



Dating Fossils and Rocks

DVD Lesson Plan

Purpose of the DVD

The purpose of the DVD is to demonstrate that the methods used to date fossils and the age of the earth are not as reliable as claimed and there are scientific evidences which support a young earth.

DVD Theme

There are hidden assumptions in the dating methods and different dating methods will often give different dates for the same object.

Using the DVD to build an accurate knowledge of the scientific evidences about origins

When textbooks present information about the age of the earth, rocks, or fossils, it is always stated as fact. The earth is mostly taught to be billions of years old (4.6 billion). However, students are very seldom taught that there are assumptions in each of the dating methods and that different dating methods will often give different dates to the same object. This DVD will help the student to better evaluate the accuracy of the dating methods and examine other scientific evidences not found in most textbooks that give a young age for the earth.

The DVD is presented in three major sections:

1. Understanding how carbon-14 dating works
2. Understanding how scientists date rocks and the age of the earth
3. Scientific evidences that support the Biblical account of a young earth

How to Teach Using This DVD

Viewing the DVD for educational purposes (suggestions for maximizing learning)

For best learning results it is recommended that students:

1. Review the objectives.
2. Review the DVD outline.
3. Review the exercise questions prior to viewing the video. This will encourage the student to know what to look for and enable better learning.
4. While watching the video, fill in the answers to each of the exercise questions so they can be used as a study guide.
5. After watching the video and studying the exercise sheet, complete the exercise again, in a test format (no notes).

DVD Objectives

At the completion of this video the student will be able to:

- State/write how carbon-14 is formed in the atmosphere.
- State/write the underlying assumption in the carbon-14 dating method and how it affects the dating method.
- State/write how the carbon-14 dating method works.
- State/write why carbon-14 supports a young earth.
- State/write how the basic process for radioisotope dating methods work.
- State/write the assumptions involved in the radioisotope dating methods.
- State/write how the amount of helium in the atmosphere and in granite rocks support a young earth.
- State/write three scientific evidences for a young earth.
- State/write the purpose of the RATE group.

DVD Outline

Part 1: Understanding how carbon-14 actually works

- The Atom and its components
- What is carbon?
- Unstable isotopes
- Radioactive decay
- How half-life is measured
- How carbon-14 is produced in the atmosphere
- The carbon-14 life cycle (N-14 – C-14 – N14)
- The assumption of equilibrium
- How the carbon dating clock works
- What we need to know
 - The rate of decay or half-life (5,730 years)
 - The starting point or amount of carbon in the specimen when it died

- How the carbon-12 and carbon-14 ratio works
- A critical assumption (equilibrium)
 - Dr. Willard Libby – the founder of carbon-14 dating method
 - The facts about equilibrium
- Factors affecting carbon-14 dating
 - Cosmic ray penetration
 - The strength of the earth’s magnetic field
 - The Genesis Flood
- The assumption (equilibrium) has been proven false
- Carbon-14 is evidence of a young earth

PART 2: Understanding how scientists date rocks and the age of the earth (Radioisotope dating methods)

- Why people believe in an old earth
- How radioactive decay works
 - Uranium (parent element) decays into lead (daughter element)
 - Potassium (parent element) decays into argon (daughter element)
- Hour glass example
- Radioisotope dating assumptions
 - The starting amount of the daughter element is known
 - All the daughter element is due to radioactive decay
 - The sample was always in a closed environment
 - The decay rate has been constant
- Examples of dating
- Reliability and consistency of dating

“When the same rock is dated by more than one method, it will often yield different ‘ages.’ And when the rock is dated more than one time by the same method, it will often give different results.”

John Morris, Ph.D. Geologic Engineering

PART 3: Scientific evidences that support the Biblical account of a young earth

- Conflicts in dating (wood found in basalt give different ages)
- Helium in the atmosphere
- Helium in granite rocks
- The RATE (Radioisotope and the Age of The Earth) group
- More evidences of a young earth
 - Helium in the earth’s atmosphere
 - Nuclear decay rates
 - Sodium in the oceans
 - Rapid disintegration of comets
 - Erosion of continents
 - Sediments in the ocean
 - Decay of the earth’s magnetic field
 - Carbon-14 ratio in the atmosphere

- Radiohalos for polonium in granite
- Population statistics
- Recession of the moon
- ...many more
- Many scientists believe in a young earth
 - “I am convinced there is far more evidence for a recent, six-day creation and a global Flood than there is for an old earth and evolution.”
 - Keith Wanser, Ph.D. Condensed Matter Physics
- Conclusion: Five facts
 - The earth has not been scientifically proven to be billions of years old.
 - The Bible teaches a literal 6-day creation.
 - Many scientists believe in a literal 6-day creation about 6,000 years ago.
 - New evidence from nuclear decay supports a young earth model.
 - There are many scientific evidences for a young earth.

INTERVIEWS

John Morris, Ph.D. Geological Engineering (President ICR)

Is there any geological evidence that supports rapid formations and a young earth?

How does the Genesis Flood affect our understanding of the age of the earth?

Larry Vardiman, Ph.D. Atmospheric Science

Where does the ice age fit into the Bible?

Are there any scientists who believe in a young earth and are they doing any scientific research on dating methods?

Jobe martin, D.M.D., Th.M.

Creationists and evolutionists look at the same data. Why do they come to different conclusions?

Why do many people in church not trust the Biblical teaching of a young earth?

Michael Oard, M.S. Atmospheric Science

How does the ice age fit into the Biblical teaching of a young earth?

ADDITIONAL RESOURCES

- *The Young Earth*, by John Morris, Ph.D. Geological Engineering
- *Radioisotopes and the Age of the Earth*, edited by Larry Vardiman, Ph.D., Andrew Snelling, Ph.D., Eugene Chaffin, Ph.D. (technical)
- *Ice Cores and the Age of the Earth*, by Larry Vardiman, Ph.D. (technical)
- *The Age of the Earth's Atmosphere*, by Larry Vardiman, Ph.D. (technical)
- *Ice Age Caused by the Genesis Flood*, By Michael Oard (technical)
- *Footprints in the Ash*, John Morris, Ph.D., and Steven Austin, Ph.D.
- *Mount Saint Helens* (DVD) by Steven Austin, Ph.D.

EXERCISES

Exercises can be given in multiple ways to check the student's knowledge of the information presented on the DVD. Two methods have been included in this lesson plan.

1. Essay format
2. Fill-in and multiple choice format

The following pages include both formats.

Dating Fossils and Rocks Exercise (essay format)

1. What are the three subatomic particles that make up an atom?
2. What is the difference between carbon-12, carbon-13, and carbon-14?
3. What subatomic feature distinguishes carbon from all other types of atoms?
4. What is meant by the half-life of an atom? What is the half-life of C-14?
5. How is C-14 produced in the atmosphere?
6. The C-14 dating method is based on an assumption called equilibrium. Explain what is meant by equilibrium in the C-14 dating method?
7. What does it mean if the assumption of equilibrium is true? What does it mean if the assumption is false?
8. What two items of information have to be known for the C-14 dating method to be reliable?

9. What other carbon isotope is used in the C-14 dating method and what is the difference between the two types of carbon?

10. What did Dr. Willard Libby, the founder of the C-14 dating method, discover about equilibrium? What did he do about it and why?

11. Based on current measurements in the atmosphere, what is known about the assumption (equilibrium) involved in the C-14 dating method? What does this mean?

12. Measurements indicate that it would take about 30,000 years to reach equilibrium. What does this indicate about the age of the earth?

13. What is meant by the terms “daughter element” and “parent element” in the radioactive decay process?

14. Give three assumptions used in radioactive decay dating.

15. Does radioactive decay dating prove the age of the earth is 4.6 billion years old? Explain your answer.

16. Give the daughter element for each of the following parent elements

PARENT

DAUGHTER

Uranium

Potassium

17. How does Helium in the atmosphere support a young earth?

18. Give three scientific evidences of a young earth.

19. Are there any scientists who believe in a young earth?

20. What is the RATE group and what kind of work are they doing?

Dating Fossils and Rocks Exercise (multiple choice/ fill-in format)

1. What are the three subatomic particles of an atom?

2. How many protons are in all forms of carbon?

3. How many neutrons do each of the isotopes of carbon have?

Carbon-12 _____

Carbon-13 _____

Carbon-14 _____

4. What is the half-life of carbon-14?

- a. 5.7 million years
- b. 10,000 years
- c. 5,730 years
- d. 3,700 years

5. How is carbon-14 produced in the atmosphere?

- a. Carbon-12 combines with oxygen to form carbon-14.
- b. Cosmic rays strike the upper atmosphere and convert some nitrogen-14 into carbon-14.
- c. Cosmic rays strike the upper atmosphere and change some of the carbon-12 into carbon-14.
- d. Carbon-12 radioactively decays into carbon-14.

6. Which of the following is an unstable isotope?

- a. Carbon-12
- b. Carbon-14

7. What is the element life-cycle of carbon-14?

- a. N-14 to C-14 to C-12
- b. N-14 to C-12 to C-14
- c. C-12 to C-14 to N-14
- d. N-14 to C-14 to N-14

8. What is (are) the assumption(s) in the carbon-14 dating method (circle all that apply)?
- The amount of C-14 being formed in the atmosphere and the amount being removed has always been the same.
 - The amount of carbon-14 in the atmosphere is in a state of equilibrium.
 - The ratio between C-12 and C-14 has always been the same.
 - That C-14 has always decayed into C-12.
9. What two items must be known to help insure the reliability of the carbon-14 dating method?
- The half-life of C-14 and the current amount of C-14 in the atmosphere.
 - The half-life of C-14 and the current ratio of C-12 to C-14 in the atmosphere.
 - The current amount of C-14 in the specimen and the amount of N-14 in the atmosphere.
 - The half-life of C-14 and the amount of C-14 in the specimen when it died.
10. What other type of carbon is used in the carbon-14 dating method?
- Carbon-9
 - Carbon-12
 - Carbon-15
 - Carbon-16
11. Based on current measurements in the atmosphere, what is known about the assumption of equilibrium involved in the C-14 dating method?
- It has been shown to be false.
 - It has been proven to be true.
12. Based on current knowledge of the assumption of equilibrium involved in the C-14 dating method, what can be concluded about the reliability of the method?
- It is not as reliable as reported in many textbooks.
 - It is reliable up to about 60,000 years as stated in many textbooks.
13. Measurements indicate that if the earth started with no C-14 in the atmosphere it would take about 30,000 years to reach equilibrium. What do these measurements and the current status of C-14 equilibrium in the atmosphere indicate about the age of the earth?
- The earth is 4.6 billion years old as reported in many textbooks.
 - The earth is only thousands of years old.
 - It has no bearing on the age of the earth.
 - The earth has to be 6,000 years old.

14. What is meant by the terms “parent element” and “daughter element” in the radioactive decay process?
- One element, the parent, is physically larger than the other.
 - One element, the parent, radioactively decays into a new element called the daughter element.
 - The parent element is made up of many components called daughter elements.
 - When the parent element radioactively decays it loses mass and becomes a physically smaller daughter element.
15. What element is the daughter element to potassium?
- Argon
 - Uranium
 - Lead
 - Helium
16. Which of the following are assumptions used in the radioisotope dating methods? (circle all that apply)
- The starting amount of the daughter element is known.
 - The decay rate has always been constant.
 - Uranium decays into lead.
 - The sample has always been in a closed environment.
17. When different radioisotope dating methods are taken on the same sample, do they always give a consistent age?
- Yes, the dates are close enough to guarantee a correct age.
 - No, sometimes the dates can be millions of years different.
18. In the process of uranium decaying into lead helium atoms are formed. Much of the helium is still found in the granite rocks and not in the atmosphere. What does this indicate?
- Since helium takes a long time to migrate out of rocks, there has not been enough time in the 4.6 billion year history of the earth for the helium to escape into the atmosphere.
 - Since the half-life of uranium is billions of years, we would expect to find most of the helium still in the rocks.
 - Since helium migrates out of rocks rapidly, the radioactive processes could not have been occurring for long ages (billions of years).
 - Since the half-life of uranium is 5,730 years we would expect to find most of the helium still in the rocks.
19. What is the RATE group?
- A group of people dedicated to building web sites promoting creation.
 - A group of scientists working on radioisotope dating and the age of the earth.
 - A group of scientists promoting evolution in schools.

- d. A group of scientists that accept creation but promote an old earth (billions of years).
20. Are there any scientists who believe in a young earth (thousands of years)?
- a. Yes
 - b. No
21. Which of the following scientific evidences support a young earth (not billions of years)? (circle all that apply)
- a. Helium in the earth's atmosphere
 - b. Rapid disintegration of comets
 - c. Recession of the moon
 - d. The origin of life
22. Has the earth been proven to be billions of years old?
- a. Yes
 - b. No
23. What are some reasons people believe in an old earth (billions of years)? (circle all that apply)
- a. Peer pressure
 - b. Most scientists believe in an old earth
 - c. They have never heard the scientific evidence for a young earth
 - d. They don't believe the age of the earth is an issue
24. Mount Saint Helens erupted in 1980. How old did some of the rocks date that were formed from this eruption?
- a. About 2-million years old
 - b. Over 2-billion years old
 - c. They have not been dated yet
 - d. They were carbon-14 dated to be only thousands of years old
25. Does the Bible teach a young earth or old earth?
- a. Young earth
 - b. Old earth

Answer Key (Essay format)

1. Protons, neutrons, and electrons
2. Carbon-12 and carbon-13 are stable isotopes of carbon and carbon-14 is unstable.
Carbon-12 contains 6 neutrons
Carbon-13 contains 7 neutrons
Carbon-14 contains 8 neutrons
3. All types of carbon contain 6 protons.
4. Half the remaining amount of an element will decay in a specific period of time. The half-life of C-14 is 5,730 years. What this means is that half the remaining C-14 in the atmosphere will decay every 5,730 years.
5. Cosmic rays from outer space bombard the earth's upper atmosphere and convert some nitrogen-14 into carbon-14.
6. The amount of C-14 being produced in the atmosphere is equal to the amount of C-14 being removed (mostly through radioactive decay). This means the amount of C-14 in the atmosphere would be stable, it does not change.
7. If the assumption is true, then carbon-14 dating is a reliable dating method up to about 60,000 years. If the assumption is false, then the dating method is not reliable beyond a few thousand years.
8. (1) The rate of decay or half-life (this is known: 5,730 years)
(2) The amount of carbon-14 in the specimen when it died
9. Carbon-12 is also used in the dating method. Carbon-12 is a stable isotope and carbon-14 is unstable.
10. Dr. Libby discovered that carbon-14 was being added to the atmosphere over 20 percent faster than it was being removed. This meant that it was not in equilibrium. Dr. Libby attributed this to an error in his calculations because he assumed we must be in equilibrium. He assumed we were in equilibrium because of his belief in evolution meaning the earth must be billions of years old. If the earth is billions of years old, the elapsed time would mean we have to be in equilibrium. Calculations suggest that it would take about 30,000 years to reach equilibrium.
11. Current calculations show that we are over 25 percent out of equilibrium. Carbon-14 is being added to the atmosphere over 25 percent faster than it is being removed. This means that the assumption the carbon-14 dating method is based upon has been shown to be false. This further means that the

carbon-14 dating method is not reliable beyond a few thousand years (3,000 – 4,000 years). It also means the information in many textbooks about carbon-14 being a reliable dating method for up to 60,000 years is wrong.

12. Since we are over 25 percent out of equilibrium, this suggests that the earth is not as old as stated in many journals and textbooks. It suggests a young earth (less than 30,000 years).
13. The parent element is the starting element such as uranium or potassium. The daughter element is the last or final element in the decay process such as lead or argon.
14. (1) The starting amount of the daughter element can be known
(2) All the daughter element in a sample is due to radioactive decay
(3) The sample has always been in a closed environment
(4) The decay rate has always been constant
15. No. First, since there are unprovable assumptions in the dating process it cannot be established as a fact. Second, the dating methods are not consistent. The same sample can be dated by different methods and give very different ages. Also, the same sample can be dated by the same method multiple times and give different ages. Third, there are many scientific evidences that indicate a young age for the earth.
16.

<u>Parent</u>	<u>Daughter</u>
Uranium	Lead
Potassium	Argon
17. If the earth is 4.6 billion years old there should be much more helium in the atmosphere due to radioactive decay. However, there is only enough helium in the atmosphere for an age of less than 2-million years. This is far too young for the evolution model. It does not suggest an age of 2-million years, but rather sets an upper limit for the age of the earth.
18. Helium in the earth's atmosphere
Nuclear decay rates
Sodium in the oceans
Rapid disintegration of comets
Erosion of continents
Sediments in the oceans
Decay of the earth's magnetic field
Carbon-14 ratio in the atmosphere
Radiohalos for polonium in granite rocks
Population statistics
Recession of the moon

19. There are many scientists who believe in a young earth. To see a partial list go to www.icr.org or www.answersingenesis.org.
20. The RATE group is a group of scientists from ICR who are working on radioisotope dating and the age of the earth.

Answer Key (Fill-in format)

1. Protons, neutrons, and electrons
2. 6 protons
3. Carbon-12 6 neutrons
Carbon-13 7 neutrons
Carbon-14 8 neutrons
4. c (5,730 years)
5. b
6. b (carbon-14)
7. d
8. a, b, c
9. d
10. b (carbon-12)
11. a
12. a
13. b
14. b
15. a
16. a, b, d
17. b
18. c
19. b
20. a
21. a, b, c

22. b

23. a, b, c, d

24. a

25. a