

CRT Science Review #11

Nature of Science: Inquiry



Standard: Inquiry - Scientific Inquiry is the process by which humans systematically examine the natural world. Scientific inquiry is a human endeavor and involves observation, reasoning, insight, energy, skill, and creativity. Scientific inquiry is used to formulate and test explanations of nature through observation, experiments and theoretical or mathematical models. Scientific explanations and evidence are constantly reviewed and examined by others. Questioning, response to criticism and open communication are integral to the process of science.

Indicators & Item Specifications:

N.8.A.1 Students know how to identify and critically evaluate information in data, tables, and graphs. E/S

- Make inferences using information from data tables, charts, and graphs.
- Identify meaningful data from an experiment and then organize the information into appropriate graphs, tables, or charts.
- Given a data set (table, graph or chart) make prediction based on information presented.
- Recognize the differences between precision, accuracy, and estimation.

N.8.A.2 Students know how to critically evaluate information to distinguish between fact and opinion. E/S

- Make factual statements given an event, lab experiment, or observation, and then use those facts to make inferences and form conclusions.

N.8.A.3 Students know different explanations can be given for the same evidence. E/S

- Given an example, recognize that results can be explained in more than one way

N.8.A.4 Students know how to design and conduct a controlled experiment. E/S

- Given a specific question, design a way to test the question using appropriate variables and controls, defend the use of the experimental design, and describe weaknesses or flaws in the test, experiment, or research design.
- Given an example identify which variable(s) should be controlled in the experimental design.
- Explain how inquiry drives the procedures of science.
- Use appropriate vocabulary when designing and conducting a controlled experiment (e.g., qualitative and quantitative, observations, inference, benefit, consequence, inferring, predicting, data, problem, hypothesis, conclusion, controls, and variable).
- Understand how to report data and share findings.

N.8.A.5 Students know how to use appropriate technology and laboratory procedures safely for observing, measuring, recording, and analyzing data. E/S

- Know established scientific procedures for lab activities and research (e.g., equipment gets used appropriately after instruction, accurately represent data, know and follow safety rules, and use data to provide evidence for a conclusion).
- Given an example identify correct practices for safely conducting an experiment.
- Use laboratory technology/equipment appropriately.
- Use appropriate SI units.

N.8.A.6 Students know scientific inquiry includes evaluating results of scientific investigations, experiments, observations, theoretical and mathematical models, and explanations proposed by other scientists. E/S

- Know and practice scientific inquiry.
- Use reliable data collection, accurate graphing, experimental design and experimental controls.
- Given multiple experiments addressing the same problem, compare, contrast, and analyze the meaning of all the results.

N.8.A.7 Students know there are multiple methods for organizing items and information. E/S

- Know how to use multiple methods such as data tables; choosing appropriate graphs to represent data and; using technology to organize information.

Sample Multiple Choice CRT-Style Questions Related to Inquiry

1. The following data table shows the number of deaths caused by influenza and pneumonia from 1917-1918, during the time of the 1918 influenza pandemic.

U.S. Deaths per 100,000 Attributed to Influenza and Pneumonia, 1917-1918

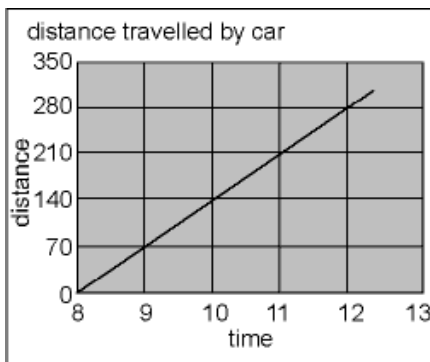
Age	1917	1918
<1	2,944.5	4,540.9
1-4	422.7	1,436.2
5-14	47.9	352.7
15-24	78	1,175.7
25-34	117.7	1,998.0
35-44	193.2	1,097.6
45-54	292.3	686.8

Adapted from *Age-specific death rates (per 100,000), Influenza & Pneumonia, USA (Noymer, 2007)*

According to the data table, which age group shows the **greatest increase** in death rates caused by influenza and pneumonia from 1917 to 1918?

- A. <1
 - B. 1-4
 - C. 25-34
 - D. 45-54
2. The graph shows a car traveling at a steady speed.

Distance (miles) traveled over time (hours)



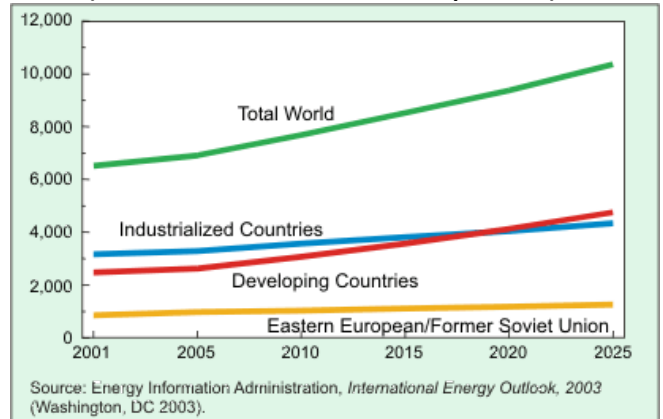
(From <http://www.studyzone.org/testprep/math4/k/trendsp.cfm>)

After how many hours will the car be at a distance of 420 miles?

- A. 13 hours
- B. 14 hours
- C. 15 hours
- D. 16 hours

3. Use the graph to make a prediction.

World Carbon Dioxide Emissions by Region (Million Metric Tons of Carbon Equivalent)



Source: Energy Information Administration, *International Energy Outlook, 2003* (Washington, DC 2003).

(From <http://www.eia.doe.gov/oiaf/1605/ggcebro/chapter1.html>)

Which of the following is an accurate prediction of the amount of carbon dioxide emitted by the total world in 2030?

- A. 4,000 - 6,000 Metric Tons
 - B. 6,000 - 8,000 Metric Tons
 - C. 8,000 - 10,000 Metric Tons
 - D. 10,000 - 12,000 Metric Tons
4. The following data table shows the percentage of elements found in the human body.

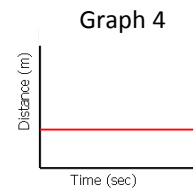
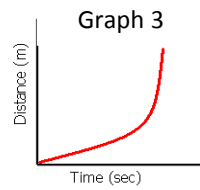
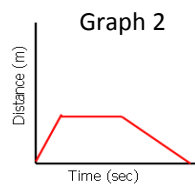
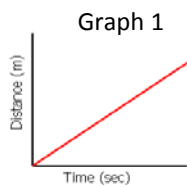
Elements of the Human Body

Element	Percentage
Oxygen	65%
Carbon	18%
Hydrogen	10%
Nitrogen	3%
Calcium	1.5%
Phosphorus	1%
Trace Elements	1%

What type of graph would **best** represent this data?

- A. Pie chart
- B. Line graph
- C. Bar graph
- D. Histogram

5. Use graphs #1-4 to answer the question below.



(From http://www.scienceclass.net/NOS/data_graphs.htm)

What distance/time graph best shows a person who starts walking and then begins to jog?

- A. Graph 1
 B. Graph 2
 C. Graph 3
 D. Graph 4
6. Use diagrams #1-4 to answer the question below.

Diagram 1

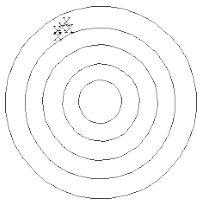


Diagram 2

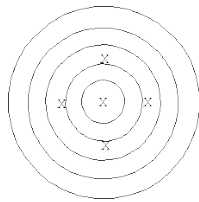


Diagram 3

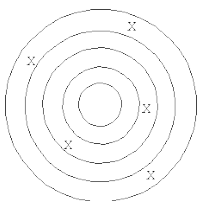
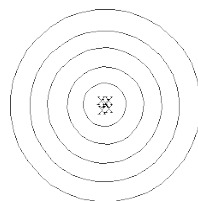


Diagram 4



Which of the diagrams represents a target hit by someone who is very precise, but not accurate?

- A. Diagram 1
 B. Diagram 2
 C. Diagram 3
 D. Diagram 4
7. Which term describes a statement referring to a particular person's feeling, thought, judgment, belief, or estimation?
- A. Fact
 B. Opinion
 C. Observation
 D. Inference

8. Students were asked to measure a string. The actual length of the string was 8.25 cm long. Which of the following shows the measurements from the **most** accurate group and why?
- A. 7.25cm, 7.75cm, 8.25cm, because these were the closest to the actual length.
 B. 7.2cm, 7.25cm, 7.3cm, because these had the most agreement between lengths.
 C. 8.25cm, 8.75cm, 9.25cm, because these had the most agreement between lengths.
 D. 8.2cm, 8.25cm, 8.9cm, because these were the closest to the actual length.

9. Hypothesis and models are constructed to give the best explanation of a set of data. Models and hypothesis based on experimentation and research are
- A. generally accepted by all scientists who are experts.
 B. modified if necessary as new data and observations are collected.
 C. not modified once completed if based on careful experimentation.
 D. generally only accepted if scientists agree with collected data.

10. What two pieces of equipment would you likely need to use in order to calculate the density of a small rock?
- A. Graduated cylinder and ruler
 B. Graduated cylinder and triple beam balance
 C. Ruler and scale
 D. Ruler and triple beam balance

11. When investigating a new cancer-fighting drug, medical researchers give some of the subjects a pill that contains the drug. Some of the other subjects are given a pill that does not contain the drug. The drug-free pill serves what purpose in the design of the investigation?
- A. A control
 B. A variable
 C. A separate trial
 D. A qualitative comparison

12. What is the SI unit of measure for the mass of an object?
- A. Meter
 B. Ounce
 C. Pound
 D. Kilogram

CRT Science Review #11 Key Nature of Science: Inquiry



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Answer Key

1. C, DOK Level 2
2. B, DOK Level 2
3. D, DOK Level 1
4. A, DOK Level 1
5. C, DOK Level 2
6. A, DOK Level 1
7. B, DOK Level 1
8. D, DOK Level 2
9. B, DOK Level 1
10. B, DOK Level 1
11. A, DOK Level 1
12. D, DOK Level 1

CRT Science Review #12

Nature of Science: Science, Technology, and Society



Standard: Science, Technology, and Society - Technology defines a society or era. It can shape the environment in which people live, and it has increasingly become a larger part of people's lives. While many of technology's effects on society are regarded as desirable, other effects are seen as less desirable. These concepts are shared across subject areas such as science, math, technology, social studies, and language arts. The development and use of technology affects society and the environment in which we live, and at the same time, society influences the development of technology and its impact on culture.

Indicators & Item Specifications:

N.8.B.1 Students understand that consequences of technologies can cause resource depletion and environmental degradation, but technology can also increase resource availability, mitigate environmental degradation, and make new resources economical. E/S

- Identify examples and explain costs and benefits of a given technological advance.
- Recognize and identify examples of the effect of technologies on use of resources.
- Describe the development of major technological advances and explain the changing balance of cost and benefits.
- Explain when and why society utilizes technology even though it can have a negative impact.

N.8.B.2 Students know scientific knowledge is revised through a process of incorporating new evidence gained through on-going investigation and collaborative discussion. E/S

- Describe that scientific knowledge is constantly changing as scientists continue to investigate and share new information.

Sample Multiple Choice CRT-Style Questions Related to Science, Technology, and Society

1. Which statement **best** describes the process of science?
 - A. Scientists are objective and free of prejudice.
 - B. Generally, scientists work independently and discover new ideas without the help of others.
 - C. Scientific ideas evolve or change over time.
 - D. New ideas in science result from planned and well-designed experiments.
2. Which of the following **best** describes an advantage of using a mass production manufacturing system instead of a custom manufacturing system?
 - A. Products can be made faster and at a lower cost.
 - B. Workers in the factories gain valuable skills.
 - C. Individualized products can easily be modified for customers.
 - D. Customers can provide specific feedback to workers.
3. The ecological resource consumption practices of the average citizen of the United States is
 - A. less than all other parts of the world.
 - B. balanced by recycling plastic items.
 - C. greater than most countries in the world.
 - D. contributing to sustainable living practices.
4. Science, technology, and society affect each other in both positive and negative ways. One example was the discovery of antibiotics. Which of the following **best** describes the negative affect that antibiotics have had on society?
 - A. The extensive use of antibiotics has led to the evolution of resistant strains of bacteria.
 - B. The extensive use of antibiotics has caused several forms of new cancers to develop.
 - C. The use of antibiotics in consumer products has led to increased obesity in humans.
 - D. The increased use of antibiotics caused an over-abundance of medical professionals.

5. Which of the following is a cost associated with the advances of modern health practices?
- Improved hygiene and water treatment practices.
 - Development of vaccines to prevent disease.
 - Decrease of infant and childhood death rates.
 - Increase in the growth of the human population.

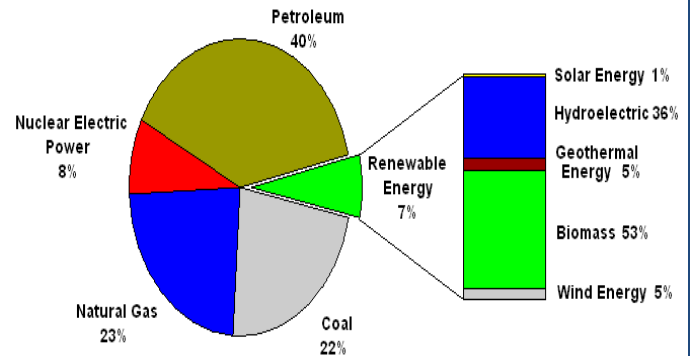
6. What is the **primary** reason why there has been so much effort put towards creating clean energy?
- The government wanted to create more jobs in this country.
 - To reduce America's dependence on fossil fuels imported from foreign countries.
 - Nuclear energy seemed like a safer alternative to petroleum energy.
 - People wanted to build more wind turbines in California and Nevada.

7. Which of the following is a **negative** impact caused by mining for resources? The mining industry
- contributes to the economy and provides employment.
 - practices reclamation procedures when a mine closes.
 - uses leaching techniques that cause heavy metals to enter the water supply.
 - provides the raw materials needed to make the items used daily by society.

8. Accurate estimates of the age of Earth were not possible until which of the following discoveries was made?
- Earth's molten core cools at predictable and measurable rates.
 - Radioactive decay occurs in certain elements at a constant rate.
 - The oldest fossils are found in layers at the bottom of rock strata.
 - The shrinking diameter of the Sun can be used to infer the age of planets.

9. Use the graph below to answer the following question.

The Role of Renewable Energy Consumption in the Nation's Energy Supply, 2007



(Source: <http://www.eia.doe.gov/fuelrenewable.html>)

In the United States, 93% of the energy supply comes from nonrenewable resources. As the supply of nonrenewable resources decreases and the demand for energy increases, how will the graph **most likely** change as technology to use renewable resources advances?

- The graph will remain the same due to high energy demand.
 - The consumption of renewable energy sources will increase.
 - The consumption of nonrenewable energy sources will increase.
 - The graph will include a new energy source not discovered yet.
10. A mining company developed a machine that removes more dirt per day than previous methods. What is a **negative** consequence of the company using this technology?
- The machine may require maintenance.
 - The environment will be impacted by removing native grasses from the topsoil.
 - The machine will work faster and longer than human labor to remove soil.
 - The mining company will save money over time by using the new machine.

CRT Science Review #12 Key

Nature of Science: Science, Technology, and Society



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Answer Key:

1. C, DOK Level 1
2. A, DOK Level 1
3. C, DOK Level 1
4. A, DOK Level 2
5. D, DOK Level 2
6. B, DOK Level 1
7. C, DOK Level 2
8. B, DOK Level 2
9. B, DOK Level 2
10. B, DOK Level 2