

1.E: What Is Chemistry? (Exercises)

1.1: Basic Definitions

Q1.1.1

1. Identify each as either matter or not matter.

- a book
- hate
- light
- a car
- a fried egg

Q1.1.2

1. Give an example of matter in each phase: solid, liquid, or gas.

2. Does each statement represent a physical property or a chemical property?

- Sulfur is yellow.
- Steel wool burns when ignited by a flame.
- A gallon of milk weighs over eight pounds.

3. Does each statement represent a physical property or a chemical property?

- A pile of leaves slowly rots in the backyard.
- In the presence of oxygen, hydrogen can interact to make water.
- Gold can be stretched into very thin wires.

4. Does each statement represent a physical change or a chemical change?

- Water boils and becomes steam.
- Food is converted into usable form by the digestive system.
- The alcohol in many thermometers freezes at about -40 degrees Fahrenheit.

5. Does each statement represent a physical change or a chemical change?

- Graphite, a form of elemental carbon, can be turned into diamond, another form of carbon, at very high temperatures and pressures.
- The house across the street has been painted a new color.
- The elements sodium and chlorine come together to make a new substance called sodium chloride.

6. What is the difference between a homogeneous mixture and a heterogeneous mixture?

7. Distinguish between an element and a compound. About how many of each are known?

8. Identify each as a heterogeneous mixture or a homogeneous mixture.

- Salt is mixed with pepper.
- Sugar is dissolved in water.
- Pasta is cooked in boiling water.

9. Identify each as a heterogeneous mixture or a homogeneous mixture.

- air
- dirt
- a television set

10. In Exercise 8, which choices are also solutions?

11. In Exercise 9, which choices are also solutions?

12. Why is oxygen considered a nonmetal?

13. Why is iron considered a metal?

14. What properties do semimetals have?

15. Distinguish between a metal and a nonmetal.

16. Pure silicon is shiny and silvery but does not conduct electricity or heat well. Of these properties, how does silicon behave as a metal? How does silicon behave as a nonmetal?

17. Elemental carbon is a black, dull-looking solid that conducts heat and electricity well. It is very brittle and cannot be made into thin sheets or long wires. Of these properties, how does carbon behave as a metal? How does carbon behave as a nonmetal?

Answers

1.
 - a. matter
 - b. not matter
 - c. not matter
 - d. matter
 - e. matter
3.
 - a. chemical change
 - b. chemical property
 - c. physical property
5.
 - a. physical change
 - b. physical change
 - c. chemical change
7. An element is a fundamental chemical part of a substance; there are about 115 known elements. A compound is a combination of elements that acts as a different substance; there are over 50 million known substances.
9.
 - a. homogeneous
 - b. heterogeneous
 - c. heterogeneous
11. Choice "a" is a solution.
13. Iron is a metal because it is solid, is shiny, and conducts electricity and heat well.
15. Metals are typically shiny, conduct electricity and heat well, and are malleable and ductile; nonmetals are a variety of colors and phases, are brittle in the solid phase, and do not conduct heat or electricity well.
17. Carbon behaves as a metal because it conducts heat and electricity well. It is a nonmetal because it is black and brittle and cannot be made into sheets or wires.

1.2: Chemistry as a Science

1. Describe the scientific method.
2. "A hypothesis is just a guess"—is this an inadequate definition?
3. Why do scientists need to perform experiments?
4. What is the scientific definition of a theory? How is this word misused in general conversation?
5. What is the scientific definition of a law? How does it differ from the everyday definition of a law?
6. Name an example of a field that is not considered a science.
7. Which of the following fields are studies of the natural universe?
 - a. biophysics (a mix of biology and physics)
 - b. art
 - c. business
8. Which of the following fields are studies of the natural universe?
 - a. accounting
 - b. geochemistry (a mix of geology and chemistry)
 - c. astronomy (the study of stars and planets [but not the earth])
9. Which of these statements are qualitative descriptions?
 - a. Titanic was the largest passenger ship build at that time.
 - b. The population of the United States is about 306,000,000 people.
 - c. The peak of Mount Everest is 29,035 feet above sea level.

10. Which of these statements are qualitative descriptions?
 - a. A regular movie ticket in Cleveland costs \$6.00.
 - b. The weather in the Democratic Republic of the Congo is the wettest in all of Africa.
 - c. The deepest part of the Pacific Ocean is the Mariana Trench.
11. Of the statements in Exercise 9, which are quantitative?
12. Of the statements in Exercise 10, which are quantitative?

Answers

1. Simply stated, the scientific method includes three steps: (1) stating a hypothesis, (2) testing the hypothesis, and (3) refining the hypothesis.
3. Scientists perform experiments to test their hypotheses because sometimes the nature of natural universe is not obvious.
5. A scientific law is a specific statement that is thought to be never violated by the entire natural universe. Everyday laws are arbitrary limits that society puts on its members.
7.
 - a. yes
 - b. no
 - c. no
9.
 - a. qualitative
 - b. not qualitative
 - c. not qualitative
11. Statements b and c are quantitative.

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