What Is Physical Science?
Guided Reading and Study

Use Target Reading Skills This is one possible way to complete the graphic organizer. Accept all logical answers.

What You Know:
Physical science includes the study of motion. Chemists are physical scientists.

What You Learned:
Physical science is the study of matter, energy, and the changes that matter and energy undergo.
The two main branches of physical science are chemistry and physics.
1. Observing, inferring, and predicting
2. Using one or more of your senses to gather information
3. Quantitative observations deal with numbers or measurements. Qualitative observations deal with descriptions that cannot be expressed in numbers.
4. Explaining or interpreting your observations based on reasoning from what you already know
5. a, c, d
6. predicting
7. Inferences are attempts to explain what is happening or has happened, while predictions are forecasts of what will happen.
8. Matter is anything that has mass and occupies space.
9. Energy is the ability to do work or cause change.
10. chemistry, physics

What Is Physical Science?
Review and Reinforce

1. Observing, inferring, and predicting
2. Reasoning from what you already know
3. Physical scientists study matter, energy, and the changes they undergo.
4. g
5. h
6. e
7. d
8. b
9. a
10. c
11. f

What Is Physical Science?
Enrich

1. Fuel cells onboard the space shuttle use a chemical reaction to produce electricity.
2. The mixture of these two elements causes a chemical reaction that produces water and energy.
3. The various branches of engineering are interrelated, and nearly all of them have important connections to the others. For example, electrical engineers working for NASA must work closely with aerospace engineers who design spacecraft.

Scientific Inquiry
Guided Reading and Study

Use Target Reading Skills Accept all logical answers. Sample answers:
scientific inquiry A process that includes the various ways that scientists find out about the natural world and try to explain what they have observed
hypothesis One possible answer to a scientific question
variable Something that can change in an experiment
manipulated variable A variable that is changed on purpose during an experiment to test a hypothesis
responding variable The variable that changes in response to changes in the manipulated variable
controlled experiment An experiment in which only one variable is manipulated
data Facts, figures, and other evidence that scientists collect through observing
communicating The ways in which scientists share ideas and experimental results with other scientists
scientific law A rule of nature that describes what scientists expect will happen every time when conditions are the same
scientific theory A single explanation that connects a large set of related observations or results from experiments
1. Scientific inquiry refers to the diverse ways in which scientists study the natural world and propose explanations based on the evidence they gather.
2. true
3. a, b
4. hypothesis
5. false
6. A hypothesis for which researchers can carry out investigations and gather evidence that will either support or disprove the hypothesis
7. experiment
8. c
9. a
10. d
11. b
12. true
13. data
14. A data table provides you with an organized way to collect and record your observations.
15. SI, or the International System of Units
16. a, b, d
17. conclusion
18. Whether or not the data support your hypothesis
19. questions
20. hypothesis
21. conclusions
22. true
23. The sharing of ideas and experimental findings with others through writing and speaking
24. A picture, diagram, computer image, or other representation of an object or process
25. A statement that describes what scientists expect to happen every time under a particular set of conditions
26. scientific law
27. A well-tested explanation for a wide range of observations or experimental results
28. true
29. Unlike a scientific theory, a scientific law describes an observed pattern in nature without attempting to explain it.

**Scientific Inquiry**

**Review and Reinforce**

1. Scientific inquiry often involves the following processes: posing questions, developing hypotheses, designing experiments, collecting and interpreting data, drawing conclusions, and communicating ideas and results.
2. A hypothesis is testable if it can be supported or disproved by observation or experiment.
3. If you didn’t control variables, there would be no way to tell which variable was responsible for your results.
4. A data table provides an organized way to collect and record observations.
5. By using scientific models and developing scientific laws and theories based on observations
6. hypothesis
7. variables
8. communicating

**Scientific Inquiry**

**Enrich**

1. Uranium salt gives off X-rays when exposed to sunlight.
2. Becquerel saw an image when he developed film wrapped in lightproof paper that had been under uranium exposed to the sun.
3. The same image was produced when the setup was left in a drawer and not exposed to sunlight.
4. He discovered that uranium produces a type of radiation.
5. Becquerel began with a question about whether fluorescent substances gave off X-rays. He developed a hypothesis and tested that hypothesis with an experiment. The results of that experiment caused him to develop an alternative hypothesis and another experiment, from which he was able to draw a conclusion.

**Science Laboratory Safety**

**Guided Reading and Study**

Use Target Reading Skills

Below is one possible way to complete the graphic organizer. Accept all logical answers.

Q. Why are safety goggles necessary in the lab?
   A. Safety goggles protect your eyes from a variety of potential hazards, including broken glass, chemical splashes, and sharp objects.

Q. Why should you wear plastic gloves and an apron when handling chemicals?
   A. To protect your skin and clothes from the chemicals

1. false
2. d
3. Appendix A
4. Ask your teacher.
5. Always follow your teacher’s instructions and the textbook directions exactly.
6. true
7. a, b, d
8. d
9. e
10. b
11. a
12. c
13. clean up
14. Follow your teacher’s instructions about proper disposal.
15. true
17. c

**Science Laboratory Safety**

**Review and Reinforce**

1. Thinking about the lab ahead of time allows you to anticipate any problems that may arise.
2. Always follow your teacher’s instructions and the textbook directions exactly.
3. The symbols alert you to possible dangers in performing the lab and remind you to work carefully.
4. Clean up your work area. Turn off and unplug any equipment and return it to the proper place. Follow your teacher’s instructions about proper disposal of wastes. Be sure to wash your hands thoroughly.
5. Notify your teacher immediately. Then, listen to your teacher’s directions and carry them out quickly.

**Science Laboratory Safety**

**Enrich**

1. He should have worn goggles.
2. He should not have inhaled fumes directly. He should never taste or touch a chemical.
3. He should have followed the instructions in the textbook exactly.
4. She should have told the teacher, and she should have flushed her skin with large amounts of water. She also should have put the top back on the bottle.
5. They should have disposed of wastes properly, and they should not have put a leaking test tube in a cupboard. They should also have washed their hands.
6. She should have told her teacher. She should also have covered the cut with a clean dressing and applied direct pressure to the wound to stop the bleeding.

**Swing Time**

**Skills Lab**

For answers, see the Teacher’s Edition.

**What Is Technology?**

**Guided Reading and Study**

**Use Target Reading Skills**

Identify the need.
Research the problem.
Design a solution.
Build a prototype.
Troubleshoot and redesign.
Communicate the solution.

1. Technology is a way of changing the natural world to meet human needs or solve problems.
2. Science studies the natural world to understand how it functions, while technology modifies the natural world to meet human needs or solve problems.
3. engineer
4. a, b, d
5. a, b, c
6. Identifying the need, that is, clearly defining the problem that you are trying to solve
7. true
8. b
9. c
10. a
11. sketches, models
12. A working model used to test a design
13. true
14. To address any problems with the design
15. troubleshooting
16. They are made of parts that work together.
17. a, c, d
18. output
19. false
20. Inputs include turning on the gas, setting the temperature, and inserting food to cook. Outputs include the release of heat, temperature reaching the set level, and cooked food.
21. false
22. People used stones to make tools such as spears, axes, and spades. These tools enabled people to hunt and to grow crops, which in turn allowed them to settle in one place.
23. false
24. true
25. Its potential risks and benefits
What Is Technology?

Review and Reinforce

1. Identifying a need, researching the problem, designing a solution, building a prototype, troubleshooting and redesigning, communicating the solution
2. Goals, inputs, processes, outputs, and, in some cases, feedback
3. Sample answer: Stone tools made in the Stone Age allowed people to stay in one place and settle in farming communities.
4. d
5. e
6. g
7. h
8. f
9. b
10. c
11. a

What Is Technology?

Enrich

1. Power subsystem, steering subsystem, and brake subsystem
2. The goal of the power subsystem is to move the bicycle forward. The input is the force of your legs pumping the pedals. The process is the turning of the gears and the wheels. The output is the forward movement of the bicycle.
3. The goal of the steering subsystem is to steer the bicycle to the right or left. The input is the force of your arms turning the handlebars. The process is the turning of the front wheel. The output is the forward movement of the bicycle to the right or the left.
4. The goal of the brake subsystem is to slow down or stop the bicycle. The input is the force of your arms gripping the brake mechanism on the handlebars. The process is the squeezing of the brake pads against the wheel rims. The output is the slowing down of the wheels.
5. Sample answer: The power subsystem, steering subsystem, and brake subsystem
Connecting Concepts
This concept map is one way to represent the main ideas and relationships in this chapter. Accept other logical answers from students.

**Physical Science**
- **is related to**: Technology
devolved by process known as Technology design process
includes stages
Identifying a need
Researching the problem
Designing a solution
Building a prototype
Troubleshooting and redesigning
Communicating the solution

can be divided into
Chemistry
Physics

Matter, energy, and the changes they undergo
uses skills such as
Observing
Inferring
Predicting

Scientific inquiry typically begins with
Posing questions
leads to
Developing hypotheses
tested by
Designing experiments
requires
Good preparation to stay safe
results in
Drawing conclusions
leads to
Communicating ideas and results

A way of changing the natural world to meet human needs or solve problems
practiced by Engineers

Qualitative observations
Quantitative observations

Subject to restrictions called Constraints

Identifying a need
Developing solutions

- The variable that a scientist changes
- The variable that changes in response to the manipulated variable
- The manipulated variable
- The responding variable
- Using senses to gather information
- Explaining an observation
- Forecasting what will happen

Technologies are developed by the process known as the design process.

**Science**

- **is the study of**: Matter, energy, and the changes they undergo
- **uses skills such as**: Observing, Inferring, Predicting
- **develops through the process of**: Scientific inquiry

**Chemistry**
- **includes**: Qualitative observations, quantitative observations
- **typically begins with**: Positing questions
- **leads to**: Developing hypotheses
- **tested by**: Designing experiments
- **requires**: Good preparation to stay safe

**Physics**
- **includes**: Qualitative observations, quantitative observations
- **typically begins with**: Problem posing
- **leads to**: Developing hypotheses
- **tested by**: Designing experiments
- **requires**: Good preparation to stay safe

**Technology**
- **includes**: Qualitative observations, quantitative observations
- **typically begins with**: Problem posing
- **leads to**: Developing hypotheses
- **tested by**: Designing experiments
- **requires**: Good preparation to stay safe
Chapter Test

1. a
2. c
3. b
4. c
5. d
6. a
7. b
8. b
9. c
10. d
11. physics
12. controlled
13. scientific law
14. engineer
15. Feedback
16. true
17. manipulated variable
18. hypothesis
19. troubleshooting
20. prototype
21. Quantitative observations involve numbers or measurements. Qualitative observations involve descriptions that cannot be expressed in numbers.
22. Always follow your teacher’s instructions and the textbook directions exactly.
23. Identifying a need; Researching the problem; Designing a solution; Building a prototype; Troubleshooting and redesigning; Communicating the solution
24. During the fourth stage, a prototype is designed and built. A prototype is a working model used to test the operation of a product, including how well it works, how long it lasts, and how safe it is to use.
25. Engineers must communicate to consumers how a product meets their needs. They must also communicate with others involved in bringing the product to consumers, such as manufacturing and marketing people.
26. Scientific inquiry refers to the diverse ways in which scientists study the natural world and propose explanations based on the evidence they gather. Scientific inquiry does not always occur in the same way. But the typical stages in the process are posing questions, forming a hypothesis, designing an experiment, collecting and interpreting data, drawing a conclusion, and communicating ideas and results.
27. If a scientist were not honest, then he or she might communicate results that are false. Other scientists working on the same or similar research would be led down the wrong paths.
28. If an experiment had two manipulated variables, there would be no way to tell which of the two variables produced the experimental results.
29. If an accident occurs, notify your teacher immediately. Then listen to your teacher’s directions and carry them out quickly.
30. Technological advancements have had a major affect on human society throughout history. In the Stone Age, for example, people made tools out of stone. They used these tools to hunt and grow crops, which enabled them to stay in one place and build permanent settlements. Today, technological advancements have a large effect on society. For example, cellular phones, satellites, and high-speed Internet connections allow people to share information quickly around the world. Technology may have good or bad effects. For example, automobiles make travel quicker and easier. However, they also produce pollution and traffic jams. Often, the negative effects of a technology are unintentional.