

## Energy and Discovery of X-rays

### Multiple Choice

Identify the choice that best completes the statement or answers the question.

- \_\_\_\_\_ 1. Matter is measured in \_\_\_\_\_.  
a. kilograms  
b. joules  
c. electron volts  
d. rems
- \_\_\_\_\_ 2. Atoms and molecules are the fundamental building blocks of \_\_\_\_\_.  
a. energy  
b. radiation  
c. matter  
d. gravity
- \_\_\_\_\_ 3. Ice and steam are examples of two forms of \_\_\_\_\_.  
a. matter  
b. radiation  
c. energy  
d. work
- \_\_\_\_\_ 4. Radio waves, light, and x-rays are all examples of \_\_\_\_\_ energy.  
a. nuclear  
b. thermal  
c. electrical  
d. electromagnetic
- \_\_\_\_\_ 5. A moving object has \_\_\_\_\_ energy.  
a. potential  
b. kinetic  
c. nuclear  
d. electromagnetic
- \_\_\_\_\_ 6. What is the removal of an electron from an atom called?  
a. ionization  
b. pair production  
c. irradiation  
d. electricity
- \_\_\_\_\_ 7. Ionizing radiation is capable of removing \_\_\_\_\_ from atoms as it passes through the matter.  
a. neutrons  
b. protons  
c. electrons  
d. ions
- \_\_\_\_\_ 8. The energy of x-rays is \_\_\_\_\_.

- a. thermal
- b. potential
- c. kinetic
- d. electromagnetic

- \_\_\_ 9. The smallest quantity of any type of electromagnetic radiation is a(n) \_\_\_\_\_.  
a. photon  
b. electron  
c. neutrino  
d. quark
- \_\_\_ 10. What is the velocity of all electromagnetic radiation?  
a.  $8 \times 10^3$  m/s  
b.  $2 \times 10^8$  m/s  
c.  $3 \times 10^8$  m/s  
d.  $4 \times 10^3$  m/s
- \_\_\_ 11. What type of tube was Roentgen working with in his lab when x-rays were discovered?  
a. Crookes tube  
b. Fluorescent tube  
c. High-vacuum tube  
d. Wurzburg tube
- \_\_\_ 12. The letter “x” in x-ray is the symbol for:  
a. electricity.  
b. the unknown.  
c. penetrating.  
d. discovery.
- \_\_\_ 13. The speed of light is:  
a.  $3 \times 10^8$  meters per second.  
b.  $3 \times 10^8$  miles per second.  
c. 186,000 miles per second.  
d. a and c.
- \_\_\_ 14. X-rays are invisible.  
a. True  
b. False
- \_\_\_ 15. X-rays carry a negative charge that causes ionization.  
a. True  
b. False
- \_\_\_ 16. X-ray photons travel at the speed of light in a vacuum.  
a. True  
b. False
- \_\_\_ 17. X-ray photons are capable of traveling around corners.  
a. True

- b. False
- \_\_\_ 18. Chemical changes may occur as a result of exposure to ionizing radiation.
- a. True
  - b. False
- \_\_\_ 19. The “building blocks” of all matter are called:
- a. electrons.
  - b. atoms.
  - c. protons.
  - d. neutrons.
- \_\_\_ 20. The quantity of matter that makes up any physical object is called its:
- a. chemical identity.
  - b. nucleus.
  - c. atomic number.
  - d. mass.
- \_\_\_ 21. Which of the following particles are located in an orbit around the nucleus of an atom?
- a. Protons
  - b. Electrons
  - c. Neutrons
  - d. Positrons
- \_\_\_ 22. When an electron is removed from an atom, the atom is said to be:
- a. radioactive.
  - b. a nuclide.
  - c. unstable.
  - d. ionized.
- \_\_\_ 23. X-rays consist of:
- a. tungsten atoms.
  - b. electricity.
  - c. electromagnetic energy.
  - d. fast-moving electrons.
- \_\_\_ 24. The smallest possible unit of electromagnetic energy is the:
- a. photon.
  - b. electron.
  - c. nucleus.
  - d. atom.
- \_\_\_ 25. When an atom gains or loses an electron, the process is called:
- a. resistance.
  - b. potential difference.
  - c. electrification.
  - d. ionization.

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### Answer Section

#### MULTIPLE CHOICE

1. ANS: A

Matter is measured in kilograms

PTS: 1                    DIF: Easy                    REF: page 3

OBJ: Recognize the unit of measurement for matter.

2. ANS: C

Atoms and molecules are the fundamental building blocks of matter.

PTS: 1                    DIF: Moderate                    REF: page 3

OBJ: List the fundamental building blocks of matter.

3. ANS: A

Ice and steam are examples of two forms of matter.

PTS: 1                    DIF: Difficult                    REF: page 4                    OBJ: Describe states of matter.

4. ANS: D

Electromagnetic energy includes radio waves, light, and x-rays as well as other parts of the spectrum.

PTS: 1                    DIF: Difficult                    REF: page 4

OBJ: List types of electromagnetic energy.

5. ANS: B

A moving object has kinetic energy.

PTS: 1                    DIF: Moderate                    REF: page 4                    OBJ: Identify various forms of energy.

6. ANS: A

The removal of an electron from an atom is called ionization.

PTS: 1                    DIF: Moderate                    REF: page 5                    OBJ: Understand ionization of matter.

7. ANS: C

Ionizing radiation is capable of removing electrons from atoms as it passes through the matter.

PTS: 1                    DIF: Moderate                    REF: page 5

OBJ: Describe the process of ionization by ionizing radiation.

8. ANS: D

X-rays are a form of electromagnetic energy.

PTS: 1                    DIF: Difficult                    REF: page 5

OBJ: List the category of energy of x-rays.

9. ANS: A

The smallest quantity of any type of electromagnetic radiation is a photon.

PTS: 1                    DIF: Easy                    REF: page 45                    OBJ: Define photons.

10. ANS: C

The velocity of all electromagnetic radiation is  $3 \times 10^8$  m/s.

PTS: 1                    DIF: Moderate            REF: page 45

OBJ: State the velocity of all electromagnetic radiation.

11. ANS: A

Roentgen was working with a low-vacuum tube known as a Crookes tube.

PTS: 1

12. ANS: B

The letter “x” represents the mathematical symbol of the unknown.

PTS: 1

13. ANS: D

The speed of light can be described as either  $3 \times 10^8$  m/sec or 186,000 miles/sec.

PTS: 1

14. ANS: A

A characteristic of x-rays is that they are invisible.

PTS: 1

15. ANS: B

X-rays are electrically neutral.

PTS: 1

16. ANS: A

In a vacuum x-rays will travel at the speed of light.

PTS: 1

17. ANS: B

X-rays travel in straight lines, so they are unable to travel around corners.

PTS: 1

18. ANS: A

Chemical changes, such as in radiographic or photographic film, occur as a result of exposure to ionizing radiation.

PTS: 1

19. ANS: B

PTS: 1

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20. ANS: D

PTS: 1

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21. ANS: B

PTS: 1

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22. ANS: D

PTS: 1

REF: Page 43

23. ANS: C

PTS: 1

REF: Page 46

24. ANS: A

PTS: 1

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25. ANS: D

PTS: 1

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