus* and *Ar. kadabba*.

### **A. ramidus**

*Amount of fossil found*

*Location of fossil parts*

*Condition of fossil*

*Supporting facts for claims of bipedality*

*Opinions of other evolutionists*

### **A. kadabba**

*Amount of fossil found*

*Location of fossil parts*

*Condition of fossil*

*Supporting facts for claims of bipedality*

Student Name: \_\_\_\_\_ Teacher: \_\_\_\_\_ Period: \_\_\_\_\_

***Opinions of other evolutionists***

*II. Based on these facts, what is your opinion of the evidence supporting these fossils as true hominids, creatures in the ancestry of man?*

## Section 4

# Later Hominids

I. On the page below, state the following facts about *A. anamensis*, *A. afarensis*, *K. platyops*, and *A. africanus*, based on the text. You may also look at any pictures of these hominids that are available in the book.

### **A. anamensis**

*Amount of fossil found*

*Location of fossil parts*

*Condition and nature of fossil*

*Supporting facts for claims of bipedality*

*Opinions of other evolutionists*

### **A. afarensis**

*Amount of fossil found*

*Location of fossil parts*

*Condition and nature of fossil*

*Supporting facts for claims of bipedality*

*Opinions of other evolutionists*

**K. platyops**

*Amount of fossil found*

*Location of fossil parts*

*Condition of fossil*

*Supporting facts for claims of bipedality*

*Opinions of other evolutionists*

**A. africanus**

*Amount of fossil found*

*Location of fossil parts*

*Condition of fossil*

*Supporting facts for claims of bipedality*

*Opinions of other evolutionists*

*II. What is the significance of the Kanapoi hominid?*

*III. Based on these facts, what is your opinion of the evidence supporting these fossils as true hominids, creatures in the ancestry of man?*

## Section 5

# “Final” Hominid

*I. Below are listed questions that a thinking person asks himself on hearing of a new fossil find. In the blank spaces state the answers to these questions in reference to H. habilis.*

**1. How much of the fossil was found, and what was its condition?**

**2. Were all the fossil parts found together, or were they found in several locations?**

**3. If they were found in different locations, were they found in rocks of the same age?**

**4. How were they dated? Were radiometric dates “adjusted” to support geologic time scale dates?**

**5. Are there additional problems with the fossil?**

**6. How do some other evolutionists feel about *H. habilis*?**

*II. How would you evaluate this fossil find, based on the answers to the questions?*



## Section 6

# Archaic Humans

Until now you have been looking at the traits that a true hominid should possess. Now think in terms of what traits and characteristics are truly human. The list below is a beginning. Verify the status of each of the following fossils based on their exhibiting these human traits and characteristics. In some instances the text may not have included the information. If this is the case, write "information not given."

### 1. Shows obvious evidence of walking upright

<i>Homo ergaster</i> (KNM-WT 1500)	
<i>Homo erectus</i>	
<i>Homo heidelbergensis</i>	
<i>Homo neanderthalensis</i>	

### 2. Has a brain capacity of 1100–1450 cubic centimeters

<i>Homo ergaster</i> (KNM-WT 1500)	
<i>Homo erectus</i>	
<i>Homo heidelbergensis</i>	
<i>Homo neanderthalensis</i>	

### 3. Bone structure and size is human in character

<i>Homo ergaster</i> (KNM-WT 1500)	
<i>Homo erectus</i>	
<i>Homo heidelbergensis</i>	
<i>Homo neanderthalensis</i>	

**4. Shows evidence of having used tools**

<i>Homo ergaster</i> (KNM-WT 1500)	
<i>Homo erectus</i>	
<i>Homo heidelbergensis</i>	
<i>Homo neanderthalensis</i>	

**5. Shows evidence of the use of fire**

<i>Homo ergaster</i> (KNM-WT 1500)	
<i>Homo erectus</i>	
<i>Homo heidelbergensis</i>	
<i>Homo neanderthalensis</i>	

**6. Shows evidence of having buried their dead**

<i>Homo ergaster</i> (KNM-WT 1500)	
<i>Homo erectus</i>	
<i>Homo heidelbergensis</i>	
<i>Homo neanderthalensis</i>	

II. Based on this information, evaluate the status of each of these Archaic humans.  
Are they human or not? WHY?

## Sections 7 & 8

# The Lake Laetoli Footprints & What Does All This Mean?

*I. Place the following words in the blanks in which they belong.  
One word will not be used.*

volcanic ash	<i>Homo</i>	3.6 million
footprints	expedition	casts
barefoot	<i>A. afarensis</i>	disagree
foot	study	old
agree	bears	similar
ours	habitually unshod	form
Indians	important	humans

The Lake Laetoli Footprints are one of the most \_\_\_\_\_ finds of the past twenty years. Mary Leakey's \_\_\_\_\_ found footprints impressed in hardened \_\_\_\_\_. Dr. Leakey states that the footprints are remarkably \_\_\_\_\_ to those of modern man. She also says that the \_\_\_\_\_ of the \_\_\_\_\_ was exactly the same as \_\_\_\_\_. Almost all scientists \_\_\_\_\_ with this description of the footprints.

Potassium-argon tests on the ash in which the footprints were found gave an age of \_\_\_\_\_ years. Therefore the evolutionary scientific community stated the footprints must have been made by \_\_\_\_\_.

Richard Tuttle of the University of Chicago made a \_\_\_\_\_ of the footprints. At first he compared them to \_\_\_\_\_. He then made \_\_\_\_\_ of the feet of some \_\_\_\_\_ of Peru who habitually go \_\_\_\_\_. He states that the footprints resemble \_\_\_\_\_ humans. He concludes that if the \_\_\_\_\_ were not so \_\_\_\_\_, we would readily conclude that they were made by a member of our genus, \_\_\_\_\_. So, simply taking the evidence at face value, the Lake Laetoli footprints were made by \_\_\_\_\_.

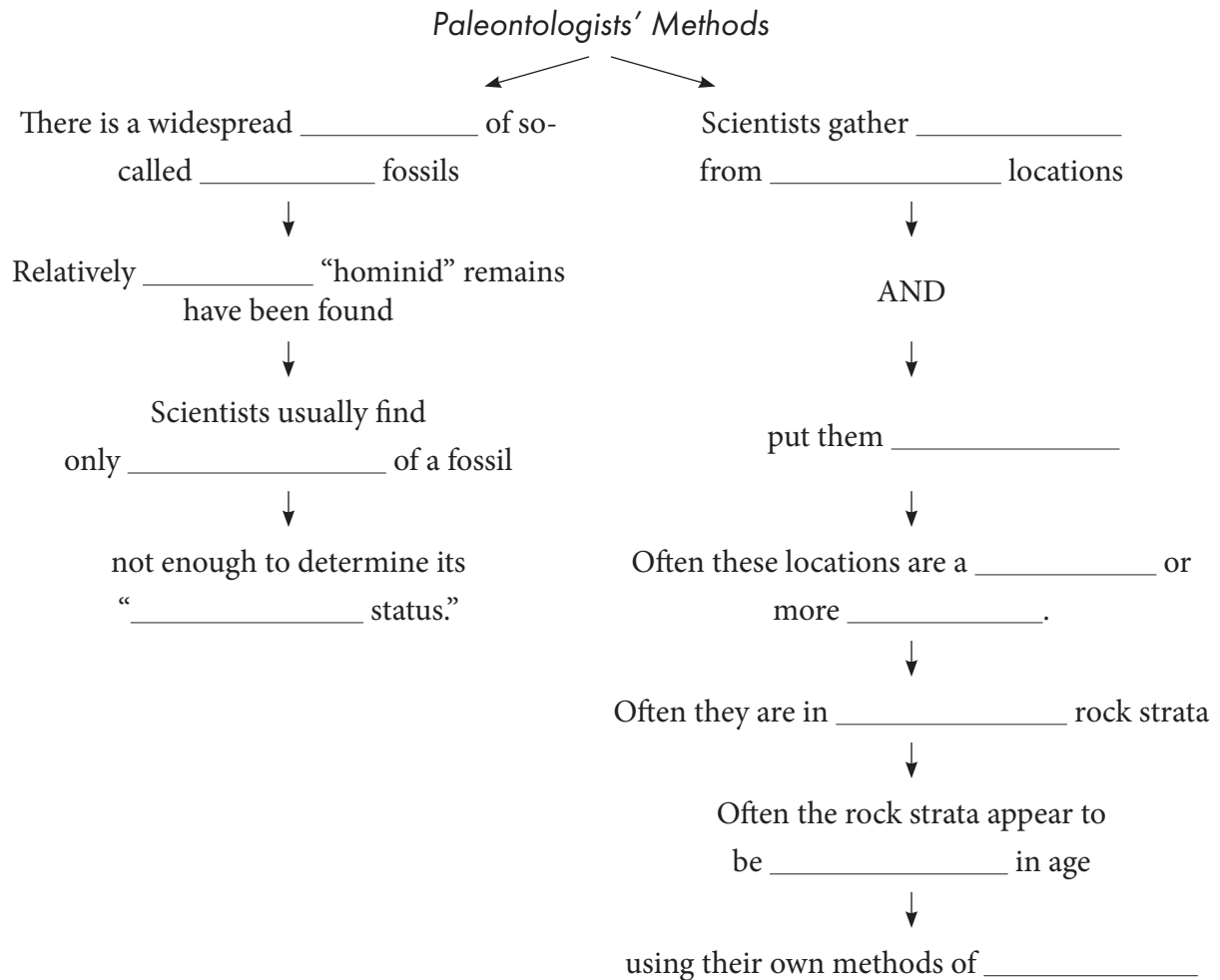
*II. What is the significance of the Lake Laetoli footprints?*

Student Name: \_\_\_\_\_ Teacher: \_\_\_\_\_ Period: \_\_\_\_\_

*III. In the spaces below, list four questions an intelligent person asks himself when he hears of an important new fossil being discovered.*

# Concept Map

## Evolution of Man?



# Vocabulary

*In the blanks below write the word which fits the definition.*

- \_\_\_\_\_ 1. A skeleton with bones in place (in correct proximity to one another).
- \_\_\_\_\_ 2. Walking on two legs.
- \_\_\_\_\_ 3. The condition in which male members of the species differ from the females (in size, etc.)
- \_\_\_\_\_ 4. A dinosaur who “never was”.
- \_\_\_\_\_ 5. Human-like species.
- \_\_\_\_\_ 6. Referring to a species which has completely died out.
- \_\_\_\_\_ 7. A fossil of a human upper arm bone dated to be over 4 m.y.o.
- \_\_\_\_\_ 8. Impressions in volcanic ash; dated radiometrically to be older than the hominids.
- \_\_\_\_\_ 9. At first believed to be an ancestor of both apes and man; later discovered to be an orangutan fossil.
- \_\_\_\_\_ 10. At first thought to be a hominid; later believed to be an intruder (or a victim) on a *Homo habilis* living site. Lack of evidence to Support hominid status.

*Match the fossil with the correct description:*

A. *A. afarensis*  
 B. *A. africanus*  
 C. *A. anamensis*

D. *Homo habilis*  
 E. *K. platyops*  
 F. *Ar. ramidus*

G. *Ar. kadabba*

- \_\_\_\_\_ 1. Discovered by Johanson; nicknamed Lucy; no skull found; other scientists disagreed that the creature had been bipedal; older human bone found nearby.
- \_\_\_\_\_ 2. Discovered by Tim White; fossil smashed and badly distorted; was in so bad a condition “digital reconstruction” and molds had to be used in putting the fossil together; fossil toe was divergent toe used for grasping, not walking.
- \_\_\_\_\_ 3. Discovered by Lewis & Mary Leakey; very small skull capacity; called “handy human”; consisted of fossil parts from several locations and mixed with bones of other species.

- \_\_\_\_\_ 4. Found by Y. Haile-Selassie, a member of Tim White's team; consisted of bone fragments of 5 different individuals, a collarbone and some teeth, and a toe bone found 10 miles away and in rock dated to be at least 200,000 years different in age.
- \_\_\_\_\_ 5. Found by Raymond Dart: not extensively studied for many years; later fossils of species fragmentary and often distorted from the fossilization process.
- \_\_\_\_\_ 6. Discovered by Meave Leakey in three different locations; fossil consisted of skull fragment, ape-like tooth and jaw fragments, and human-like tibia; parts dated to be 500,000 year different in age.
- \_\_\_\_\_ 7. Partial skull and fragmentary upper jaw only parts that could be definitely assigned to this species; skull has been cracked and distorted; no skeletal bones.

# Review

*I. In the spaces below list some questionable methods used by paleontologists and physical anthropologists.*

*II. In the spaces below name two “link fossils” in the line of man which were at first accepted and later disproved by evolutionists. Then tell what they really were.*

*III. In the spaces below, give at least two reasons to explain why the seven listed hominids should not be listed as our ancestors.*

**1. *Ar. ramidus***

**2. *Ar. kadabba***



3. *A. anamensis*

4. *A. afarensis*

5. *K. platyops*

6. *A. africanus*

7. *Homo habilis*

*IV. Explain what the following fossils are and discuss their significance.*

**A. Kanapoi Hominid**

**B. Laetoli Footprints**

*V. In the space below give five questions a thinking person should ask each time he hears of a new fossil find.*

*VI. What is a more logical way to classify Archaic humans?*

# Test

## Matching

Use the letters below to fill in the space provided. Each question is worth 1 point each

- |                         |                            |
|-------------------------|----------------------------|
| A. Articulated skeleton | F. hominid                 |
| B. bipedal              | G. Kanapoi hominid         |
| C. <i>Ramapithecus</i>  | H. Lake Laetoli footprints |
| D. <i>Brontosaurus</i>  | I. sexual dimorphism       |
| E. Extinct              | J. <i>P. boisei</i>        |

- \_\_\_\_\_ 1. Human-like species
- \_\_\_\_\_ 2. A complete set of bones of one creature all in one place
- \_\_\_\_\_ 3. A dinosaur who never was.
- \_\_\_\_\_ 4. Impressions in volcanic ash; dated radiometrically to be older than the hominids
- \_\_\_\_\_ 5. Referring to a species that has died out
- \_\_\_\_\_ 6. A hominid that was really an orangutan
- \_\_\_\_\_ 7. A condition in which the male members of a species are veruy different in shape or size from the females
- \_\_\_\_\_ 8. Walking on two legs
- \_\_\_\_\_ 9. Also known as KP271; an upper human arm bone found in rock strata dated to be older than the australopithecines
- \_\_\_\_\_ 10. At first thought to be a hominid; later believed to be an intruder (or a victim) on a *Homo habilis* living site. Lack of evidence to support hominid status.

## True and False

Circle T if the statement is true or F if the statement is false. Each question is worth one point.

- T F 1. A great number of hominid fossil remains have been found.
- T F 2. Scientists are careful to include only fossil parts found in the same rock strata.
- T F 3. *Ar. ramidus* consisted of an articulated skeleton.
- T F 4. Scientists often put bones from different locations together to form one fossil.

- T F* 5. Paleontologists can generally date their fossils fairly accurately.
- T F* 6. Brontosaurus is really an *Apatosaurus* with the wrong head.
- T F* 7. *A. kadabba* has more evidence to support its hominid status than *A. ramidus*.
- T F* 8. In addition to a skull, paleontologists also had several skeletal bones of *K. platyops*.
- T F* 9. Parts of the *A. anamensis* fossil were dated to be 500,000 years different in age.
- T F* 10. In determining the validity of a hominid, it is important to know how much of the fossil was found.
- T F* 11. The fossilization process often distorts fossils.
- T F* 12. Scientists often assign “hominid status” to human bones when they are considered too old to be human.

*In the spaces below, give two reasons why each of the hominids listed are poor choices for our ancestors. Each answer is worth 2 points each.*

**1. *Ar. ramidus***

**2. *Ar. kadabba***

**3. *A. anamensis***

4. *A. afarensis*

5. *K. platyops*

6. *A. africanus*

7. *Homo habilis*

*In the space below write a paragraph explaining what the two following fossils are and discussing their significance: Kanapoi hominid, Laetoli footprints. (6 points)*

Student Name: \_\_\_\_\_ Teacher: \_\_\_\_\_ Period: \_\_\_\_\_

**Name at least two questions a thinking person should ask before accepting a fossil as a hominid.**

*VI. What is a more logical way to classify Archaic humans?*

## Chapter 9

# Suggestions for Beginning

**H**ave available some sort of simple machine which is easily taken apart. A manual can opener might do. Even though the mousetrap is discussed in this chapter, it is also an excellent machine to use, and the repetition will not hurt your student(s). Discuss with your student(s) what the machine is and how it works. Point out that it has at least three necessary parts. One by one, suggest taking away or modifying various parts of the machine. Ask the following questions as you mention each part.

1. Would the machine still work without this part?
2. Could I damage this part without damaging the effectiveness of the machine?
3. Why not?
4. Would there be any reason for this machine to exist, if this part were missing?

The consensus of opinion generally is that there is no reason for the machine to exist unless it is complete and functional. Therefore, it is an irreducibly complex structure. Point out that machines in nature are constructed in the same way.





## Section Two: Perfection in Animals and Birds

*1. What is unique about the bird's respiratory system? Why is it difficult to see how it could have evolved?*

*2. What is unique about the bat microchiroptera's echolocation system which makes it an irreducibly complex structure?*

*3. Why would it be necessary for the giraffe's circulatory system to have been complete and in place in the first giraffe? Explain.*

### **Section Three: Perfection in Larger Systems**

*1. Explain how the oxygen and oxygen-weathering cycles work together to keep oxygen in balance on the Earth.*

### **Section Four: Ideal Characteristics of Water and Sunlight**

*1 .List three of the special attributes of water and explain their significance.*

*2. Explain why the sun's beneficial radiation reaches the Earth's surface, while most of the sun's harmful radiation does not.*

## **Section Five: Planet Earth's Perfect Position in the Solar System and the Universe**

*1. List four of special characteristics of a habitable planet mentioned by Dr. Brownlee and Dr. Ward, and explain why these characteristics are necessary.*

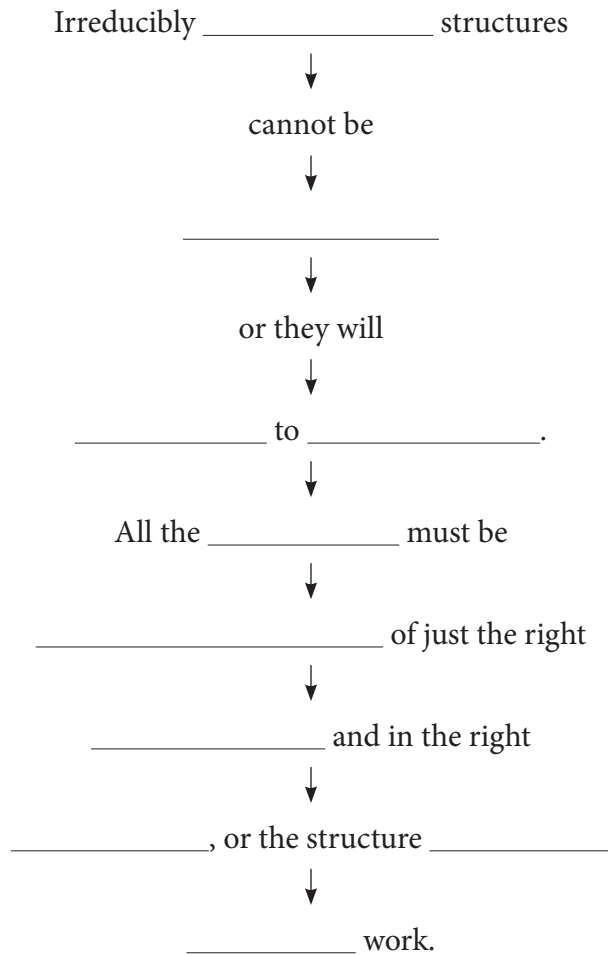
*Reasons:*

Student Name: \_\_\_\_\_ Teacher: \_\_\_\_\_ Period: \_\_\_\_\_

*2. Why does Dr. Denton's assessment seem far more logical than that of Dr. Brownlee and Dr. Ward?*

# Concept Map

## Irreducible Complexity



# Review

## Matching

*Match the following terms with their definitions.*

- A. Biosonar
- B. Bacterial flagellum
- C. Oxygen balance
- D. Pervasiveness of perfection
- E. Electromagnetic spectrum
- F. Gated transport

- G. Surface tension
- H. Irreducibly complex structure
- I. Water's essential characteristics
- J. A cell

- \_\_\_\_\_ 1. The idea that the Earth is filled with extremely complex systems much like computers, each system perfectly suited to perform its particular function and also to work together in harmony with other systems to achieve greater goals.
- \_\_\_\_\_ 2. A "machine" that consists of at least three components, each of which must be present and working harmoniously with the others for the machine to function.
- \_\_\_\_\_ 3. The movement of materials through the membranes of various organelles and through the cell membrane itself.
- \_\_\_\_\_ 4. The name of a bat's echolocation system.
- \_\_\_\_\_ 5. The extension on the body of a bacteria that looks something like a tail; its construction has been compared to that of an outboard motor.
- \_\_\_\_\_ 6. The maintenance of a steady level of oxygen in the Earth's atmosphere.
- \_\_\_\_\_ 7. This causes water to rise up through the soil into the roots of plants and up their stems to their tops.
- \_\_\_\_\_ 8. The radiation emitted by the sun and other stars, characterized by waves of widely varying wavelengths and frequencies.
- \_\_\_\_\_ 9. A good example of a fully automated, self-replicating factory.
- \_\_\_\_\_ 10. Its special thermal and chemical properties and its surface tension.

### **Short answer**

*Answer the following in short but complete sentences:*

**1. What did Darwin expect that scientists would find as they were able to study smaller units? What did scientists actually find?**

**2. Why is the bat's brain extraordinary?**

**3. What do most compounds do as they get colder and freeze—expand or contract? What does water do? Why is this important?**

**4. Why is oxygen balance important?**

**5. How has the cell been described?**

### **Essay questions**

*Answer the following questions in detail, using complete sentences:*

**1. Explain how the cell resembles a man-made factory.**

**2. What is gated transport? Describe the process. Why is it considered irreducibly complex?**

**3. Describe the parts of the bacterial flagellum and explain how each part works with the others to form an irreducibly complex structure.**

**4. How are birds' lungs different from ours? Why would they be considered irreducibly complex?**

**5. Give the name of the bat microchiroptera's system for locating insects, list each part of the system, and explain how they all work together to enable the bat to find food.**

**6. Describe the giraffe's unique circulatory system and explain how each part works together with the others to enable the giraffe to survive, in spite of its long neck and legs.**



**7. Describe in detail the different elements of oxygen balance. Include an explanation of the plant-animal cycle, chemical weathering, the action of algae and bacteria, and density currents.**

**8. Select two of the thermal properties of water and explain how these characteristics help to make life possible on Earth.**

**9. Explain how the energy of the electromagnetic spectrum is uniquely suited to favor life on earth. Include an explanation of how the sun produces it and also how the Earth's atmosphere affects what energy reaches the Earth's surface.**

Student Name: \_\_\_\_\_ Teacher: \_\_\_\_\_ Period: \_\_\_\_\_

**10. Pick out three of the characteristics mentioned by Drs. Ward and Brownlee as being necessary for the Earth to sustain life and explain why they are important.**

# Test

## Multiple Choice

*Circle the letter of the correct answer below. Be sure you read every answer before you decide!*

- \_\_\_\_\_ 1. The “pervasiveness of perfection” means:
- A. perfection is uncommon in nature
  - B. everywhere there are machines and systems carefully built and suited for the tasks they perform
  - C. there are some machines in nature that are well suited for their tasks
  - D. perfection is common only in the microscopic world
- \_\_\_\_\_ 2. In an irreducibly complex structure:
- A. the parts work well together
  - B. there are no moving parts
  - C. the machine will not work unless all the parts are present and functioning together
  - D. both A and C
- \_\_\_\_\_ 3. When Darwin formulated his theory, he believed that as scientists studied smaller and smaller units, they would find that:
- A. things became increasingly less complicated
  - B. things became more complex
  - C. the same degree of complexity
  - D. none of the above
- \_\_\_\_\_ 4. As scientists have studied smaller and smaller units, they have found:
- A. that things become less complicated
  - B. layer upon layer of complexity
  - C. microscopic machines
  - D. both B and C
- \_\_\_\_\_ 5. A cell is a good example of:
- A. an automated factory
  - B. a complex system of machines working together
  - C. an irreducibly complex structure
  - D. all of these

- \_\_\_\_\_ 6. Gated transport is:
- A. carrying of proteins through the cell's cytoplasm to the ribosomes
  - B. movement through the membrane of the organelle for which the protein was produced
  - C. a good illustration of the complexity of cellular activities
  - D. both B and C
- \_\_\_\_\_ 7. The bacterial flagellum is considered an irreducibly complex structure because:
- A. it has more than one part
  - B. it is small
  - C. it has at least three essential parts
  - D. none of these
- \_\_\_\_\_ 8. A bacterial flagellum has been compared to:
- A. an outboard motor
  - B. a boat
  - C. a cell
  - D. a tail
- \_\_\_\_\_ 9. Birds' lungs:
- A. have one-way passages
  - B. have two-way passages
  - C. are irreducibly complex
  - D. both A and C
- \_\_\_\_\_ 10. Bats navigate by a complex system which may be called:
- A. biosonar
  - B. an irreducibly complex structure
  - C. both A and B
  - D. neither A nor B
- \_\_\_\_\_ 11. Biosonar:
- A. is an echolocation system
  - B. is a relatively simple system
  - C. could easily have evolved
  - D. involves only the ears and larynx of the bat
- \_\_\_\_\_ 12. The bat's brain is extraordinary because:
- A. it must be able to separate the reflected sound of its own pulse from that of other bats
  - B. it must determine the size of an object and its distance away
  - C. it requires split-second cooperation of larynx, ears and brain
  - D. A, B, and C are correct
  - E. none are correct
- \_\_\_\_\_ 13. The giraffe's circulatory system:
- A. could have evolved rather easily
  - B. is uniquely suited to its specialized body
  - C. is relatively uncomplicated
  - D. none of the above

\_\_\_\_\_ 14. The feature of the giraffe's body that presents the greatest challenge from an evolutionary standpoint is:

- A. the heart
- B. the long neck
- C. the system of blood vessels
- D. the liver

\_\_\_\_\_ 15. The giraffe has a unique situation because:

- A. it must have a large, strong heart to pump enough blood to its long neck and legs
- B. it must be able to bend its head to the ground to drink water
- C. its body cannot stand a great fluctuation in blood pressure
- D. all of the above

\_\_\_\_\_ 16. The giraffe's body:

- A. has a unique system of arteries and veins
- B. has a unique system of arteries but a very ordinary system of veins
- C. has a unique system of veins but a very ordinary system of arteries
- D. none of the above

\_\_\_\_\_ 17. The giraffe's veins:

- A. are much like those of other mammals
- B. have valves to counteract the effects of gravity on the giraffe's long legs
- C. have valves to prevent part of the blood from receding from the brain
- D. have specialized valves only near the aorta
- E. both B and C

\_\_\_\_\_ 18. In the giraffe's arteries:

- A. some of the blood is shunted off to the vertebral artery when the head is lowered
- B. blood travels the same way it does in other mammals
- C. some of the arteries expand and contract to hold different amounts of blood
- D. both A and C

\_\_\_\_\_ 19. Oxygen balance is:

- A. relatively unimportant
- B. is very important, since too much or too little oxygen can lead to disastrous effects
- C. is achieved only by the balance between animal and plant life
- D. none of the above

- \_\_\_\_\_ 20. Part of oxygen balance is achieved by:
- A. animals giving off carbon dioxide that plants use and, in turn, give off oxygen
  - B. chemical weathering removing oxygen from the atmosphere
  - C. algae in the ocean producing oxygen
  - D. all of the above
- \_\_\_\_\_ 21. Oxygen balance is also aided by:
- A. bacteria on the ocean's bottom
  - B. density currents in the oceans
  - C. both A and B
  - D. neither A nor B
- \_\_\_\_\_ 22. The Earth is uniquely suited for life because it has:
- A. the right tilt
  - B. ocean(s) of the right size
  - C. the right atmosphere
  - D. the right amount of carbon
  - E. both A and B
  - F. A, B, C, and D
- \_\_\_\_\_ 23. Most compounds:
- A. contract as they get colder
  - B. expand as they get colder
  - C. remain the same as they get colder
  - D. none of the above
- \_\_\_\_\_ 24. Water:
- A. contracts as it gets colder and freezes
  - B. contracts as it gets colder until it reaches 40 centigrade
  - C. remains the same as it gets colder
  - D. contracts as it gets warmer
- \_\_\_\_\_ 25. The following characteristic(s) of water is (are) absolutely necessary for life on Earth:
- A. water's thermal characteristics
  - B. water's surface tension
  - C. water's chemical properties
  - D. A, B, and C are correct
  - E. only A and B are correct
- \_\_\_\_\_ 26. The electromagnetic spectrum:
- A. is composed of waves that reach the Earth in equal amounts
  - B. is composed of waves, most of which are beneficial to living things
  - C. is composed of waves, most of which are harmful to living things
  - D. is composed of waves with a narrow band of wavelengths

\_\_\_\_\_ 27. The sun produces the majority of its radiation in:

- |  |                |
|--|----------------|
| A. the ultraviolet band  | C. radio waves |
| B. the near ultraviolet, visible light,<br>and near infrared bands | D. gamma rays  |

\_\_\_\_\_ 28. Very little harmful radiation reaches the Earth because:

- |  |  |
|--|--|
| A. the sun produces very little harmful<br>radiation         | C. both A and B  |
| B. the Earth's atmosphere acts to block<br>harmful radiation | D. the harmful radiation is unable to<br>travel so far through space |

### Essay Questions

*Below are nine essay questions dealing with what you have learned in this chapter. Select four of these and answer them as clearly and fully as possible. Each question is worth five points.*

**1. Explain how the cell resembles a man-made factory.**

**2. What is gated transport? Describe the process. Why is it considered irreducibly complex?**

**3. Describe the parts of the bacterial flagellum and explain how each part works with the others to form an irreducibly complex structure.**

**4. How are birds' lungs different from ours? Why would they be considered irreducibly complex?**

**5. Give the name of the bat microchiroptera's system for locating insects, list each part of the system, and explain how they all work together to enable the bat to find food.**

**6. Describe the giraffe's unique circulatory system and explain how each part works together with the others to enable the giraffe to survive, in spite of its long neck and legs.**

**7. Describe in detail the different elements of oxygen balance. Include an explanation of the plant-animal cycle, chemical weathering, the action of algae and bacteria, and density currents.**



**8. Select two of the thermal properties of water and explain how these characteristics help to make life possible on Earth.**

**9. Explain how the energy of the electromagnetic spectrum is uniquely suited to favor life on earth. Include an explanation of how the sun produces it and also how the Earth's atmosphere affects what energy reaches the Earth's surface.**

*Pick out three of the characteristics mentioned by Drs. Ward and Brownlee as being necessary for the Earth to sustain life and explain why they are important.*

# Short Research Paper Topics

There are essay questions at the end of each section of Chapter 9. However, only a review sheet and an exam have been provided as separate exercises for this chapter. This chapter is better suited to research projects. For example, your student(s) might make posters or displays that illustrate in detail the parts and operations of one of nature's machines and explain why it is irreducibly complex. If you insist that your pupil(s) provide greater detail, any of the machines mentioned in this chapter might do. In addition, several other possible machines are listed below.

**Note:** since Chapter 11 has research papers as projects, it might be advantageous to study Chapters 9 and 11 consecutively and broaden the scope of your student's research. Some students might also want to do research on some creationist theories. Excellent research sources for this chapter are *Darwin's Black Box*, *Evolution: a Theory in Crisis*, and *Nature's Destiny*. *Rare Earth* is also helpful; although its authors maintain their evolutionary stance, they give the facts clearly and correctly.

The publication information for each of these books is in the end notes at the back of this book. Also, high school biology and physics books should be of help, since they often give details about the functioning of different machines in nature that show them to be irreducibly complex.

## *Natures Irreducibly Complex Structures, etc. :*

1. A bird's feather
2. A cilium
3. The woodpecker's unique head
4. The human eye
5. Photosynthesis
6. Defense mechanism, bombardier beetle
7. The blood clotting mechanism
8. The body's immune system
9. Synthesis of protein in the cell
10. DNA replication
11. Penguins
12. Attini ants
13. Human lung
14. Human kidney
15. *Rehobatrachus silus* frog
16. Lobster's eye
17. Humpback whale flippers
18. Nitrogen cycle
19. Bioluminescence
20. Structure of a leaf

**Some more complicated ones for a brighter student who is interested in science:**

21. The synthesis of AMP (adenosine monophosphate)

22. The regulatory mechanism of AMP biosynthesis

A little research or a discussion with a local Christian school's biology and physics teachers should also increase your list of topics. However, looking at any organ of the human body or any of God's creatures will show their uniqueness and irreducible complexity to a student who does the research.

## Chapter 10

# Suggestions for Beginning

Since you are probably teaching Christian student(s), they may have some predetermined theory of how and when God created the Earth and the fossil record. Now is a good time to find out where they are on this subject. Begin by asking them the questions below. List some of your students' opinions on a sheet of paper. Try not to be judgmental about their opinions but rather let the scientific facts speak for themselves as they read the chapter.

1. What explanations have you heard about the creation of the Earth?
2. Do you believe Noah's Flood occurred? If so, how do you think it occurred?
3. What geologic events could have precipitated it?
4. Do you think there was an ice age?
5. How do you think all that oil got far beneath the ocean floor in so many places? After all, oil is made from organic material like trees and plants. And it takes massive amounts of them.

This last question is to spark their thinking about the present structure of the earth and how it got that way. After a short period of discussion, direct your student(s) to the first section(s) of Chapter 10 by pointing out to them that there is disagreement among creationists about some things. Chapter 10 discusses this and attempts to give the best known explanation of origins, both scripturally and scientifically.

# Sections Question Key

## Section One: Philosophical Theories of Non-evolutionist Groups

1. *Describe the gap theory and the day-age theory.*
2. *Contrast the beliefs of the old-Earth and young-Earth creationists. Which groups fall into each category?*
3. *Describe the attitude of the intelligent design group.*
4. *Please read the article on Genesis and poetry below and then answer the following question. Does it appear that the Genesis account of creation was meant to be taken poetically? Why or why not?*

## Section Two: The Runaway Subduction Theory

1. *What is subduction?*
2. *Describe the Runaway Subduction Theory.*

3. *What would cause the ocean to subside to its present level, according to this theory?*

4. *What happened to the super continent that once existed? When did this occur?*

5. *What were the results of the scientists' computer simulations?*

### **Section Three: Noah's Flood**

1. *Give three detailed examples of supporting evidence for Noah's flood.*

2. *After reading the above article on the formation of coal and petrified fossil trees, explain briefly Dr. Steve Austin's theory of how petrified forests can be formed.*

## Section Four: The Ice Age

1. *What two conditions are necessary for an ice age to occur?*
  
  
  
  
  
  
  
  
  
  
2. *What events may have created the conditions necessary for an ice age immediately after Noah's flood?*
  
  
  
  
  
  
  
  
  
  
3. *What exists off the coast of Norway today which gives evidence for a warmer, shallower ocean? Why?*

## Section 1

# Non-Evolutionists

*Below are statements that describe groups which have different beliefs about the origin of life on Earth. If the statement is true of the intelligent design group, put "ID" in the space in front. If it is true of the Gap theorists, put "GT" in the space. If it is true of Day-age theorists, use "DA". If it is true of Young Earth creationists, use "YE". Some statements may require more than one answer.*

- \_\_\_\_\_ 1. They believe all of creation took place in six twenty-four hour days.
- \_\_\_\_\_ 2. They believe the days mentioned in Genesis were actually long periods of time.
- \_\_\_\_\_ 3. They take the first chapter of Genesis literally and believe the gap and day-age theorists misinterpret scripture.
- \_\_\_\_\_ 4. They have determined scientifically that spontaneous generation is not possible.
- \_\_\_\_\_ 5. They are old Earth creationists.
- \_\_\_\_\_ 6. They use Isaiah 14:12–16 and Ezekial 28:12–16 as support for their theory.
- \_\_\_\_\_ 7. They have a great deal of scientific proof that evolution did not occur, and they deal only with scientific proof, not Scripture.
- \_\_\_\_\_ 8. They use 2 Peter 3:8 as support for their theory.
- \_\_\_\_\_ 9. They believe the Earth and its inhabitants were created instead of evolving.
- \_\_\_\_\_ 10. They believe there was an earlier creation which was destroyed when Satan was put out of Heaven.
- \_\_\_\_\_ 11. They believe that God created the earth's inhabitants over a long period of time.
- \_\_\_\_\_ 12. They believe the Earth is thousands rather than billions of years old.
- \_\_\_\_\_ 13. They believe "somebody" had to do it.
- \_\_\_\_\_ 14. They believe the God of the Bible is the creator of the world.

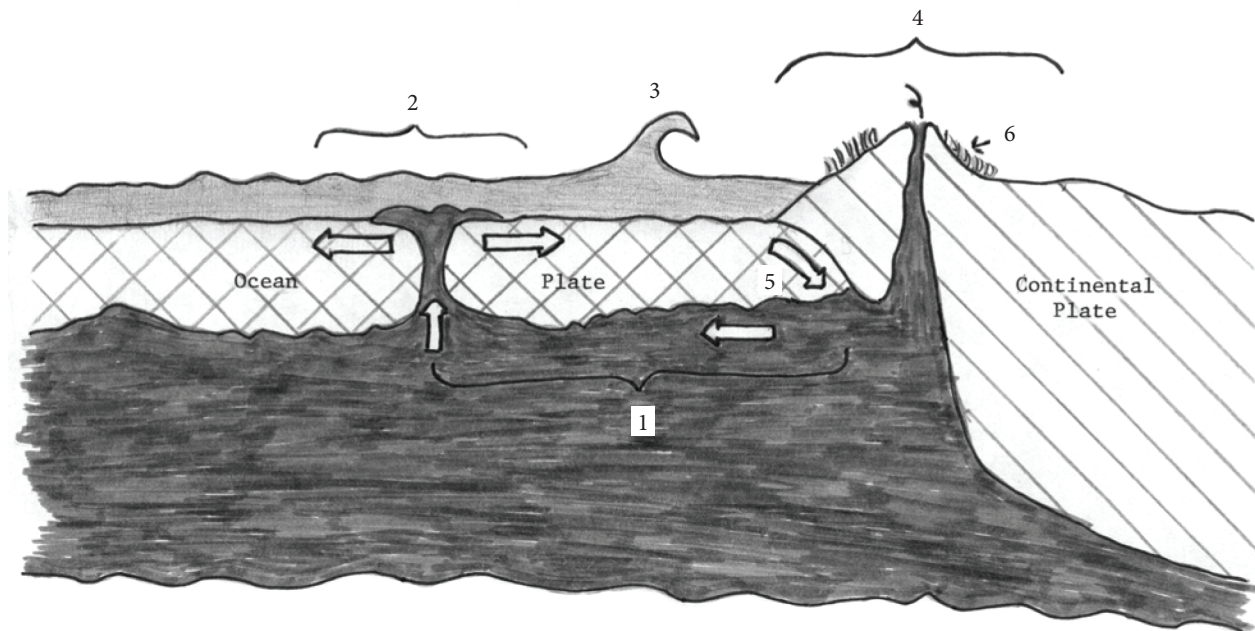


## Section 3

# Runaway Subduction Theory

*On the illustration below, several locations have been numbered. Write down the events that are taking place at these locations, according to your text. Use the following terms within your explanation. Then write a short paragraph explaining the theory of runaway subduction in your own words. You will need to add some information from the text as well as mention the activities below.*

Divergent plate boundary allows magma to come to the surface  
 Convergent plate boundary with subduction and volcanic activity  
 Subduction is occurring here.  
 A convection current has formed  
 A volcano has formed  
 Undersea activity has caused tsunamis



*Give the proper terms for the numbers on the illustration:*

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_
4. \_\_\_\_\_
5. \_\_\_\_\_
6. \_\_\_\_\_

*Briefly explain what runaway subduction is, according to the theory.*

## Section 3

# Noah's Flood

*Evidences for the flood: complete the sentences below:*

1. Creationists generally agree that there was \_\_\_\_\_
2. There are several phenomena that can be \_\_\_\_\_
3. Polystrate fossils are \_\_\_\_\_
4. Since rapid burial and sedimentation \_\_\_\_\_, this indicates the strata \_\_\_\_\_
5. In the fossil record, thousands \_\_\_\_\_
6. This is what we would expect if the fossils \_\_\_\_\_
7. These fossils are sometime caught in \_\_\_\_\_
8. Often these fossils are distorted \_\_\_\_\_
9. The construction of sedimentary rock \_\_\_\_\_
10. Sedimentary rock will not \_\_\_\_\_
11. The Tapeats Sandstone is a large sedimentary rock formation in \_\_\_\_\_
12. Evolutionary geologists believe the Tapeats Sandstone was laid down \_\_\_\_\_
13. Yet, even though the Tapeats Sandstone is bent at a 90o angle \_\_\_\_\_
14. This indicates \_\_\_\_\_

## Section 4

# The Ice Age

*Complete the following sentences:*

1. There is abundant geological evidence to support an \_\_\_\_\_
2. Today, conditions on Earth \_\_\_\_\_
3. Cold winters are not enough; abnormally \_\_\_\_\_
4. The oceans must also be abnormally \_\_\_\_\_
5. Today in Siberia and the polar areas the temperature is so cold \_\_\_\_\_

- 
6. After Noah's flood \_\_\_\_\_
  7. The cracking of the crust and runaway subduction \_\_\_\_\_

- 
8. This would have released \_\_\_\_\_
  9. Volcanic ash reflects \_\_\_\_\_
  10. This reflection of the sun's energy would lead to \_\_\_\_\_
  11. Also, the post-flood ocean would have been warmer due to \_\_\_\_\_

- 
12. Thus, the unusual conditions of warm \_\_\_\_\_

- 
13. The catastrophic events of Noah' flood \_\_\_\_\_
-

## Group Activity

# Runaway Subduction

**Note:** This activity works well with just two people or with a group of four. Read all background material before you begin.

### *Purpose*

To acquaint you with runaway subduction by demonstrating the four types of plate boundaries and the geologic activity that occurs at each type of boundary. This lab should enable you to better to understand the effects of plate tectonics on the earth's surface and the landforms generated by such activity.

### *Materials:*

- ▶ One entire graham cracker (an oblong section or two squares). More as needed
- ▶ One sheet of wax paper on which there are 1—2 heaping tablespoons of cake frosting
- ▶ One half of a small styrofoam plate, with pencil holes near the straight edge
- ▶ A paper towel and a small beaker with water for cleanup

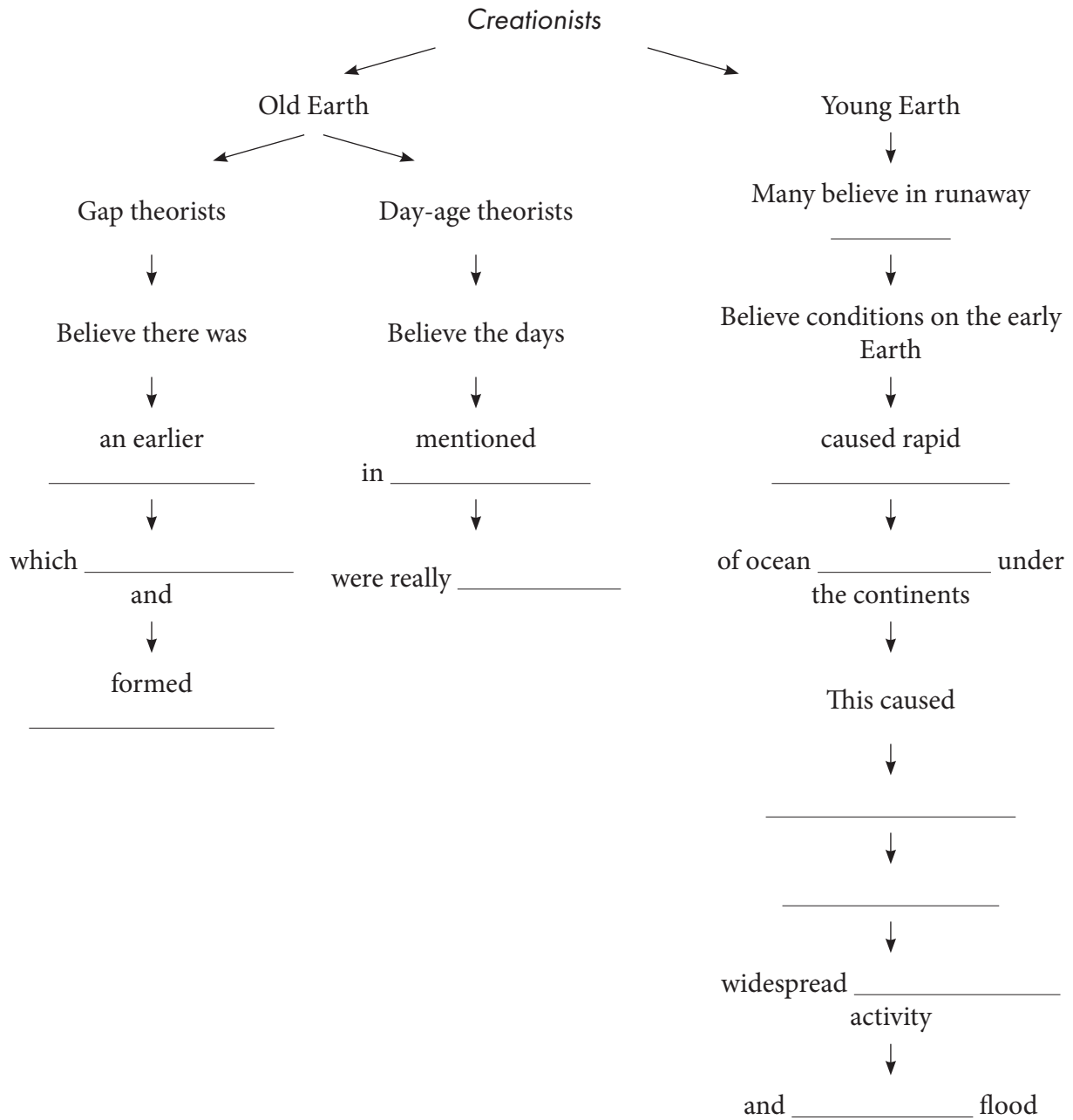
### *Background:*

The theory of plate tectonics states that the crust of the earth is composed of individual pieces which “float” on the hot, plastic-like lower mantle. At plate boundaries, the crustal plates may collide (convergent boundary), come apart (divergent boundary), or grind past one another (strike-slip fault). At a convergent boundary between an ocean plate and a continental plate, subduction zones occur and volcanoes are formed. At a convergent boundary between two continental plates, the crust buckles and mountains form. According to the Runaway Subduction Theory, in the past these geologic activities also occurred, but at a much more rapid rate.

In this group activity, you will investigate the interactions that occur between plates at their boundaries. Using the graham crackers as your “plates” and the cake frosting as the “mantle,” you will study plate collision, subduction, earthquakes, volcanoes, and divergence. Using the paper, you will study mountain building.

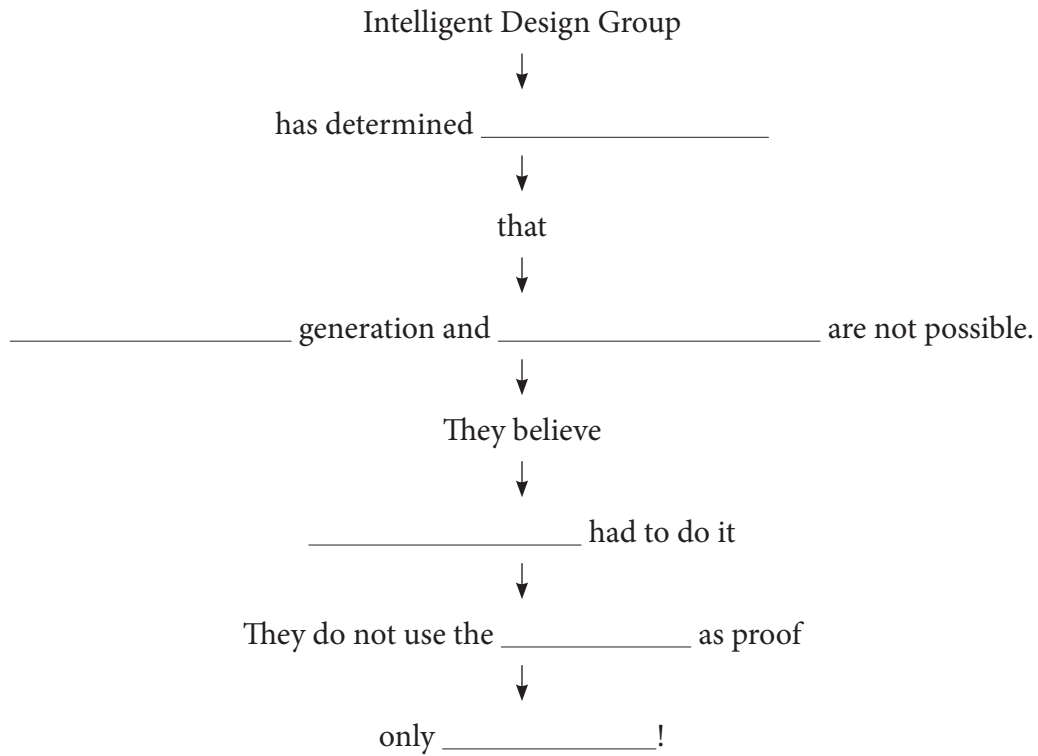
# Concept Map One

## Different View of Creation



## Concept Map Two

# Intelligent Design



# Vocabulary

*Match the following words with their definitions:*

- |                             |                           |                             |
|-----------------------------|---------------------------|-----------------------------|
| A. circumstantial evidence  | G. Long Day Theory        | L. Runaway Subduction       |
| B. convergent boundary      | H. Old Earth Creationists | Theory                      |
| C. Day-age Theorists        | I. pangaea                | M. Short Day Theory         |
| D. divergent boundary       | J. polystrate fossils     | N. subduction zone          |
| E. Gap Theorists            | K. ring of fire           | O. Young Earth Creationists |
| F. Intelligent design group |                           |                             |

- \_\_\_\_\_ 1. This group of old Earth creationists believes that the days referred to in Genesis are actually long periods of time.
- \_\_\_\_\_ 2. They are creationists who believe that the Earth is millions of years old.
- \_\_\_\_\_ 3. A tree or other plant or an animal which extends through several layers of rock.
- \_\_\_\_\_ 4. Facts that lead to a conclusion that is hard to explain in any other way.
- \_\_\_\_\_ 5. They believe that science proves “somebody” had to do it.
- \_\_\_\_\_ 6. They believe the days mentioned in Genesis refer to 24 hour days.
- \_\_\_\_\_ 7. They believe that there was a long period of time between Genesis 1:1 and Genesis 1:2 during which an earlier creation existed, but was destroyed when Satan fell from Heaven.
- \_\_\_\_\_ 8. An area on the Earth where a denser plate “dives” beneath a less dense one.
- \_\_\_\_\_ 9. A string of volcanoes that have formed all around the Pacific plate.
- \_\_\_\_\_ 10. This theory states that in the past the Earth’s ocean floor was denser than both the continental crust and mantle, causing rapid descending of the ocean plate into the mantle.
- \_\_\_\_\_ 11. A spot on the Earth where two plates come together.
- \_\_\_\_\_ 12. The name of the supercontinent believed to have existed at one time on the Earth.
- \_\_\_\_\_ 13. A spot on the Earth where two plates pull apart.
- \_\_\_\_\_ 14. Another term for the Day-age theory.
- \_\_\_\_\_ 15. The theory that the days mentioned in Genesis were 24 hours.



# Review

1. *There are two major groups of old Earth creationists. They use some scripture to support their theories. Name these two groups and explain a weakness in their interpretations of these scriptures.*
2. *What does the intelligent design group believe and on what do its members base their belief?*
3. *Name the major group of young Earth creationists and explain why they believe that the days mentioned in Genesis should be interpreted as ordinary days.*
4. *Briefly explain the runaway subduction theory.*
5. *What is circumstantial evidence? Does it have any basis in fact?*
6. *List three examples of circumstantial evidence which support Noah's flood.*

*7. Why is it highly unlikely that we could have a new ice age today?*

*8. How might conditions following the flood have contributed to the ice age?*

*9. Explain briefly Dr. Steve Austin's theory of how petrified forests can be formed.*

*10. Does it appear that the Genesis account of creation was meant to be taken poetically? Why or why not?*

# Test

## Multiple Choice

*Place the letter in the space provided that best completes the sentence.*

- \_\_\_\_\_ 1. The belief that there was an earlier creation which was destroyed when Satan fell is known as:
- |                       |                         |
|-----------------------|-------------------------|
| A. The Day-age Theory | D. The Old Earth Theory |
| B. The Gap Theory     | E. None of these.       |
| C. The Canopy Theory  |                         |
- \_\_\_\_\_ 2. Scientists who believe that the Earth and its inhabitants are too complicated to have happened by chance, and therefore someone had to create them are known as the:
- |                      |                             |
|----------------------|-----------------------------|
| A. Gap theorists     | C. Young Earth creationists |
| B. Day-age theorists | D. Intelligent Design Group |
- \_\_\_\_\_ 3. Those who believe that all of creation was accomplished in six literal 24-hour days are known as:
- |                           |                             |
|---------------------------|-----------------------------|
| A. Old Earth creationists | C. Day-age theorists        |
| B. Gap theorists          | D. Young Earth creationists |
- \_\_\_\_\_ 4. Those who believe that the days mentioned in Genesis were really long periods of time are known as :
- |                      |                             |
|----------------------|-----------------------------|
| A. Day-age theorists | C. Young Earth creationists |
| B. Gap theorists     | D. Canopy theorists         |
- \_\_\_\_\_ 5. An area where one crustal plate goes beneath another is known as a:
- |                       |                  |
|-----------------------|------------------|
| A. divergent boundary | C. hydroplate    |
| B. subduction zone    | D. none of these |
- \_\_\_\_\_ 6. Which of the following would be considered circumstantial evidence?
- |   |                         |
|---|-------------------------|
| A. A fingerprint left at the scene of a crime | C. DNA at a crime scene |
| B. An eyewitness report                       | D. Both A and C         |

\_\_\_\_\_ 7. The Genesis account of creation:

- |  |  |
|--|--|
| A. is meant to be taken poetically               | C. in the original Hebrew is structured like narrative |
| B. in the original Hebrew structured like poetry | D. is not clear on the subject                         |

\_\_\_\_\_ 8. Petrified fossil forests, like the one in Yellowstone National Park, logically could have come about as:

- |  |   |
|--|---|
| A. the result of a long slow process involving millions of years | C. the result of trees settling to the bottom of a body of water while in a vertical position |
| B. the result of trees being uprooted violently                  | D. both B and C   |

### Modified True and False:

*If, according to the text, the statement is true, circle T. If it is false, circle F and then change the underlined word to correct the statement in the space provided. (One or two points each)*

T F 1. Circumstantial evidence has no basis in fact.

\_\_\_\_\_

T F 2. Polystrate fossils are circumstantial evidence for the flood.

\_\_\_\_\_

T F 3. Young Earth Creationists believe that the Noah's flood was a worldwide cataclysm.

\_\_\_\_\_

T F 4. The ring of fire is a string of volcanoes that extend around the Atlantic Ocean.

\_\_\_\_\_

T F 5. Tsunamis would be one possible effect of runaway subduction of the ocean's plates.

\_\_\_\_\_

T F 6. Few fossils are generally found together.

\_\_\_\_\_

T F 7. Rapid burial and sedimentation are necessary in order for organisms to be fossilized.

\_\_\_\_\_

*T F* 8. Fossil bones are often found in distorted positions.

---

*T F* 9. Neither the Gap nor the Day-age theorists attempt to use any scriptural support.

---

*T F* 10. The gap theory provides a good explanation for polystrate fossils.

---

*T F* 11. There are only two possibilities: both the universe and all its inhabitants are the result of random mechanistic processes or they are the result of intelligent action.

---

*T F* 12. In order to have an ice age, short, cool winters are needed.

---

### Essay Questions:

*1. Why is it highly unlikely that another ice age could happen today? Also, explain how conditions following the flood may have contributed to the first ice age. (6 points)*

*2. List two examples of circumstantial evidence which support the idea that Noah's flood caused the fossil record and explain their significance. (4 points)*

3. *Briefly explain the Runaway Subduction Theory. (5 points)*

4. *Does it appear that the Genesis account of creation was meant to be taken poetically? Why or why not?*

## Chapter 11

# Suggestions for Beginning

**S**tart by putting the word IDEAS on a sheet of paper in big, bold print. Then spark a discussion with your student(s) by asking:

1. Do ideas have power?  
Put words such as test, freedom, happiness, love, special creation, and accident of nature on the paper in successive order and ask the following about each one:
2. What effect does this word have on you?
3. What things do you connect with it?
4. Which of these two terms would you prefer to describe you?
5. What is the effect on humans of thinking that they are special creations?  
Your student(s) may reply that it makes them feel important, valuable, or loved. They may also bring out that this implies an obligation on their part to their creator.
6. What is the effect on humans of thinking that they are accidents of nature? How would it affect you?  
Your student(s) may point to the increase in mental illness (especially depression), suicide, and murder, along with other escalating problems of modern society.

Finish by telling them that Chapter Eleven deals with the effects of this idea (#8) on the social, moral, and political climate of the world over the past 150 years.

# Sections Question Key

## Section One: The Political Ramifications of Darwinism

1. *Why was Karl Marx so pleased with Darwin's theory of evolution? What did he offer to do?*
2. *What effect did a belief in evolution have on Lenin?*
3. *What effect did a belief in "survival of the fittest" have on Stalin?*
4. *How did Hitler justify Germany's conquering and enslaving nearby countries?*
5. *How did Mussolini justify his treatment of other countries and peoples?*

## Section Two: The Social Effects of Darwinism

1. *According to Darwin, what effect do vaccination and caring for society's weak have on the human race?*



2. *How did Herbert Spencer's belief in evolution affect his view of human society?*

3. *Describe two instances of evolution's effect on literature.*

### **Section Three: Darwinism's Effects on Ethics**

1. *Who is Peter Singer?*

2. *How does his belief in evolution affect his ethical beliefs concerning the old and the ill?*

3. *Who does Singer consider to be a person?*

4. *What does Singer consider a fetus or a newborn baby to be? How does he feel about abortion and infanticide?*

5. *How is euthanasia being practiced in the Netherlands today?  
Who is being affected by it?*

*6. How and where is assisted suicide being practiced in the United States today?*

**Thought Questions:**

*1. Is any such law in accordance with a Christian world view based on God's Word?*

*2. What is the significance of the Oregon law stating that assisted suicide is not suicide?*

**Section Four: The Moral Consequences of a Belief in Darwinism**

*1. What is the "God is Dead" philosophy, and what is the reasoning behind it?*

*2. According to Paul A. Carter, in what sense is God dead?*

*3. Explain the pattern of reasoning that develops from a belief that evolution is true.*

## Section 1

# Political Ramifications of Darwinism

*Match the following persons with the statements which describe them. If the description fits Marx, put MA in the blank. If it fits Lenin, put L. If it fits Stalin, put S. If it fits Hitler, put H. If it fits Mussolini, put MU. Some descriptions may fit more than one person.*

- \_\_\_\_\_ 1. He offered to dedicate his book to Darwin.
- \_\_\_\_\_ 2. He used evolution as an excuse for his enslaving other races.
- \_\_\_\_\_ 3. He regarded animals of more value than humans.
- \_\_\_\_\_ 4. He established the communist dictatorship which ruled Russia for more than 70 years.
- \_\_\_\_\_ 5. He used evolution as an excuse for violently disposing of any potential enemies.
- \_\_\_\_\_ 6. During his time in power, he forcibly removed millions of people from their land and was responsible for the deaths of over 17 million people.
- \_\_\_\_\_ 7. He felt Aryan people were the “fittest,” and that this justified the conquering, enslaving, and annihilating of other “less fit” people.
- \_\_\_\_\_ 8. He developed racial laws prohibiting marriage between his “racially superior” people and those he considered “less fit”.
- \_\_\_\_\_ 9. He regarded Darwin as “one of the two greatest thinkers of the 19<sup>th</sup> century”.
- \_\_\_\_\_ 10. He glorified war because he considered it right and natural for the strong to use force to subjugate the weak.
- \_\_\_\_\_ 11. He felt Darwin’s *Origin of Species* made atheism scientifically acceptable.
- \_\_\_\_\_ 12. He was an atheist.
- \_\_\_\_\_ 13. He believed in the right of the strong to conquer and kill or enslave the weak.
- \_\_\_\_\_ 14. His biographers claim that he first read Darwin in his teens and became an atheist.

- \_\_\_\_\_ 15. He persecuted the Christian church in his country.
- \_\_\_\_\_ 16. He stated, “It is an iron principle that the weaker one falls so that the stronger one gains life”.
- \_\_\_\_\_ 17. He used the evolutionary theory to justify genocide.
- \_\_\_\_\_ 18. He believed in struggle as a Darwinian principle that “forced every people to try to dominate all others”.
- \_\_\_\_\_ 19. He was a vicious tyrant.
- \_\_\_\_\_ 20. He was the “father” of communism.

## Section 2

# The Social Effects of Darwinism

Darwin's theory was at first applied only to \_\_\_\_\_. However, he was aware that it could also be applied to \_\_\_\_\_. In fact, he felt that helping the weak and sick did not allow \_\_\_\_\_ to operate and thus weakened the human race.

One of the individuals who applied Darwin's theory to \_\_\_\_\_ was Herbert Spencer. He developed a theory that became known as \_\_\_\_\_. It was Herbert Spencer who coined the phrase, \_\_\_\_\_. He felt that \_\_\_\_\_ of the strong over the \_\_\_\_\_ was not only logical but also \_\_\_\_\_.

Darwinism also affected the literature of the time. It influenced the works of such well-known American writers as \_\_\_\_\_ and \_\_\_\_\_, as well as British writers such as George Bernard Shaw. For example, Jack London wrote a short story entitled "The Law of Life." In it, an old Alaskan \_\_\_\_\_ is left to die by his tribe because he is too old and blind to care for himself. He finally accepts his fate with resignation. He thinks, "Was it not the \_\_\_\_\_ of life?"

In Modern literature such as Jonathon Kellerman's *Survival of the Fittest*, the author describes a serial killer who uses \_\_\_\_\_ as an excuse to kill people with \_\_\_\_\_. The killer regards humans as just \_\_\_\_\_ material, of no particular value. He considers himself to be helping the human race by getting rid of its \_\_\_\_\_ ones. Unfortunately, his \_\_\_\_\_, though warped and distorted, is a \_\_\_\_\_ outcome of the application of \_\_\_\_\_ to \_\_\_\_\_ society.

## Section 3

# Darwinism's Effects on Ethics

*From your text, locate the word or phrase that best completes the following sentences and write them in the blanks.*

1. A belief in evolution has led to destructive \_\_\_\_\_  
\_\_\_\_\_
2. Hitler's belief in evolution led to the \_\_\_\_\_  
\_\_\_\_\_
3. Stalin looked upon the loss of farm animals as more important than \_\_\_\_\_  
\_\_\_\_\_
4. Peter Singer, an Australian philosopher and professor at Princeton, is considered \_\_\_\_\_  
\_\_\_\_\_
5. Mr. Singer's belief system comes directly from \_\_\_\_\_  
\_\_\_\_\_
6. Singer says—if we are an animal, rather than a specially created being made in the image of God – \_\_\_\_\_  
\_\_\_\_\_
7. Singer's new "commandments" are based on \_\_\_\_\_  
\_\_\_\_\_
8. He considers a "person" to be \_\_\_\_\_  
\_\_\_\_\_
9. Singer advocates the abortion of \_\_\_\_\_  
\_\_\_\_\_
10. In addition, he advocates the infanticide of \_\_\_\_\_  
\_\_\_\_\_
11. He states, "Since neither a newborn human infant nor a fish is a person, \_\_\_\_\_  
\_\_\_\_\_
12. Derek Humphry founded the Hemlock Society, an organization dedicated to \_\_\_\_\_  
\_\_\_\_\_
13. Dr Jack Kevorkian was a Michigan pathologist who advocated \_\_\_\_\_  
\_\_\_\_\_
14. Supporting Dr. Kevorkian's position requires a belief in \_\_\_\_\_  
\_\_\_\_\_

15. In the Netherlands, where euthanasia is practiced, they have moved from assisted suicide to voluntary euthanasia, and from voluntary euthanasia to \_\_\_\_\_

16. Many people attribute this loss of value for the human life in the Netherlands to \_\_\_\_\_

17. Dr. Herbert Hendin points out that many in the U.S. also advocate \_\_\_\_\_

18. He states, "In a culture in which life has no continuity, in which life lacks significance beyond itself, \_\_\_\_\_

19. Assisted suicide is now being practiced in \_\_\_\_\_

*Below are listed 5 "new commandments" by Dr. Peter Singer. In the space provided, explain the basic meaning of each "commandment" (as Dr. Singer means it) in your own words. Hint: look at the Christian commandment he puts opposite it.*

1. Recognize the worth of human life varies.

2. Take responsibility for the consequences of your decisions.

3. Respect a person's desire to live or die.

4. Bring children into the world only if they are wanted.

5. Do not discriminate on the basis of species.

## Section 4

# The Moral Effects of a Belief in Evolution

*Answer the following in complete sentences:*

1. Why is the “personhood” of all humans being questioned?
2. What is the “God is Dead” philosophy, and how has it come into being?
3. How does Mr. Carter describe much of Christian theology today?
4. It has been rightly stated that many belief systems have fostered evil acts by some of their advocates. For example, all manner of evil has been justified in the name of Christianity. How is this different from the acts of evolutionists?

*Describe the logical progression of thought which arises from a belief in evolution. Start each sentence with “If” and the conclusion with “then.” The first sentence has been done as an example for you.*

1. *If all organisms evolved from a spontaneously generated single-celled creature, **then** the Genesis account of creation is false.*

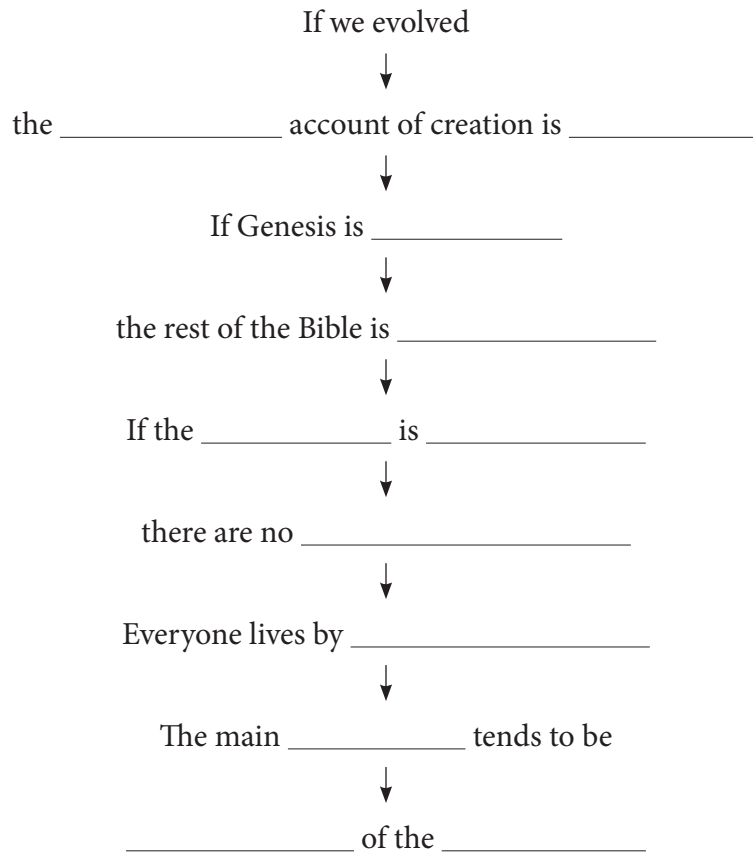


Student Name: \_\_\_\_\_ Teacher: \_\_\_\_\_ Period: \_\_\_\_\_

**5. What is the final result?**

# Concept Map

## The Moral Effects of a Belief in Evolution



# Vocabulary

*Match the following words with their definitions.*

- |                           |                    |                                   |
|---------------------------|--------------------|-----------------------------------|
| A. animal rights movement | G. euthanasia      | L. Manifesto of Racist Scientists |
| B. anti-Semitism          | H. fascism         | M. medicide                       |
| C. assisted suicide       | I. Hemlock Society | N. moral relativism               |
| D. atheism                | J. humanism        | O. social Darwinism               |
| E. communism              | K. infanticide     | P. worldview                      |
| F. ethics                 |                    |                                   |

- \_\_\_\_\_ 1. An organization dedicated to the legalization of assisted suicide and euthanasia in the U.S.
- \_\_\_\_\_ 2. Situational ethics; right and wrong depend on the circumstances.
- \_\_\_\_\_ 3. A belief that no god exists.
- \_\_\_\_\_ 4. The theory of natural selection applied to human society; “survival of the fittest”.
- \_\_\_\_\_ 5. The killing of newborn babies.
- \_\_\_\_\_ 6. An organization dedicated to giving “higher” animals a status equal to man.
- \_\_\_\_\_ 7. Hatred of Jews.
- \_\_\_\_\_ 8. A paper in which Italian scientists stated that the Aryan race was superior to others, especially Jews.
- \_\_\_\_\_ 9. Having help in killing oneself.
- \_\_\_\_\_ 10. A philosophy that centers on humans and their abilities and capacities, and whose value system depends on human rather than spiritual standards.
- \_\_\_\_\_ 11. A system of government characterized by state ownership of property. The state controls the economy, and all goods are supposed to be equally shared among all people.
- \_\_\_\_\_ 12. Using medical knowledge to perform assisted suicide and euthanasia.
- \_\_\_\_\_ 13. Rules or standards governing the conduct of people.
- \_\_\_\_\_ 14. The perspective from which one sees and interprets the world around him.
- \_\_\_\_\_ 15. The practice of putting to death an individual suffering from an incurable disease or condition.
- \_\_\_\_\_ 17. A system of government, usually headed by a dictator, that controls all political, economic, and cultural activities; it allows industry to remain in private hands, but under strict government control.

# Review

*Match the following people with the correct description. Some of the descriptions will fit more than one man.*

- |                   |                     |                    |
|-------------------|---------------------|--------------------|
| A. Charles Darwin | E. Vladimir Lenin   | I. Herbert Spencer |
| B. Adolf Hitler   | F. Karl Marx        | J. Joseph Stalin   |
| C. Derek Humphry  | G. Benito Mussolini |                    |
| D. Jack Kevorkian | H. Peter Singer     |                    |

- \_\_\_\_\_ 1. He founded the Hemlock Society.
- \_\_\_\_\_ 2. He is the father of communism.
- \_\_\_\_\_ 3. He was the fascist leader of Germany during World War II.
- \_\_\_\_\_ 4. He led the communist revolution in Russia.
- \_\_\_\_\_ 5. He considers neither a fish nor a baby to be a person.
- \_\_\_\_\_ 6. During his reign as dictator of Russia, he caused the deaths of more people than died in World War I.
- \_\_\_\_\_ 7. He offered to dedicate a book to Darwin.
- \_\_\_\_\_ 8. He recognized the effect his theory could have on several areas.
- \_\_\_\_\_ 9. He supposedly read Darwin in his early teens and became an atheist.
- \_\_\_\_\_ 10. He advocated a new medical specialty called medicide which will prepare doctors to assist in suicides.
- \_\_\_\_\_ 11. He regarded Darwin as one of the two great thinkers of the 19<sup>th</sup> century.
- \_\_\_\_\_ 12. He felt the Aryan race was superior to all others.
- \_\_\_\_\_ 13. He coined the term “survival of the fittest”.
- \_\_\_\_\_ 14. He is a philosopher who is considered moderate.
- \_\_\_\_\_ 15. He felt London’s poor should not receive charity but instead be allowed to die.
- \_\_\_\_\_ 16. He considers infanticide, abortion, assisted suicide, and euthanasia all to be acceptable.
- \_\_\_\_\_ 17. He created some new commandments based on evolutionary humanism.
- \_\_\_\_\_ 18. He wants to elevate the moral status of animals to that of humans.
- \_\_\_\_\_ 19. His belief in survival of the fittest led to the killing and/or enslaving of many people.

- \_\_\_\_\_ 20. He viewed religion as “the opiate of the people”.
- \_\_\_\_\_ 21. His belief in the racial superiority of his people led to the passing of laws prohibiting marriage to “lesser” races.
- \_\_\_\_\_ 22. He believed in “survival of the fittest” to the end—even when he realized he would lose the war.
- \_\_\_\_\_ 23. He felt that victory of the strong over the weak was totally acceptable.

*Answer the following in complete sentences, often more than one sentence.*

**1. Explain briefly how a belief in evolution influenced the actions of the following dictators.**

***A. Lenin***

***B. Stalin***

***C. Hitler***

***D. Mussolini***

**2. In what way can belief in evolution lead to moral relativism? List each step in this logical process.**

**3. State three of Peter Singer’s “commandments” and explain in your own words what they mean.**

**KNOW THE VOCABULARY RELATED TO THIS CHAPTER ALSO!**

# Test

## Multiple Choice

*Place the letter in the space provided that best completes the sentence.*

- \_\_\_\_\_ 1. Although many law-abiding, moral citizens accept evolution as true, it can logically lead to \_\_\_\_\_ in many lives.
- |                     |                 |
|---------------------|-----------------|
| A. moral relativism | C. agnosticism  |
| B. social darwinism | D. all of these |
- \_\_\_\_\_ 2. Karl Marx viewed religion as:
- |                          |                             |
|--------------------------|-----------------------------|
| A. a benefit to people   | C. the opiate of the people |
| B. unimportant to people | D. none of these            |
- \_\_\_\_\_ 3. Marx was very excited when he read Darwin's work because:
- |  |  |
|--|--|
| A. it showed how God created the world       | C. it was easy for a layman to read  |
| B. it made atheism scientifically acceptable | D. it showed how God used evolution instead of the Biblical method to create the world |
- \_\_\_\_\_ 4. Marx was so impressed and grateful to Darwin that he:
- |  |  |
|--|--|
| A. invited him to speak at a Communist rally | C. asked him to write a book especially for Communists to read |
| B. offered to dedicate a book to him         | D. became a Christian  |
- \_\_\_\_\_ 5. Lenin was deeply influenced by Darwin's theory; he went on to:
- |  |   |
|--|---|
| A. become an atheist                       | C. use a belief in social Darwinism as an excuse for violence and killing |
| B. lead the communist revolution in Russia | D. all of these   |
- \_\_\_\_\_ 6. Joseph Stalin, according to his biographers,
- |   |   |
|---|---|
| A. was not particularly influenced by Darwin            | C. was only mildly influenced by Darwin                 |
| B. read Darwin in his early teens and became an atheist | D. at first accepted Darwin but later changed his views |

- \_\_\_\_\_ 7. During his time in power, Stalin:
- A. introduced several 5-year plans which caused the death of millions
  - B. began enforcing grain quotas which didn't leave enough for the farmers to eat
  - C. forcibly removed millions of people from their land
  - D. all of these
- \_\_\_\_\_ 8. The number dying in Stalin's "war against the peasants" was:
- A. greater than the number of lives lost in World War I
  - B. sizable but less than a million
  - C. less than a thousand
  - D. two million
- \_\_\_\_\_ 9. Hitler's entire justification for enslaving and annihilating non-Germanic peoples was:
- A. they posed a threat to German people
  - B. the Germanic people were trying to help other countries
  - C. the German people were the most fit and therefore had a right to take what they wanted
  - D. both B and C
- \_\_\_\_\_ 10. In 1945, when Hitler realized the Russians would win, he:
- A. still believed in survival of the fittest
  - B. declared the Germans were still the best
  - C. abandoned his belief in evolution
  - D. gave up his atheism
- \_\_\_\_\_ 11. Benito Mussolini:
- A. read Darwin and only partially accepted his theory
  - B. regarded Darwin as one of the two greatest thinkers of the 19th century
  - C. was a faithful Christian
  - D. none of these
- \_\_\_\_\_ 12. Mussolini:
- A. also believed in the superiority of the Aryan race
  - B. used social Darwinism as an excuse to enslave other races
  - C. passed laws preventing Italians from intermarrying with other races
  - D. all of these
- \_\_\_\_\_ 13. "Survival of the fittest" was world view which was held by:
- A. Lenin
  - B. Stalin
  - C. Hitler
  - D. Mussolini
  - E. all of these

\_\_\_\_\_ 14. Euthanasia is:

- |  |                       |
|--|-----------------------|
| A. assisted suicide                                  | C. a type of abortion |
| B. killing of the ill, with or without their consent | D. none of these      |

\_\_\_\_\_ 15. In moral relativism:

- |   |   |
|---|---|
| A. right and wrong depend on Biblical absolutes               | C. right and wrong depend on the circumstances of the situation |
| B. right and wrong depend on the absolutes of a given culture | D. right and wrong are not considered                           |

### Modified True and False

*If, according to the text, the statement is true, circle T. If it is false, circle F and then change the underlined word to correct the statement in the space provided.*

T F 1. Peter Singer is considered a moderate by some sections of our society.

T F 2. Mr. Singer considers infanticide as acceptable under certain circumstances.

T F 3. Mr. Singer considers humans to be special creations.

T F 4. Mr. Singer has created some new commandments based on Christian ethics.

T F 5. Mr. Singer wants to elevate the moral status of animals to that of humans.

T F 6. Singer is the only prominent individual to promote euthanasia in the United States.

T F 7. Karl Marx, in his book *Man Versus the State*, felt that London's poor should not receive charity but be allowed to die.

T F 8. The evolutionary worldview also had a profound effect on literature.



*T F* 9. Herbert Spencer felt that the victory of the strong over the weak was unacceptable.

---

*T F* 10. In the Netherlands, involuntary euthanasia is at times practiced.

---

*T F* 11. In the Netherlands, guidelines to prevent abuse of assisted dying are strictly enforced.

---

*T F* 12. The “God is Dead” philosophy came about as a result of a belief in evolution.

---

### Short Answers

*Answer the following in complete sentences.*

**1. How does a belief in evolution lead to moral relativism? List each step in this logical process.**

**2. It has been rightly stated that many belief systems have fostered evil acts by some of their advocates. For example, all manner of evil has been justified in the name of Christianity. How is this different from the acts of evolutionists?**

**3. Explain how a belief in evolution contributed to the actions of the dictators we discussed. Use the actions of at least 2 dictators as examples.**

**4. Choose two of Singer’s “commandments” listed in your text and explain what they mean in your own words.**

# Research Paper

If you have time left at the end of the semester, this is an excellent opportunity to allow your student(s) to become “experts” in one area of creation research. It would help to have a library stocked with some books on creation, since many of these are not available at the public library or a secular bookstore. The website [creation.com](http://creation.com) is an excellent source of information. Many secular magazines, especially National Geographic, are available at used book sales or you can get them at your local library. You can also request copies of the individual articles from your public library and create your own files.

The paper need not be long in order to be successful. Five hundred to a thousand words are sufficient. Three to four days of library research, followed by three or four days of work to write and “polish” the papers should be enough time.

Emphasize that your student(s) needs to “digest” the information and write the paper in their own words. Of course, giving credit to sources is equally important. If you teach in a Christian school, perhaps you can work together with a fellow teacher such as an English teacher to coordinate work on a term paper that is graded by both of you. This can work very well.

## *Possible Topics*

1. Do an “in depth” study of spontaneous generation. Is it possible for it to have happened? Explain why or why not.
2. Does comparative embryology provide any true evidence for evolution having occurred? Why or why not? Give examples.
3. Do a study of the geologic time scale. How was it originally set up? Is there a legitimate way it can be used? What is wrong with using it to date fossils and rocks?
4. Study in detail the evolution of the whale. Are there any problems with considering this a true evolutionary series? Explain.
5. How is long range radiometric dating supposed to work? Does it give accurate dates for the rocks tested? Why or why not?
6. How is carbon dating supposed to work? Does it give totally accurate dates for the artifacts tested? Why or why not? Is there any way it can be used with accuracy?
7. Pick one “hominid” and do an in-depth study of it. How was it found? Who found it? How much of it was found? What research methods were used? Why does it make a poor ancestor? Make sure the student goes back to the original article written by the finder of the hominid.
8. Explain in detail the runaway subduction theory. How does it explain many of the features of the Earth we see today? What are its weak points, if any?
9. What are polystrate fossils? Where are they found? Why are they an evolutionist’s nightmare? How do they support the theory of a world-wide flood? What is one creationist theory of their origin? Explain in detail.
10. There are several other theories of spontaneous generation besides Oparin’s. Discuss these and point out the basic problems with any theory of this kind.
11. What was Miller’s experiment? Did it truly provide evidence for spontaneous generation? Why or why not?

12. Does comparative homology provide any true evidence for evolution? Why or why not?
13. What is the history of comparative embryology? Why has it persisted as proof for evolution, in spite of its incorrectness?
14. Trace the political effects of a belief in evolution in the twentieth century.
15. Trace the social effects of a belief in evolution in the twentieth century.
16. Trace the effects of a belief in evolution on the Christian church in the late nineteenth and twentieth centuries.
17. Do a study of the "Eugenics Movement" started by Francis Galton, Darwin's cousin, and directly attributable to a belief in evolution.
18. Do a study of euthanasia. Who are its strongest supporters? Who argue against it? Why? Where is it presently being practiced? Are the rules always being followed?
19. Any other related topic you may choose related to this subject. As has been mentioned before, what can be especially fascinating is having a student pick any organ in the body or any one of several creatures and research how it is unique and irreducibly complex and therefore impossible to have evolved.

# Final exam question sheet

*Many of the questions in this section are from an Evolutionist's Perspective.*

- \_\_\_\_\_ 1. Most fossils are found in \_\_\_\_\_ rock.
- A. sedimentary
  - B. metamorphic
  - C. basalt
  - D. igneous
- \_\_\_\_\_ 2. According to Lamarck's theory
- A. evolution was a quick, punctuated process
  - B. traits acquired in one generation would be passed on only if they were in the sex cells
  - C. traits acquired in one generation were passed on to the next generation
  - D. only the fittest survive
- \_\_\_\_\_ 3. Natural selection is a process by which
- A. acquired traits are passed on to the next generation
  - B. organisms well adapted to the environment will survive and reproduce more often than other organisms
  - C. mutations change organisms
  - D. all answers are correct
- \_\_\_\_\_ 4. Hugo de Vries
- A. wrote a book on populations
  - B. proved the theory of use and disuse
  - C. discovered genes
  - D. proposed that evolution proceeded by mutations
- \_\_\_\_\_ 5. Lyell proposed
- A. the theory of use and disuse
  - B. the principle of uniformity
  - C. the theory of populations
  - D. the mutation theory
- \_\_\_\_\_ 6. Meiosis
- A. provides the variety for devolution to occur
  - B. produces cells exactly like parent cells
  - C. does not affect devolution
  - D. none of these

- \_\_\_\_\_ 7. Organs which appear to be reduced in size and to have no function are said to be
- |                |                    |
|----------------|--------------------|
| A. vestigial   | C. acquired traits |
| B. adaptations | D. recessive       |
- \_\_\_\_\_ 8. Rocks which are formed from fragments of plants, animals and other rocks are
- |                |                |
|----------------|----------------|
| A. metamorphic | C. igneous     |
| B. granite     | D. sedimentary |
- \_\_\_\_\_ 9. Recessive genes
- |  |   |
|--|---|
| A. are often expressed in an organism's phenotype                    | C. gradually disappear from an organism |
| B. are not expressed if the corresponding dominant genes are present | D. none of these                        |
- \_\_\_\_\_ 10. The process by which a parent's genes are divided and passed on to the offspring is
- |                      |               |
|----------------------|---------------|
| A. an acquired trait | C. mutation   |
| B. meiosis           | D. adaptation |
- \_\_\_\_\_ 11. Dominant genes
- |   |                        |
|---|------------------------|
| A. are expressed in an organism's phenotype | C. gradually disappear |
| B. are not expressed                        | D. none of these       |
- \_\_\_\_\_ 12. "The present is the key to the past" is
- |                                  |                                 |
|----------------------------------|---------------------------------|
| A. the mutation theory           | C. the principle of uniformity  |
| B. the theory of acquired traits | D. the principle of segregation |
- \_\_\_\_\_ 13. Which of the following is a proposed ancestor of the whales?
- |                       |                        |
|-----------------------|------------------------|
| A. <i>Pakicetus</i>   | C. <i>Basilosaurus</i> |
| B. <i>Ambulocetus</i> | D. all of these        |
- \_\_\_\_\_ 14. Hardened tree sap which traps and preserves insects is
- |          |                     |
|----------|---------------------|
| A. mold  | C. cast             |
| B. amber | D. original remains |
- \_\_\_\_\_ 15. Body parts of different organisms that have the same basic structure but are used for different functions are called
- |                 |                  |
|-----------------|------------------|
| A. homologous   | C. analogous     |
| B. evolutionary | D. none of these |

- \_\_\_\_\_ 16. This is created when minerals fill in a cavity after the organism that formed the cavity decays.
- |          |            |
|----------|------------|
| A. Mold  | C. Cast    |
| B. Amber | D. Imprint |
- \_\_\_\_\_ 17. Change within a genus or species due primarily to meiosis, along with genetic isolation, genetic drift, and natural selection is:
- |                         |               |
|-------------------------|---------------|
| A. evolution            | C. devolution |
| B. geographic isolation | D. mutation   |
- \_\_\_\_\_ 18. Movement into or out of a population is:
- |                      |                  |
|----------------------|------------------|
| A. mutation          | C. genetic drift |
| B. genetic isolation | D. migration     |
- \_\_\_\_\_ 19. This occurs when members of the same species cannot interbreed.
- |              |                      |
|--------------|----------------------|
| A. Migration | C. Meiosis           |
| B. Mutation  | D. genetic isolation |
- \_\_\_\_\_ 20. He proposed a theory as to how the first cell on Earth could have arisen spontaneously.
- |           |            |
|-----------|------------|
| A. Miller | C. Oparin  |
| B. Redi   | D. Pasteur |
- \_\_\_\_\_ 21. He performed an experiment to test a theory of how the first cell was formed.
- |           |             |
|-----------|-------------|
| A. Miller | C. Darwin   |
| B. Oparin | D. De Vries |
- \_\_\_\_\_ 22. An evolutionary theory which states that in the past there were rapid changes in species, followed by long periods of stability and little change:
- |                           |                  |
|---------------------------|------------------|
| A. gradualism             | C. genetic drift |
| B. punctuated equilibrium | D. both A and B  |
- \_\_\_\_\_ 23. Cytochrome C is:
- |  |   |
|--|---|
| A. a mutant gene                         | C. present in a wide variety of species |
| B. a protein used in aerobic respiration | D. both B and C                         |
- \_\_\_\_\_ 24. This is a hollow cavity in rock formed by the body of a dead organism.
- |         |            |
|---------|------------|
| A. Cast | C. Imprint |
| B. Mold | D. Amber   |

- \_\_\_\_\_ 25. This occurs when plants or plant leaves are buried and decay partially, leaving carbon from their bodies.
- A. Amber  
B. Mold  
C. Carbon film fossil  
D. cast
- \_\_\_\_\_ 26. The type of nuclear division in which the final chromosome count is half the normal number is known as:
- A. meiosis  
B. mitosis  
C. natural selection  
D. both A and B
- \_\_\_\_\_ 27. It is believed to be brought about primarily by mutation and natural selection working together.
- A. Genetic drift  
B. Devolution  
C. Evolution  
D. None of these
- \_\_\_\_\_ 28. An impression left in a rock by a leaf or a foot before the rock hardens is:
- A. a carbon film fossil  
B. a cast  
C. a mold  
D. an imprint
- \_\_\_\_\_ 29. Bacteria which do not require oxygen; believed to have been the first cells on Earth:
- A. aerobic  
B. anaerobic  
C. mutational  
D. nucleic
- \_\_\_\_\_ 30. A random change in a gene or chromosome is:
- A. meiosis  
B. mitosis  
C. mutation  
D. natural selection
- \_\_\_\_\_ 31. Fossils can be trapped and preserved in:
- A. tar  
B. ice  
C. tree sap  
D. all of these
- \_\_\_\_\_ 32. The name *Homo habilis* means:
- A. human-like  
B. handy human  
C. ape-like  
D. none of these
- \_\_\_\_\_ 33. Neanderthals are noted for:
- A. using simple tools  
B. walking upright  
C. a large brain capacity  
D. all of these

- \_\_\_\_\_ 34. A scientist who studies fossils to learn about the Earth's history is a:
- A. geologist
  - B. paleontologist
  - C. physical anthropologist
  - D. paleoanthropologist
- \_\_\_\_\_ 35. A scientist who studies primarily human fossils is a(n):
- A. paleontologist
  - B. geologist
  - C. physical anthropologist
  - D. archaeologist
- \_\_\_\_\_ 36. *Homo erectus* appears to be much like modern man because:
- A. he had a brain capacity close to that of modern humans
  - B. he was as large as modern humans
  - C. he had a much smaller brain capacity
  - D. none of these
- \_\_\_\_\_ 37. *Homo erectus* also shows intelligence because:
- A. he used fire
  - B. he made and used simple tools
  - C. he used agriculture
  - D. both A and B
- \_\_\_\_\_ 38. The hominids are believed to have been bipedal. This means:
- A. they were able to do two things at once
  - B. they walked on two legs
  - C. they walked on four legs
  - D. none of these
- \_\_\_\_\_ 39. Humans, along with apes and several other creatures are placed in the order:
- A. Primates
  - B. Animalia
  - C. Diptera
  - D. Isoptera
- \_\_\_\_\_ 40. *A. africanus* is different from *A. afarensis* because:
- A. he is believed to have had a thumb like humans
  - B. he wore animal skins
  - C. he had larger, more rounded skull
  - D. both A and C
- \_\_\_\_\_ 41. *A. anamensis* is considered a hominid by its discoverer because:
- A. she found a complete skeleton
  - B. the mandible she found appeared ape-like, but the tibia she found demonstrated bipedalism
  - C. both the mandible and the tibia appeared to be similar to humans
  - D. she found forty per cent of the fossil
- \_\_\_\_\_ 42. *Ar. ramidus* is considered by its discoverer to be:
- A. 4.4 million years old
  - B. an ancestor of man
  - C. bipedal
  - D. all of these are correct



- \_\_\_\_\_ 43. The original fossil of *A. afarensis*
- A. was nicknamed Lucy
  - B. was made up of 40% of the original skeleton
  - C. did not have a complete skull
  - D. all answers are correct
- \_\_\_\_\_ 44. In general hominids:
- A. are considered bipedal but retain some ape-like characteristics
  - B. are very easy to find
  - C. are considered neither ape-like nor human-like
  - D. none of these
- \_\_\_\_\_ 45. Evolutionists generally believe:
- A. an increase in brain capacity came before bipedalism
  - B. bipedalism came before an increase in brain capacity
  - C. brain capacity and bipedalism evolved at the same time
  - D. none of these

### From a Creationists' Perspective

- \_\_\_\_\_ 46. Louis Pasteur helped to disprove spontaneous generation by:
- A. showing that maggots could not arise spontaneously from rotten meat
  - B. demonstrating that microorganisms could not arise spontaneously
  - C. testing Oparin's theory
  - D. none of these
- \_\_\_\_\_ 47. Francisco Redi helped to disprove spontaneous generation by:
- A. boiling beef broth in a jar
  - B. performing an experiment on amino acids
  - C. showing that maggots could not arise spontaneously from rotten meat
  - D. helping Stanley Miller test Oparin's theory
- \_\_\_\_\_ 48. In the experiment on rotten meat, maggots formed
- A. in all the jars
  - B. in none of the jars
  - C. in the covered jars only
  - D. in the uncovered jars only
- \_\_\_\_\_ 49. In the experiment on beef broth, microorganisms formed
- A. only in the flasks contaminated by dust
  - B. in all the flasks
  - C. in none of the flasks
  - D. only in the flasks uncontaminated by dust

- \_\_\_\_\_ 50. "Living things can come only from other living things" is
- A. the principle of biogenesis
  - B. the second law of thermodynamics
  - C. a description of spontaneous generation
  - D. none of these
- \_\_\_\_\_ 51. Oparin's theory:
- A. attempted to explain the principle of biogenesis
  - B. attempted to explain Stanley Miller's experiment
  - C. took into account all the chemical processes of life
  - D. attempted to explain how spontaneous generation of the first cell could take place
- \_\_\_\_\_ 52. Stanley Miller attempted to test Oparin's theory, but the experimental apparatus contained one thing not present in nature. This was:
- A. a condenser
  - B. an energy source
  - C. a trap
  - D. lightning
- \_\_\_\_\_ 53. The ocean could not protect amino acids because
- A. the sun's ultraviolet rays could still destroy them
  - B. the water would dissolve them
  - C. neither of these
  - D. both A and B
- \_\_\_\_\_ 54. In order to form proteins from amino acids \_\_\_\_\_ are absolutely necessary.
- A. lactic acids
  - B. enzymes
  - C. UV rays
  - D. none of these
- \_\_\_\_\_ 55. Enzymes are:
- A. proteins
  - B. sugars
  - C. inorganic molecules
  - D. proteinoids
- \_\_\_\_\_ 56. Another major difficulty with Miller's experiment is that it
- A. had no available heat source
  - B. produced a great deal of other compounds besides amino acids
  - C. had no way to turn the gases back into liquids
  - D. produced only left-handed amino acids
- \_\_\_\_\_ 57. In an organic soup the amino acids would be more likely to combine with
- A. other amino acids
  - B. other substances
  - C. proteins
  - D. none of these

- \_\_\_\_\_ 58. Nature uses exclusively:
- A. right-handed sugars
  - B. left-handed amino acids
  - C. left- and right-handed amino acids
  - D. both A and B
- \_\_\_\_\_ 59. Photosynthesis could not evolve because:
- A. it has one phase that is very complicated
  - B. it has two phases which are mutually dependent on one another
  - C. both its phases are very complicated
  - D. both B and C
- \_\_\_\_\_ 60. Without a trap, amino acids that were produced in Miller's experiment would:
- A. combine to form proteins
  - B. combine with other substances
  - C. be destroyed by the energy that formed them
  - D. be unaffected
- \_\_\_\_\_ 61. Oparin's theory stated that the early Earth had a reducing atmosphere. This was absolutely necessary because:
- A. organic molecules will not combine in the presence of free oxygen
  - B. DNA requires free oxygen in order to combine
  - C. the organic soup had to be protected from the sun's UV rays
  - D. water vapor was not important to his theory
- \_\_\_\_\_ 62. These form the "punctuation" of DNA.
- A. Start & stop codons
  - B. Proteins
  - C. Nucleotides
  - D. Genes
- \_\_\_\_\_ 63. DNA has often been compared to:
- A. a factory
  - B. a gene
  - C. a language
  - D. none of these
- \_\_\_\_\_ 64. It has been said that the probability of five favorable mutations occurring within a single life cycle of an organism is:
- A. very likely
  - B. effectively zero
  - C. not likely but possible
  - D. moderately likely
- \_\_\_\_\_ 65. Michael Richardson has shown that the same parts of embryos of different species:
- A. do not look alike
  - B. look very much alike
  - C. vary widely in size
  - D. both A and C

- \_\_\_\_\_ 66. The same parts of the embryos of different species often:
- A. do not develop into similar body parts in adults
  - B. always develop into similar body parts in adults
  - C. look very similar
  - D. both A and C
- \_\_\_\_\_ 67. What evolutionists call “gill slits” in humans are more accurately called:
- A. the throat
  - B. the coccyx
  - C. pharyngeal pouches
  - D. all of these
- \_\_\_\_\_ 68. The yolk sac was once thought to be vestigial. This means:
- A. it is too large
  - B. it is reduced in size and has no function
  - C. it is too small to be useful
  - D. it has a use only in adults
- \_\_\_\_\_ 69. Mankind’s embryonic yolk sac:
- A. is truly vestigial
  - B. is marginally useful
  - C. is useful late in the pregnancy
  - D. performs an important function early in the pregnancy
- \_\_\_\_\_ 70. These are not mentioned as homologous structures by evolutionists.
- A. The fingers
  - B. The legs of humans
  - C. The hind legs of most vertebrates
  - D. Both B and C
- \_\_\_\_\_ 71. So-called homologous structures in adult organisms:
- A. often develop from different parts of their respective embryos
  - B. always develop from the same parts of their respective embryos
  - C. are really analogous structures
  - D. never develop from the same parts of their respective embryos.
- \_\_\_\_\_ 72. The genes that control so-called homologous structures:
- A. are always homologous
  - B. are frequently found in different locations and on different chromosomes
  - C. are always found on the same chromosomes
  - D. none of these
- \_\_\_\_\_ 73. Pleiotropy is :
- A. the phenomenon of a gene influencing more than one trait
  - B. a strong argument against comparative homology
  - C. both A and B
  - D. neither A nor B

- \_\_\_\_\_ 74. Scientists are trying to use a protein which is present in many organisms to determine which are intermediate or link species. This protein is:
- A. leucine
  - B. praline
  - C. glutamine
  - D. cytochrome C
- \_\_\_\_\_ 75. When evolutionists tested different organisms using this protein (see # 74), they found that:
- A. all species tested appeared to be equidistant from bacteria
  - B. there were several species which could be considered intermediate
  - C. there were one or two species that could be considered intermediate
  - D. most of the species could not be considered intermediate
- \_\_\_\_\_ 76. Which of the following provides evidence that supports evolution?
- A. Genetics
  - B. Comparative embryology
  - C. Comparative homology
  - D. Comparative biochemistry
  - E. None of these
- \_\_\_\_\_ 77. Devolution occurs primarily due to:
- A. the loss of genetic information
  - B. the gain of genetic information
  - C. neither of these
  - D. both of these
- \_\_\_\_\_ 78. Geologists originally used \_\_\_\_\_ to determine the relative ages of rocks.
- A. the principle of biogenesis
  - B. the principle of uniformity
  - C. carbon-14 dating
  - D. none of these
- \_\_\_\_\_ 79. Creationists have used another dating method to disprove geologic column dating. This is:
- A. uranium-lead
  - B. rubidium-strontium
  - C. isochron dating
  - D. carbon-14
- \_\_\_\_\_ 80. Representatives of what percentage of the known phyla show up in Cambrian rock?
- A. 15%
  - B. 50%
  - C. 95%
  - D. 75%
- \_\_\_\_\_ 81. The species that died in the Cambrian period are essentially the same as those we have today. This means the fossil record exhibits:
- A. stasis
  - B. meiosis
  - C. gradual change
  - D. none of these

- \_\_\_\_\_ 82. If birds evolved from reptiles, there should be \_\_\_\_\_ intermediate fossils in the fossil record.
- A. ten or twenty  
B. thousands of  
C. 1 or 2  
D. thirty or forty
- \_\_\_\_\_ 83. Because of the transitional forms, Stephen Gould and Niles Eldredge proposed another theory of evolution. This is called:
- A. mutation  
B. circular reasoning  
C. punctuated equilibrium  
D. both A and C
- \_\_\_\_\_ 84. One of the major problems with fossil study is:
- A. too many fossils to choose from  
B. too little of the fossil to give it link fossil status  
C. a lack of soft tissue  
D. both B and C
- \_\_\_\_\_ 85. Creationists consider *Archaeopteryx* to be simply a bird because:
- A. some modern birds have claws on their wings  
B. some modern birds have flat breast-bones  
C. it has no halfway features between scales and feathers  
D. all choices are correct
- \_\_\_\_\_ 86. One problem with the whale series is:
- A. the specimens' only similarity to a whale is some bones in the ear  
B. the specimens are too small for study  
C. there are too many specimens to work with  
D. none of these
- \_\_\_\_\_ 87. Using the rocks to date the fossils and the fossils to date the rocks is an example of
- A. logical progression of thought  
B. begging the question  
C. circular reasoning  
D. none of these
- \_\_\_\_\_ 88. Correlating the rocks is:
- A. the process of examining the rocks in different locations to determine if they are the same age  
B. examining the processes that help to form rocks  
C. an example of circular reasoning  
D. all of the answers are correct
- \_\_\_\_\_ 89. Organisms which have no living examples are said to be
- A. transitional  
B. homologous  
C. analogous  
D. extinct

- \_\_\_\_\_ 90. Another term for link fossil is
- A. intermediate form
  - B. transitional form
  - C. both A and B.
  - D. neither A nor B
- \_\_\_\_\_ 91. Most radiometric dating relies on \_\_\_\_\_ assumptions.
- A. 1
  - B. 2
  - C. 3
  - D. 4
- \_\_\_\_\_ 92. We know that the rate of radioactive decay has been relatively constant for approximately:
- A. the last 100 years
  - B. billions of years
  - C. a few million years
  - D. never
- \_\_\_\_\_ 93. The time it takes for 50% of the radioactive atoms in a sample rock to break down into its daughter element is called its:
- A. decay element
  - B. half-life
  - C. parent element
  - D. None of these choices
- \_\_\_\_\_ 94. The assumption about radiometric dating that has the most support is:
- A. the original composition of the rock is unimportant
  - B. there are several ways for radioactive material to get out of the rock
  - C. the rate of decay has always been constant
  - D. none of the assumptions has any support at all
- \_\_\_\_\_ 95. Scientists testing samples of radioactive rock get:
- A. consistently the same results
  - B. fairly close results
  - C. widely varying results
  - D. none of the above
- \_\_\_\_\_ 96. Radioactive elements are unstable because:
- A. they have an excess of protons
  - B. their nuclei are too large for stability
  - C. they have more neutrons than protons
  - D. all of these can cause instability
- \_\_\_\_\_ 97. Element x has a half-life of 5 minutes. This means that at the end of 15 minutes \_\_\_\_\_ will be left.
- A. 1/8
  - B. 1/4
  - C. 1/3
  - D. 1/2

- \_\_\_\_\_ 98. In order to use long-range dating methods scientists
- A. must use carbon-14 only
  - B. can use uranium-lead
  - C. can use potassium-argon
  - D. can use rubidium-strontium
  - E. B, C, D, are correct
- \_\_\_\_\_ 99. Uranium—lead dating is based on the ratio of uranium to lead in a(an) \_\_\_\_\_ rock.
- A. sedimentary
  - B. igneous
  - C. metamorphic
  - D. shale
- \_\_\_\_\_ 100. The following material(s) can be removed from a given rock through leaching by ground water.
- A. Rubidium
  - B. Strontium
  - C. Lead
  - D. Uranium
  - E. All of these
- \_\_\_\_\_ 101. One of the reasons the Potassium—Argon method of dating is inaccurate is that:
- A. potassium and argon can be leached out of rocks
  - B. rocks can absorb argon from the air
  - C. argon can be forced up to the surface of the rock from the rock's interior
  - D. argon can be trapped in the rock
  - E. B, C, and D are correct
- \_\_\_\_\_ 102. Rubidium-strontium dating:
- A. is very accurate
  - B. is not affected by the problems that other methods have
  - C. gives dates which are out of line with other methods of dating
  - D. is relatively accurate
- \_\_\_\_\_ 103. Isochron dating is an attempt to date the age of rocks by measuring the ratio of different \_\_\_\_\_ within the rocks.
- A. minerals
  - B. isochrons
  - C. electrons
  - D. isotopes
- \_\_\_\_\_ 104. Isochron dating has problems because:
- A. it is impossible to determine the original ratio of isotopes
  - B. different isotopes of both rubidium and strontium can be leached out of the rock
  - C. neither A nor B
  - D. both A and B



- \_\_\_\_\_ 105. Carbon-14 dating as used by evolutionists is used to date material up to \_\_\_\_\_ years old.
- A. 10 million
  - B. 50,000
  - C. 10,000
  - D. 1 million
- \_\_\_\_\_ 106. Libby, the developer of Carbon-14 dating, assumed:
- A. carbon-14 is stabilized in the atmosphere
  - B. carbon-14 is not stabilized in the atmosphere
  - C. it didn't matter if Carbon-14 is stabilized or not
  - D. none of the above
- \_\_\_\_\_ 107. Carbon-14 dating is used to date:
- A. artifacts (organic materials)
  - B. minerals
  - C. rocks
  - D. none of these
- \_\_\_\_\_ 108. Being stabilized means:
- A. the same amount of the substance is constantly present
  - B. the  $^{14}\text{C}$  levels have fluctuated over time
  - C. the amount of carbon-14 in the upper atmosphere fluctuates, but the amount near the earth does not
  - D. the amount of carbon-14 is building up
- \_\_\_\_\_ 109. If  $^{14}\text{C}$  has not yet stabilized in the atmosphere, this means:
- A. carbon-14 is still building up in the atmosphere
  - B. test samples will appear to be older than they actually are
  - C. test samples will appear to be younger than they actually are
  - D. both A and B
- \_\_\_\_\_ 110. Brontosaurus is really
- A. a dinosaur
  - B. an *Apatosaurus* with the wrong head
  - C. the largest sauropod ever to live
  - D. an example of how easy it is to put fossils together
- \_\_\_\_\_ 111. A problem with the species, *Homo habilis* is
- A. parts of the fossil were found with other creatures scattered over an acre of ground
  - B. many scientists believe the genus has become a "taxonomic wastebasket"
  - C. neither of these is a problem.
  - D. both A and B are problems

- \_\_\_\_\_ 112. The Lake Laetoli footprints are an important find for creationists because:
- A. they are of unshod humans
  - B. they are obviously ape-like
  - C. they are dated to be older than many hominids
  - D. both A and C are correct
- \_\_\_\_\_ 113. *A. anamensis* is questionable as a true hominid because:
- A. its finder took it from three different locations
  - B. the bones appeared to be from both a human and another primate
  - C. parts of the fossil were found in rock strata dated to be of very different ages
  - D. all of the above
- \_\_\_\_\_ 114. *Ar. kadabba* is questionable as our ancestor because
- A. parts of the fossil were found 10 miles and 200,000 years apart
  - B. parts were squashed
  - C. the fossil consisted of an arm bone
  - D. none of these
- \_\_\_\_\_ 115. More recent examples of *H. erectus* appear to be
- A. orangutans
  - B. humans
  - C. apes
  - D. gibbons
- \_\_\_\_\_ 116. *K. platyops* is questionable as our ancestor because
- A. its parts were scattered
  - B. its parts were distorted
  - C. it had been dated to be too young
  - D. finders couldn't assemble a skull
- \_\_\_\_\_ 117. *Homo heidelbergensis* and *Homo neanderthalensis* are obviously both
- A. hominids
  - B. poor examples of humans
  - C. not really human
  - D. human
- \_\_\_\_\_ 118. Parts of the different specimens of *A. Africanus*
- A. come from several locations
  - B. are often fragmentary
  - C. give no evidence that it was bipedal
  - D. A and C are correct
  - E. A,B,C are correct
- \_\_\_\_\_ 119. Evidence for *Ar. ramidus* being our ancestor is debatable because
- A. its evidence for being bipedal is a divergent big toe
  - B. its bones disintegrated at a touch
  - C. its parts had been trampled and scattered
  - D. A and B are correct
  - E. all answers are correct

\_\_\_\_\_ 120. The “pervasiveness of perfection” means:

- A. perfection is uncommon in nature
- B. everywhere there are machines and systems carefully built and suited for the tasks they perform
- C. there are some machines in nature that are well suited for their tasks
- D. perfection is common only in the microscopic world

\_\_\_\_\_ 121. In an irreducibly complex structure:

- A. the parts work well together
- B. there are no moving parts
- C. the machine will not work unless all the parts are present and functioning together
- D. both A and C

\_\_\_\_\_ 122. As scientists have studied smaller and smaller units, they have found:

- A. that things become simpler
- B. layer upon layer of complexity
- C. microscopic machines
- D. both B and C

\_\_\_\_\_ 123. Gated transport is:

- A. carrying of proteins through the cell's cytoplasm to the ribosomes
- B. movement through the membrane of the organelle for which the protein was produced
- C. a good illustration of the complexity of cellular activities
- D. both B and C

\_\_\_\_\_ 124. The bacterial flagellum is considered an irreducibly complex structure because:

- A. it has more than one part
- B. it is small
- C. it has at least three essential parts
- D. none of these

\_\_\_\_\_ 125. The bat's brain is extraordinary because:

- A. it must be able to separate the reflected sound of its own pulse from that of other bats
- B. it must determine the size of an object and its distance away
- C. it must work in split-second cooperation with the bat's larynx and ears
- D. A, B, and C are correct
- E. none are correct

\_\_\_\_\_ 126. The giraffe's veins:

- A. are much like those of other mammals
- B. have valves to counteract the effects of gravity on the giraffe's long legs
- C. have valves to prevent part of the blood from receding from the brain
- D. have specialized valves only near the aorta
- E. both B and C

- \_\_\_\_\_ 127. In the giraffe's arteries:
- A. some of the blood is shunted off to the vertebral artery when the head is lowered
  - B. blood travels the same way it does in other mammals
  - C. some of the arteries expand and contract to hold different amounts of blood
  - D. both A and C
- \_\_\_\_\_ 128. Part of oxygen balance is achieved by:
- A. animals giving off carbon dioxide which plants use and, in turn, give off oxygen
  - B. chemical weathering removing oxygen from the atmosphere
  - C. algae in the ocean producing oxygen
  - D. all of the above
- \_\_\_\_\_ 129. Oxygen balance is also aided by:
- A. bacteria on the ocean's bottom
  - B. density currents in the oceans
  - C. both A and B
  - D. neither A nor B
- \_\_\_\_\_ 130. The Earth is uniquely suited for life because it has:
- A. the right tilt
  - B. ocean(s) of the right size
  - C. the right atmosphere
  - D. the right amount of carbon
  - E. A, B, C, and D
  - F. only A and B are correct
- \_\_\_\_\_ 131. The following characteristic(s) of water is (are) absolutely necessary for life on Earth:
- A. water's thermal characteristics
  - B. water's surface tension
  - C. water's chemical properties
  - D. A, B, and C are correct
  - E. only A and B are correct
- \_\_\_\_\_ 132. The sun produces the majority of its radiation in:
- A. the ultraviolet band
  - B. the near ultraviolet, visible light, and near infrared bands
  - C. radio waves
  - D. gamma rays
- \_\_\_\_\_ 133. Very little harmful radiation reaches the Earth because:
- A. the sun produces very little harmful radiation
  - B. the Earth's atmosphere acts to block harmful radiation
  - C. both A and B
  - D. the harmful radiation is unable to travel so far through space

- \_\_\_\_\_ 134. The belief that there was an earlier creation which was destroyed when Satan fell is known as the:
- |                   |                     |
|-------------------|---------------------|
| A. Day-age Theory | C. Canopy Theory    |
| B. Gap Theory     | D. Old Earth Theory |
- \_\_\_\_\_ 135. Scientists who believe that the Earth and its inhabitants are too complicated to have happened by chance, and therefore someone had to create them are known as the:
- |                      |                             |
|----------------------|-----------------------------|
| A. Gap theorists     | C. Intelligent Design Group |
| B. Day-age theorists | D. Young Earth Creationists |
- \_\_\_\_\_ 136. Those who believe that the days mentioned in Genesis were 24 hours in length are known as
- |                           |                             |
|---------------------------|-----------------------------|
| A. Old Earth Creationists | C. Young Earth Creationists |
| B. Gap theorists          | D. Day-age theorists        |
- \_\_\_\_\_ 137. Those who believe that the days mentioned in Genesis were really long periods of time are known as:
- |                      |                             |
|----------------------|-----------------------------|
| A. Day-age theorists | C. Young Earth Creationists |
| B. Gap theorists     | D. Canopy theorists         |
- \_\_\_\_\_ 138. An area where one crustal plate goes beneath another is known as a:
- |                       |                  |
|-----------------------|------------------|
| A. divergent boundary | C. hydroplate    |
| B. subduction zone    | D. none of these |
- \_\_\_\_\_ 139. The Runaway Subduction theory proposes that
- |  |  |
|--|--|
| A. the Earth once had ocean plates which were denser than they are today | C. the rapid movement of crustal plates caused the catastrophe of Noah's flood |
| B. the ocean plates once moved very rapidly under the continental plates | D. all choices are correct   |
- \_\_\_\_\_ 140. Which of the following would be considered circumstantial evidence?
- |   |   |
|---|---|
| A. A fingerprint left at the scene of a crime | C. Laboratory repetition of experiments |
| B. An eyewitness report                       | D. None of these                        |
- \_\_\_\_\_ 141. In order for an ice age to occur, there must be a combination of
- |  |  |
|--|--|
| A. abnormally cool summers and abnormally warm arctic oceans | C. abnormally cool summers and abnormally cool arctic oceans |
| B. Abnormally warm summers and abnormally warm arctic oceans | D. abnormally warm summers and abnormally cool arctic oceans |

- \_\_\_\_\_ 142. These offer good circumstantial evidence for a catastrophic flood.
- A. Radioactive elements
  - B. Structure of the fossil beds
  - C. Polystrate fossils
  - D. Both B and C
- \_\_\_\_\_ 143. This (these) would be a possible consequence of runaway subduction.
- A. Rapid continental drift
  - B. Tsunamis
  - C. Frozen, preserved mammoths
  - D. Both A & B
- \_\_\_\_\_ 144. These theorists attempt to use scripture for support.
- A. Canopy theorists
  - B. Hydroplate theorists
  - C. Gap theorists
  - D. Day-age theorists
  - E. All of these
- \_\_\_\_\_ 145. These theorists believe in rapid continental drift.
- A. Day-age theorists
  - B. Gap theorists
  - C. Runaway Subduction theorists
  - D. None of these
- \_\_\_\_\_ 146. Circumstantial evidence:
- A. has no basis in fact
  - B. has very little basis in fact
  - C. has a definite basis in fact
  - D. is not acceptable in a court of law
- \_\_\_\_\_ 147. Although many law-abiding, moral citizens accept evolution as true, it can logically lead to \_\_\_\_\_ in their lives.
- A. moral relativism
  - B. social darwinism
  - C. agnosticism
  - D. all of these
- \_\_\_\_\_ 148. Karl Marx viewed religion as:
- A. a benefit to people
  - B. unimportant to people
  - C. the opiate of the people
  - D. none of these
- \_\_\_\_\_ 149. Marx was very excited when he read Darwin's work because:
- A. it showed how God created the world
  - B. it made atheism scientifically acceptable
  - C. it was easy for a layman to read
  - D. it showed how God used evolution instead of the Biblical method to create the world
- \_\_\_\_\_ 150. Marx was so impressed and grateful to Darwin that he:
- A. invited him to speak at a Communist rally
  - B. offered to dedicate a book to him
  - C. asked him to write a book especially for Communists to read
  - D. became a Christian

- \_\_\_\_\_ 151. Lenin was deeply influenced by Darwin's theory; he went on to
- A. become an atheist
  - B. lead the communist revolution in Russia
  - C. use a belief in Social Darwinism as an excuse for violence and killing
  - D. all of these
- \_\_\_\_\_ 152. Joseph Stalin, according to his biographers,
- A. was not particularly influenced by Darwin
  - B. read Darwin in his early teens and became an atheist
  - C. was only mildly influenced by Darwin
  - D. at first accepted Darwin but later changed his views
- \_\_\_\_\_ 153. During his time in power, Stalin:
- A. introduced several 5-year plans which caused the death of millions
  - B. began enforcing grain quotas which didn't leave enough for the farmers to eat
  - C. forcibly removed millions of people from their land
  - D. all of these
- \_\_\_\_\_ 154. The number dying in Stalin's "war against the peasants" was:
- A. greater than the number of lives lost in World War I
  - B. sizable but less than a million
  - C. less than a thousand
  - D. two million
- \_\_\_\_\_ 155. Hitler's entire justification for enslaving and annihilating non-Germanic peoples was:
- A. they posed a threat to German people
  - B. the Germanic people were trying to help other countries
  - C. the German people were the most fit and therefore had a right to take what they wanted
  - D. both B and C
- \_\_\_\_\_ 156. In 1945, when Hitler realized the Russians would win, he:
- A. still believed in survival of the fittest
  - B. declared the Germans were still the best
  - C. abandoned his belief in evolution
  - D. gave up his atheism
- \_\_\_\_\_ 157. Benito Mussolini:
- A. read Darwin and only partially accepted his theory
  - B. regarded Darwin as one of the two greatest thinkers of the 19th century
  - C. was a faithful Christian
  - D. none of these

- \_\_\_\_\_ 158. Mussolini:
- A. also believed in the superiority of the Aryan race
  - B. used social Darwinism as an excuse to enslave other races
  - C. passed laws preventing Italians from intermarrying with other races
  - D. all of these
- \_\_\_\_\_ 159. "Survival of the fittest" was the world view which was held by:
- A. Lenin
  - B. Stalin
  - C. Hitler
  - D. Mussolini
  - E. all of these
- \_\_\_\_\_ 160. Peter Singer is:
- A. a Christian philosopher
  - B. a college professor
  - C. considered a moderate by many
  - D. a believer in moral absolutes
  - E. both B and C
- \_\_\_\_\_ 161. Prof. Singer believes:
- A. abortion is okay but infanticide is wrong
  - B. both abortion and infanticide are acceptable
  - C. euthanasia is acceptable
  - D. both B and C
- \_\_\_\_\_ 162. Euthanasia is:
- A. assisted suicide
  - B. killing of the ill, with or without their consent
  - C. a type of abortion
  - D. none of these
- \_\_\_\_\_ 163. In the Netherlands, guidelines to prevent abuse of assisted dying are:
- A. strictly enforced
  - B. never enforced
  - C. left to the judgment of the attending doctor
  - D. none of these
- \_\_\_\_\_ 164. In moral relativism:
- A. right and wrong depend on Biblical absolutes
  - B. right and wrong depend on the absolutes of a given culture
  - C. right and wrong depend on the circumstances of the situation
  - D. right and wrong are not considered



\_\_\_\_\_ 165. If evolution were true, which of the following series of statements is a logical progression of thought?

- A. Genesis is a myth that God gave us. The rest of the Bible is okay. There are still moral absolutes.
- B. Most of Genesis is still true. The Bible is fairly accurate. We have some basic moral absolutes.
- C. God used evolution to create the world. He gave us the Bible to guide us. He is still the creator God.
- D. Genesis is false. The rest of the Bible is therefore unreliable. There are no moral absolutes. Right and wrong depend on circumstances. Survival of the strongest and fittest is “right” and logical.

# Vocabulary (Chapters 1–5)

## Chapter 1

- \_\_\_\_\_ 1. Rock formed from melted rock.
- \_\_\_\_\_ 2. Rock formed from heat and pressure.
- \_\_\_\_\_ 3. Rock formed from the remains of plants, animals, and rock fragments.
- \_\_\_\_\_ 4. Rock in which most fossils are found.
- \_\_\_\_\_ 5. He proposed the Theory of Acquired Traits and the Theory of Use and Disuse.
- \_\_\_\_\_ 6. This states that traits acquired in one generation are passed on to the next generation.
- \_\_\_\_\_ 7. These appear to be reduced in size and to have no apparent function.
- \_\_\_\_\_ 8. He proposed the Principle of Uniformity. He said the slow processes we see today indicate an old earth. “The present is the key to the past”.
- \_\_\_\_\_ 9. He proposed the Mutation Theory, which states that mutations provide the genetic variety on which natural selection can work.
- \_\_\_\_\_ 10. He popularized natural selection.
- \_\_\_\_\_ 11. The process by which organisms well adapted to the environment will survive and reproduce more often than those that are not.
- \_\_\_\_\_ 12. He is the “father” of genetics. He discovered dominant (expressed) genes and recessive (unexpressed) genes.
- \_\_\_\_\_ 13. The process by which a parent’s genes are divided, and one half passed on to the next generation; provides the genetic variety for devolution to occur.

## Chapter 2

- \_\_\_\_\_ 14. Change primarily within genus or species, and extending in some cases to the family level: occurs primarily because of a loss of genetic information.
- \_\_\_\_\_ 15. Change that goes beyond the genus, species, or family level; requires the influx of a massive amount of genetic information.
- \_\_\_\_\_ 16. Movement into or out of a population.

- \_\_\_\_\_ 17. This occurs when organisms are unable to interbreed.
- \_\_\_\_\_ 18. A mold is a cavity in rock formed by the body of a buried organism which then decays. This is created when minerals fill in the cavity.
- \_\_\_\_\_ 19. Carbon film fossils occur when plants are buried and decay partially, leaving carbon from their bodies; what is hardened tree sap called?
- \_\_\_\_\_ 20. Analogous structures are body parts which have a different structure but the same function; what are body parts of different organisms that have the same basic structure but a different function called?
- \_\_\_\_\_ 21. Oparin proposed a theory as to how the first cell formed: this man tested it.
- \_\_\_\_\_ 22. Evolutionary theory that proposes that in the past there were rapid changes followed by long periods of stability and little change. It was formulated primarily to explain the lack of link (transitional or intermediate) fossils.
- \_\_\_\_\_ 23. Devolution is brought about primarily by the interaction of meiosis and natural selection; what is supposed to be brought about by mutation and natural selection?
- \_\_\_\_\_ 24. A random change in a gene or chromosome. Scientists have estimated that the probability of 5 beneficial ones occurring in the same organism during its lifespan is effectively zero.
- \_\_\_\_\_ 25. Fossils can be found in ice, tar, tree sap and this.
- \_\_\_\_\_ 26. A protein used in respiration in a wide variety of organisms.
- \_\_\_\_\_ 27. The first cell is supposed to have resembled this, a bacterium that does not require free oxygen.
- \_\_\_\_\_ 28. An impression left in a rock by a leaf or a foot, etc. before the rock hardens.

### Chapter 3

- \_\_\_\_\_ 29. A geologist is a scientist who studies fossils to learn about the earth's history. What is a scientist who studies primarily human fossils called?
- \_\_\_\_\_ 30. Hominids are human-like species which were supposed to have retained some ape-like characteristics. They supposedly walked on two legs. What is walking on two legs called?
- \_\_\_\_\_ 31. Humans, along with several other creatures, are placed in this order.

\_\_\_\_\_ 32. It was a small monkey-like primate that is supposed to have lived between 8 and 17 million years ago and was considered for a time to have been the ancestor of both apes and man. It was really an orangutan.

\_\_\_\_\_ 33. The fossil consisted of a mandible, some arm bones, and pieces of skull in one location. Together with bones found in another location, they had about 45% of a skeleton. Believed to have lived 4.4 million years ago.

\_\_\_\_\_ 34. Believed to have walked upright and to have been an ancestor of *Ar. ramidus*.

\_\_\_\_\_ 35. It consists of a badly abraded skull and a partial upper jaw; found in 1999 near Lake Turkana, Kenya by Justus Erus, a member of Meave Leakey's team.

\_\_\_\_\_ 36. Meave Leakey found this fossil; she considered it to be a hominid because the mandible she found was ape-like, but the tibia she found demonstrated bipedalism.

\_\_\_\_\_ 37. *A. afarensis* was discovered by Donald Johanson and nicknamed Lucy. Forty per cent of the skeleton was found (although no head). What is the name of the claimed fossil descendent which is different from *A. afarensis* because he is supposed to have had a larger, more rounded skull and a thumb like humans?

\_\_\_\_\_ 38. Evolutionists believe an increase in this came after hominids began to walk upright.

\_\_\_\_\_ 39. An archaic human whose holotype specimen consisted of a human femur and a skull plate resembling a neanderthal's. Now considered an archaic human.

\_\_\_\_\_ 40. These are considered Archaic humans by evolutionists.  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

\_\_\_\_\_ 41. This human is identical in appearance to modern man.

\_\_\_\_\_ 42. States that modern humans evolved in Africa and then came out of the continent and replaced other, less-evolved hominids that had left Africa at an earlier time. Also known as Single Origin Model.

\_\_\_\_\_ 43. States that groups of *Homo erectus* left Africa and dispersed into many areas of the old world; then each group fathered a line that gave rise to modern humans. Also known as Multi-regional Model.  
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## From a creationist's perspective

### Chapter 4

- \_\_\_\_\_ 44. Francisco Redi was an Italian scientist who disproved spontaneous generation of larger organisms by showing that maggots did not arise spontaneously from rotten meat. Who is the French scientist who proved that microorganisms could not arise spontaneously. Note: you are responsible to know what happened in these experiments.
- \_\_\_\_\_ 45. This states, "living things can come only from other living things".
- \_\_\_\_\_ 46. He attempted to explain how the first cell could have spontaneously generated, but he failed to take into account all the chemical processes of life.
- \_\_\_\_\_ 47. Stanley Miller's experimental apparatus contained one thing not present in nature. What is it? Because it is missing, the amino acids would have been destroyed by the energy that formed them. On Oparin's Earth, oceans could not have protected the amino acids because the water would have dissolved them and the UV rays of the sun could still have reached them.
- \_\_\_\_\_ 48. These proteins are absolutely necessary to form other proteins from amino acids.
- \_\_\_\_\_ 49. This produced a great deal of other compounds besides amino acids with which the amino acids would be much more likely to combine.
- \_\_\_\_\_ 50. 51. Nature uses exclusively \_\_\_\_\_ sugars and \_\_\_\_\_ amino acids.
- \_\_\_\_\_ 52. This could not have evolved because it has two very complicated processes that are mutually dependent.
- \_\_\_\_\_ 53. This is an atmosphere with no free oxygen. It is absolutely necessary for any theory of spontaneous generation because organic molecules will not combine in the presence of free oxygen.
- \_\_\_\_\_ 54. This proves there was O<sub>2</sub> in the early atmosphere.
- \_\_\_\_\_

### Chapter 5

- \_\_\_\_\_ 55. This has often been compared to a language. It has "letters", (nucleotides) "words", (triplets) "sentences", (genes) and "punctuation", (start and stop codons).
- \_\_\_\_\_ 56. DNA carries this. This never arises by accident.

- \_\_\_\_\_ 57. His research showed that embryos of different organisms at the same stage of development do not look alike. It has also been shown by other scientists that homologous parts of embryos of different species often do not develop into homologous parts in the adult organisms. The reverse is also true. For example, the so-called “gill slits” (more accurately called pharyngeal pouches) of human embryos do not develop into the respiratory system as in fish; instead, they grow into various glands.
- \_\_\_\_\_ 58. This performs an important function early in embryonic development; it provides the red blood cells to the baby until the bone marrow can take over the job.
- \_\_\_\_\_ 59. Evolutionists do not mention these as homologous structures.
- \_\_\_\_\_ 60. The genes that control so-called homologous structures are frequently found on different locations and on different chromosomes. \_\_\_\_\_ is the phenomenon of a gene influencing more than one trait. It is also a strong argument against comparative homology. Both situations indicate non-homologous genes are controlling so-called homologous structures.
- \_\_\_\_\_ 61. Scientists comparing this protein in different species, looking for evidence for evolution, found that all species appeared to be equidistant from bacteria. There were no intermediate species.
- \_\_\_\_\_ 62. This science offers some good support for evolution.

# Vocabulary (Chapters 6–11)

## Chapter 6

- \_\_\_\_\_ 1. The process of examining the rocks in different locations to determine if they are the same age.
- \_\_\_\_\_ 2. Geologists originally used this to determine the relatively old ages of rocks.
- \_\_\_\_\_ 3. Using the rocks to date the fossils and the fossils to date the rocks is an example of this.
- \_\_\_\_\_ 4. Creationists have used this dating method to disprove geologic column dating.
- \_\_\_\_\_ 5. Representatives of this percentage of the known phyla show up in Cambrian rock. Once they show up, the different species remain essentially the same. This is known as stasis.
- \_\_\_\_\_ 6. If evolution is true, there should be hundreds of thousands of these in the fossil record. (Also called link fossils, or intermediate forms.)
- \_\_\_\_\_ 7. These organisms have no living examples.
- \_\_\_\_\_ 8. The study of these is hampered by too little of the organisms to give them link status and no soft tissue to examine.
- \_\_\_\_\_ 9. This is considered a bird by creationists because some modern birds have claws on their wings and flat breastbones and some extinct birds have teeth; also, it has no half-way features between scales and feathers.
- \_\_\_\_\_ 10. One problem with this series is that most of the specimens have nothing in common with the creature they are supposed to be ancestors of except a few ear bones.
- \_\_\_\_\_ 11. This was considered a link fossil between fish and amphibians until a live one was discovered.

## Chapter 7

- \_\_\_\_\_ 12. These are unstable because they have an excess of protons, an excess of neutrons, or their nuclei are too large for stability.
- \_\_\_\_\_ 13. The radioactive element is often called the parent element. The element into which the radioactive element decays is called (Also called decay element.)

\_\_\_\_\_ 14. The time it takes for 50% of a rock's radioactive material to break down. Know how to figure this! (See Chapter 7)

\_\_\_\_\_ 15. Most radioactive dating rests on \_\_\_\_\_ premises or assumptions.

16. State the 3 assumptions of radioactive dating on the lines below.

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Which of these assumptions has the most support and why?

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\_\_\_\_\_ 17. Rubidium, strontium, uranium, and lead can all be washed out of rock by ground water. What is this called? Because of this problem, scientists using radioactive dating methods tend to get widely varying results when dating the same rock formation.

\_\_\_\_\_ 18. These are considered long-range dating methods.

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\_\_\_\_\_ 19. This method is flawed because the decay element can be absorbed from the air, forced to the surface of the rock from the rock's interior, and trapped within the rock.

\_\_\_\_\_ 20. This method is an attempt to date the age of rocks by measuring the ratio of different isotopes within the rocks. It has problems because it is impossible to determine the original ratio of isotopes. Also, the isotopes can be leached from the rocks.

\_\_\_\_\_ 21. These long-range methods, like uranium-lead and potassium-argon, give dates that are out of line with other methods of dating. (*Two*)

\_\_\_\_\_ 22. A short-range, radioactive dating method that dates artifacts up to 50,000 years old.

\_\_\_\_\_ 23. In formulating this method, Libby inaccurately assumed that this element was \_\_\_\_\_ in the atmosphere. This means that the same amount of the element has been constantly present in the atmosphere for at least 50,000 years. However, since it isn't, samples tested using this method would appear to be older than they actually are.

## Chapter 8

\_\_\_\_\_ 24. This creature is really an *Apatosaurus* with the wrong head.



- \_\_\_\_\_ 25. The parts of this so-called hominid were found in 3 different locations and in rock strata dated, using evolutionists' methods, to be very different in age. The bones appeared to be from both a human and a primate.
- \_\_\_\_\_ 26. Forty per cent of this fossil was found by Donald Johanson. It lacked a head. Johanson later found a head in a different location and declared it to be the same species. There is some argument as to whether it was really bipedal.
- \_\_\_\_\_ 27. The holotype of this species consisted of a skull. Later specimens consist of bones that are often fragmentary and found in several locations. Evolutionary scientists generally believe it was not bipedal.
- \_\_\_\_\_ 28. The parts of this "hominid" were found with other creatures scattered over an acre of ground. The leg bones are more similar to living great apes than to humans. There is also no proof that *Homo habilis* walked upright. Some evolutionists believe it has become "a wastebasket taxon".
- \_\_\_\_\_ 29. The parts of the original fossil of this "hominid" (Java Man) consisted of a skull plate and a femur found 50 feet apart in what was once river gravel. Other, more recent specimens appear to be smaller Neanderthals.
- \_\_\_\_\_ 30. Pieces of a skull, and some teeth and arm bones were found in one location and a pelvis and some tibia bones in another. Later, about 100 more fossil fragments were found, together with the original find making up about 45% of a skeleton. Had a divergent big toe.
- \_\_\_\_\_ 31. The bone fragments of jaw, arm hand and feet together with a collar-bone and some teeth. The fragments were of at least five different specimens. Toe bone found 10 miles away in rock 200,000 years difference in age.
- \_\_\_\_\_ 32. a partial skull and a fragmentary upper jaw found near Lake Turkana in Kenya. These are the only parts that can be definitely assigned to this species. The skull is cracked and distorted.
- \_\_\_\_\_ 33. Judging by their size, bone structure, brain capacity, and evidence of social behavior, these species were obviously human.
- \_\_\_\_\_ 34. The footprints of unshod humans in hardened, volcanic ash dated radiometrically to be 3.6 million years old, older than many of the proposed hominids.
- \_\_\_\_\_ 35. A human upper arm bone dated to be as old or older than the Australopithecines.

## Chapter 9

- \_\_\_\_\_ 36. The idea that everywhere there are irreducibly complex machines and systems working together.
- \_\_\_\_\_ 37. A machine that possesses at least 3 parts working well together and all necessary to the function of the machine.
- \_\_\_\_\_ 38. Movement through the cell's or an organelle's membrane; extremely complex.
- \_\_\_\_\_ 39. An irreducibly complex structure on a bacterium.
- \_\_\_\_\_ 40. Separates the reflected sound of its own pulse from those of other bats, determines the size of an object, and its distance away from the bat.
- \_\_\_\_\_ 41. Has specialized arteries and specialized veins with valves in both legs and neck.
- \_\_\_\_\_ 42. In this part of the giraffe's body, blood is shunted to the vertebral artery and arteries expand and contract to control the blood pressure.

43. List five different components of oxygen balance.

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- \_\_\_\_\_ 44. It has the right tilt, oceans of the right size, the right atmosphere, and the right amount of carbon.
- \_\_\_\_\_ 45. The characteristics of water that are necessary for life on Earth.
- \_\_\_\_\_ 46. The sun produces the majority of its radiation in this narrow band.
- \_\_\_\_\_ 47. The sun produces very little of this and the Earth's atmosphere acts to block it.

## Chapter 10

- \_\_\_\_\_ 48. The belief that there was an earlier creation which was destroyed when Satan fell is known as the Gap Theory. What is the theory that proposes that the days in Genesis were actually very long periods of time? (*Two names for this theory*)
- \_\_\_\_\_

- \_\_\_\_\_ 49. Scientists who believe that the Earth and its inhabitants are too complicated to have happened by chance are known as the Intelligent Design Group. Those who believe the days mentioned in Genesis were literal 24 hour days are known as \_\_\_\_\_.
- \_\_\_\_\_ 50. This theory, the best from a scientific standpoint, states that the Earth once had ocean plates that were much denser than the continental plates. This caused the ocean plates to subduct rapidly beneath the continental plates, causing much of the catastrophic results of Noah's flood such as tsunamis and rapid continental drift.
- \_\_\_\_\_ 51. These theorists attempt to use scripture for support (more than one).
- \_\_\_\_\_ 52. This is evidence left behind that is difficult to explain in any other way. It has a basis in fact.
- \_\_\_\_\_ 53. The structure of the fossil beds, many rock layers, and polystrate fossils offer good evidence for this.
- \_\_\_\_\_ 54. In order for this to occur there must be a combination of abnormally cool summers and abnormally warm arctic oceans.

## Chapter 11

- \_\_\_\_\_ 55. He viewed religion as the "opiate of the people". He was very excited when he read Darwin's book because it made atheism scientifically acceptable. He was so impressed and grateful he offered to dedicate a book to Darwin.
- \_\_\_\_\_ 56. He was deeply influenced by Darwin's theory and became the atheistic leader of the communist revolution in Russia. He used social Darwinism as an excuse for violence and killing.
- \_\_\_\_\_ 57. He read Darwin in his early teens and became an atheist. While in power, he introduced several 5 year plans in the Soviet Union, enforced cruel grain quotas, and forcibly removed millions of people from their land. It is said the number dying as a result of his actions was greater than the number of people lost in World War I.
- \_\_\_\_\_ 58. His entire justification for enslaving and killing non-Germanic peoples was that the Germans were the most "fit" and had a right to take what they wanted. When he realized the Russians would win the war, he still believed in the "survival of the fittest".

\_\_\_\_\_ 59. He believed Darwin to be one of the great thinkers of the 19th century. As a result, he believed the Aryan race was superior and used Social Darwinism as an excuse to conquer and enslave other races. He even passed laws preventing his people from intermarrying with “inferior” races.

\_\_\_\_\_ 60. This belief was held by Lenin, Stalin, Hitler and Mussolini, as well as by many other non-dictators.

\_\_\_\_\_ 61. An English philosopher who felt that victory of the strong over the weak was the natural way of life.

\_\_\_\_\_ 62. This Australian-born philosopher and professor, because of his belief in evolution, advocates not only abortion, but also infanticide, and euthanasia. However he is considered moderate by many.

\_\_\_\_\_ 63. This is killing of the weak, sick, or old, with or without their permission.

\_\_\_\_\_ 64. In this country, guidelines to prevent abuse of assisted dying are left to the judgment of the attending doctor, leading to cases of unauthorized euthanasia.

\_\_\_\_\_ 65. In this moral belief system, right and wrong depend on the circumstances of the situation.

\_\_\_\_\_ 66. Advocates of assisted suicide have been successful in passing laws to allow it in three states. What are they?

\_\_\_\_\_ 67. Allows terminally ill adults 18 years of age or older to obtain lethal doses of medication if they are terminally ill.

68. On the lines below, state the logical progression of thought leading from the premise that evolution is true.

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