WHAT IS SCIENCE?

#3537

OPEN-CAPTIONED
CLEARVUE/eav
1996
Grade Levels: 8-12
25 minutes
3 Instructional Graphics Enclosed

DESCRIPTION

Obtaining knowledge is at the core of science. Introduces many branches of science and explains the importance of observing, organizing, analyzing, and classifying data in order to prove or disprove theories. Mentions famous scientists and their contributions. Touches on chemistry, biology, astronomy, social science, and mathematics. Reminds the viewer how important science is to everyday life.

ACADEMIC STANDARDS

Subject Area: Science

- Standard: Understands the nature of scientific knowledge
  - Benchmark: Knows that scientific explanations: must meet certain criteria to be considered valid (e.g., they must be consistent with experimental and observational evidence about nature, make accurate predictions about systems being studied, be logical, respect the rules of evidence, be open to criticism, report methods and procedures, make a commitment to making knowledge public) (See Instructional Goal #4)
  - Benchmark: Understands how scientific knowledge changes and accumulates over time (e.g., all scientific knowledge is subject to change as new evidence becomes available; some scientific ideas are incomplete and opportunity exits in these areas for new advances; theories are continually tested, revised, and occasionally discarded) (See Instructional Goal #5)
- Standard: Understands the nature of scientific inquiry
  - Benchmark: Understands the nature of scientific explanations (e.g. emphasis on evidence; use of logically consistent arguments; use of scientific principles, models, and theories; acceptance or displacement based on new scientific evidence) (See Instructional Goal #1)

INSTRUCTIONAL GOALS

1. To explain the process of scientific inquiry and investigation.
2. To name key scientists instrumental in the advancement of scientific knowledge.
3. To discuss the differences between the major branches of science.
4. To describe how experimentation is fundamental to scientific inquiry.
5. To explain how the knowledge gained by science can create better ways of maintaining and improving life on earth.

VOCABULARY

1. astronomy
2. beadle
3. Becquerel
4. behavioral psychologist
5. biochemist
6. dependent variable

7. experimentation
8. gallium
9. germanium
10. hypothesis
11. independent variable
12. isotope
13. natural selection
14. regression analysis
15. seismologist
16. species
17. statistics
18. stimulus
19. theory

BEFORE SHOWING

1. Review the steps in the scientific method.
2. Using an overhead or other projection system, list various branches of science and discuss the work the scientists in those fields do.
   a. Point out the similarities and differences in their work.
   b. Discuss the contributions they make to society.
3. Complete a multiple-choice worksheet as a pretest. (See INSTRUCTIONAL GRAPHICS.)

DURING SHOWING

Discussion Items and Questions

1. View the video more than once, with one showing uninterrupted.
2. Pause at the picture of the following scientists and point out the contributions each made:
   a. Dmitri Mendeleev
   b. Charles Darwin
   c. Gregor Mendel
   d. Beadle
   e. Watson and Crick
   f. Albert Einstein
   g. John Dalton
   h. J. J. Thomson
   i. Antoine Becquerel
   j. Marie and Pierre Curie
   k. Ernest Rutherford
   l. Sir Isaac Newton
   m. Ivan Pavlov
   n. B .F. Skinner
3. Pause at the section explaining independent and dependent variables and list examples. Stress the importance of holding all other variables constant.
4. Pause at the section showing the actual and apparent location of the stars.
   a. Explain Einstein's theory of light rays bending in the presence of a strong gravitational field.
   b. Discuss how the eclipse of the sun helps verify this theory.

5. Pause at the end of the interview with each of the four scientists and discuss their areas of work.

AFTER SHOWING

Discussion Items and Questions

1. Discuss which scientists would not spend much time inside a laboratory conducting experiments.
2. What does the word *science* mean in Latin?
3. Discuss how knowledge gained by scientific investigation has helped humankind.
4. Why did Mendeleev leave blank squares in his original periodic table?
5. What is *natural selection*?
6. What is a *hypothesis* and how is it tested?
7. How did Mendel's work help support Darwin's theories?
8. Why is it usually easier to define and control variables in sciences like chemistry and physics than in psychology and astronomy?
9. On what do physicists concentrate their studies?
10. What are atoms with different atomic weights called?
11. Why did scientists find it so important in the early 1950s to find the structure of the DNA molecule?
12. Discuss the importance of math in the field of science.
13. What is *classical conditioning* and how is it helpful in the field of behavioral psychology?
14. What is a "Skinner box" and for what is it used?
15. Discuss how DNA is used to help solve criminal cases.

Applications and Activities

1. Using a computer-generated slide show, report on the scientists mentioned in the video.
2. Research science or math textbooks for math formulas commonly used in the study of science.
3. Visit a police or forensic laboratory. Investigate the methods used to collect and analyze blood, hair samples, and saliva found at crime scenes.
4. Complete a worksheet on four scientists' experimental methods. (See INSTRUCTIONAL GRAPHICS.) Work in pairs and report to compare the information assembled.
5. Complete a crossword puzzle containing key words from the video. (See INSTRUCTIONAL GRAPHICS.)

INSTRUCTIONAL GRAPHICS

- MULTIPLE CHOICE
- METHODS OF EXPERIMENTATION
- CROSSWORD PUZZLE ABOUT SCIENCE

RELATED RESOURCES

Captioned Media Program

- Albert Einstein #2249
- Evolution #3357
- Patterns of Inheritance: Understanding Genetics #3389
- Scientific Method #2521
- Periodic Table, The #3281

- What is Biology? #3533
- What is Chemistry? #3534
- What is Earth Science? #3535

World Wide Web

The following Web sites complement the contents of this guide; they were selected by professionals who have experience in teaching deaf and hard of hearing students. Every effort was made to select accurate, educationally relevant, and "kid-safe" sites. However, teachers should preview them before use. The U.S. Department of Education, the National Association of the Deaf, and the Captioned Media Program do not endorse the sites and are not responsible for their content.

- AN EXPERIMENTAL SCIENCE PROJECT: AN INTERMEDIATE LEVEL GUIDE
  http://www.isd77.k12.mn.us/resources/cf/SciProjInter.html

  Presents basic information for doing a science project. Includes details about the experimental science method and the steps involved.

- MENDELWEB http://www.netspace.org/MendelWeb/

  Serves as an educational resource for those interested in the history of genetics, data analysis, and plant science. Includes transcripts of Mendel's original papers, glossary of terms, notes on the Mendel text, discussion questions, and homework sets.

- THE ALBERT EINSTEIN PAGE http://www.geocities.com/CapeCanaveral/Lab/3555/
  Includes a biography of Einstein and a discussion of his major contributions to science.

- SCIENCE ODYSSEY http://www.pbs.org/wgbh/aso/

  Features selections such as "That's My Theory" (interview with Albert Einstein), "People and Discovery" (databank of biographies of scientists), "DNA Workshop," "Atom Builder," and "Human Evolution."

- HISTORY OF SCIENCE http://www.wcsu.ctstateu.edu/library/s_history_of_science.html

  Contains links to an alchemy virtual library, beginner's guide to research of the history of science, Galieo project, and science inventions.

Multiple Choice Worksheet

Directions: Circle the best answer.

1. What do all scientists have in common?
   a. They conduct experiments in a science laboratory.
   b. They ask testable questions.
   c. They are all inventors.
   d. They pour chemicals into test tubes.

2. What is the science of studying the stars called?
   a. Biology
   b. Chemistry
   c. Astronomy
   d. Meterology

3. What is Dmitri Mendeleev noted for?
   a. Found the structure of DNA.
   b. Developed the theory of evolution.
   c. Developed the periodic table.
   d. Proposed the existence of genes.

4. What contribution did John Dalton make to science?
   a. Found the structure of DNA.
   b. Proposed that atoms were indestructible solid spheres.
   c. Discovered radioactive particles.
   d. Proposed the existence of genes.

5. What did Gregor Mendel accomplish?
   a. Found the structure of DNA.
   b. Conducted experiments with atoms.
   c. Discovered radioactive particles.
   d. Proposed the existence of genes.

6. What contribution did James Watson and Francis Crick make to science?
   a. Found the structure of DNA.
   b. Conducted experiments with atoms.
   c. Discovered radioactive particles.
   d. Proposed the existence of genes.

7. Who was the scientist who learned about classical conditioning by experimenting With dogs and their salivating?
   a. B. F. Skinner
   b. Ivan Pavlov
   c. Albert Einstein
   d. J. J. Thomson

8. For what is Ernest Rutherford famous?
   a. Found the structure of DNA.
   b. Discovered radioactive particles.
   c. Theorized that atoms contain a small, dense, positively charged nucleus.
   d. Developed calculus.

9. What contribution did Isaac Newton make to science?
   a. Found the structure of DNA.
   b. Discovered radioactive particles.
   c. Theorized that atoms consists of a small, dense, positively charged nucleus.
   d. Developed calculus.

10. What do scientists call a likely explanation of how something works?
    a. Experimentation
    b. Hypothesis
    c. Evidence
    d. Element

11. What is the smallest part of matter called?
    a. Molecule
    b. Element
    c. Atom
    d. Isotope

Methods of Experimentation

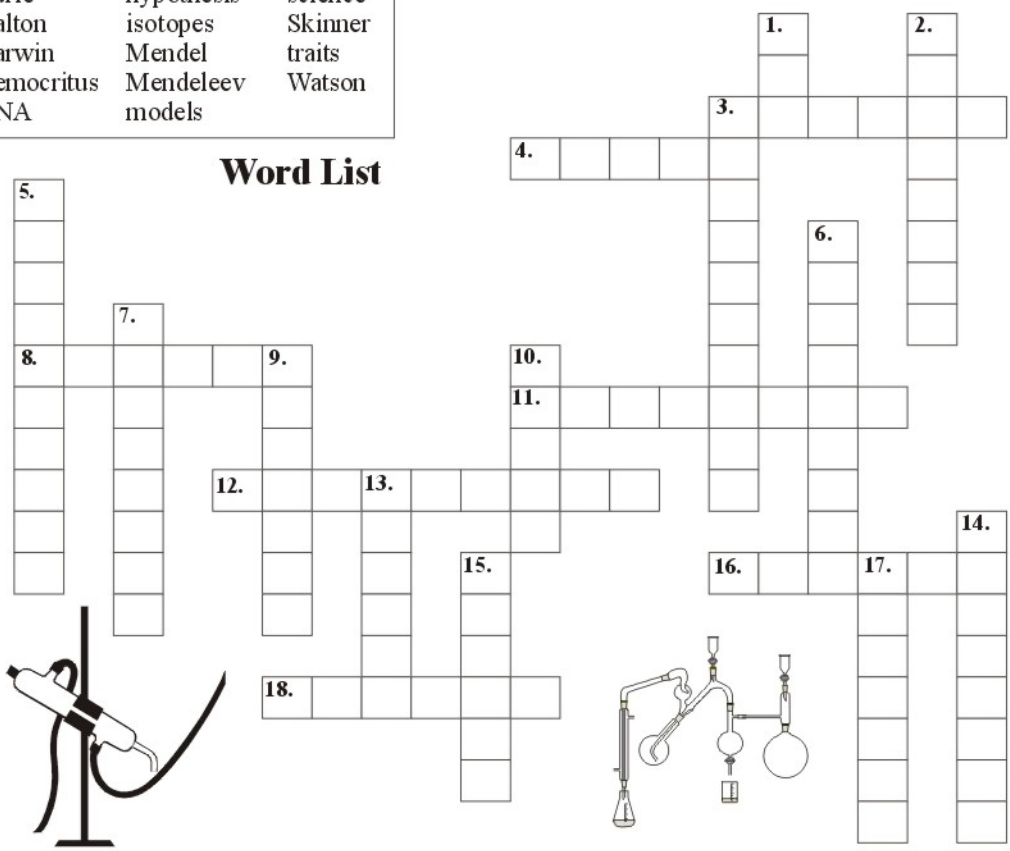
Directions: Below are the titles of four scientists. From what you learned in the video, write ways in which they use the methods of experimentation in order to do their jobs.

	Makes observations	Forms a testable hypothesis	Conducts experiments	Organizes and evaluates data	Uses tools	Draws a conclusion
Behavioral Psychologist 						
Biochemist 						
Wildlife Biologist 						
Seismologist 						

Crossword Puzzle About Science

analysis	Einstein	Pavlov
calculus	genes	physicist
Curie	hypothesis	science
Dalton	isotopes	Skinner
Darwin	Mendel	traits
Democritus	Mendeleev	Watson
DNA	models	

Word List



ACROSS

3. English chemist who proposed that atoms are indestructible solid spheres.

4. Pierre and Marie _____ discovered two highly radioactive elements.

8. Taxonomists classify organisms by their _____.

11. He predicted that light would bend in the presence of a strong gravitational field.

12. Russian scientist best known for developing the periodic table.

16. _____ and Crick proposed the double helix model of DNA.

18. Czech monk who proposed the existence of cellular structures called "genes."

DOWN

1. The coded heredity "fingerprint" found in almost every organism.

2. Atoms with different atomic weights.

3. Greek philosopher who theorized that matter is made up of very small particles called "atoms."

5. A likely explanation of how something works based on gathered information.

6. A scientist who studies atoms and subatomic particles.

7. Isaac Newton developed this branch of mathematics.

9. The Latin root of this word means "knowledge."

10. Structures that carry traits from one generation to the next.

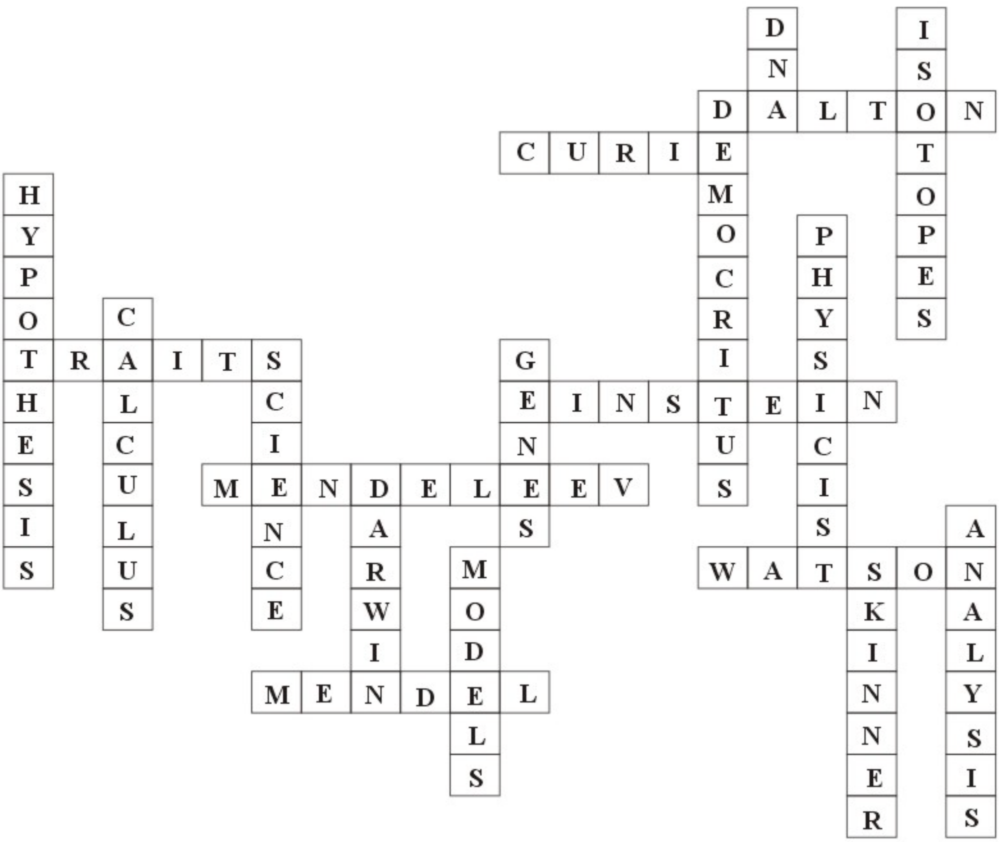
13. He theorized that all species evolve over time by means of natural selection.

14. One statistical technique is called "Regression _____."

15. Scientists have developed _____ of the atom to better understand its structure.

17. He developed an apparatus that conditioned animals to perform behaviors such as pecking buttons to receive a reward.

#3537 WHAT IS SCIENCE? ANSWER SHEET



CAPTIONED MEDIA PROGRAM

PLEASE RETURN LESSON GUIDE WITH VIDEO

Lesson guide also available online at *www.cfv.org*

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