

**Chemistry: The Central Science, 12e (Brown et al.)**

**Chapter 1 Introduction: Matter and Measurement**

**1.1 Multiple-Choice Questions**

1) In the following list, only \_\_\_\_\_ is not an example of matter.

- A) planets
- B) light
- C) dust
- D) elemental phosphorus
- E) table salt

Answer: B

Diff: 2 Page Ref: Sec. 1.1

2) What is the physical state in which matter has no specific shape but does have a specific volume?

- A) gas
- B) solid
- C) liquid
- D) salts
- E) ice

Answer: C

Diff: 1 Page Ref: Sec. 1.2

3) The law of constant composition applies to \_\_\_\_\_.

- A) solutions
- B) heterogeneous mixtures
- C) compounds
- D) homogeneous mixtures
- E) solids

Answer: C

Diff: 1 Page Ref: Sec. 1.2

4) A combination of sand, salt, and water is an example of a \_\_\_\_\_.

- A) homogeneous mixture
- B) heterogeneous mixture
- C) compound
- D) pure substance
- E) solid

Answer: B

Diff: 1 Page Ref: Sec. 1.2

5) A small amount of salt dissolved in water is an example of a \_\_\_\_\_.

- A) homogeneous mixture
- B) heterogeneous mixture
- C) compound
- D) pure substance
- E) solid

Answer: A

Diff: 1 Page Ref: Sec. 1.2

6) Which one of the following has the element name and symbol correctly matched?

- A) P, potassium
- B) C, copper
- C) Mg, manganese
- D) Ag, silver
- E) Sn, silicon

Answer: D

Diff: 1 Page Ref: Sec. 1.2

7) Which one of the following has the element name and symbol correctly matched?

- A) S, sodium
- B) Tn, tin
- C) Fe, iron
- D) N, neon
- E) B, bromine

Answer: C

Diff: 1 Page Ref: Sec. 1.2

8) Which one of the following elements has a symbol that is not derived from its foreign name?

- A) tin
- B) aluminum
- C) mercury
- D) copper
- E) lead

Answer: B

Diff: 2 Page Ref: Sec. 1.2

9) Which one of the following is a pure substance?

- A) concrete
- B) wood
- C) salt water
- D) elemental copper
- E) milk

Answer: D

Diff: 1 Page Ref: Sec. 1.2

10) Which one of the following is often easily separated into its components by simple techniques such as filtering or decanting?

- A) heterogeneous mixture
- B) compounds
- C) homogeneous mixture
- D) elements
- E) solutions

Answer: A

Diff: 3 Page Ref: Sec. 1.2

11) Which states of matter are significantly compressible?

- A) gases only
- B) liquids only
- C) solids only
- D) liquids and gases
- E) solids and liquids

Answer: A

Diff: 1 Page Ref: Sec. 1.2

12) For which of the following can the composition vary?

- A) pure substance
- B) element
- C) both homogeneous and heterogeneous mixtures
- D) homogeneous mixture
- E) heterogeneous mixture

Answer: C

Diff: 2 Page Ref: Sec. 1.2

13) If matter is uniform throughout and cannot be separated into other substances by physical means, it is \_\_\_\_\_.

- A) a compound
- B) either an element or a compound
- C) a homogeneous mixture
- D) a heterogeneous mixture
- E) an element

Answer: B

Diff: 2 Page Ref: Sec. 1.2

14) An element cannot \_\_\_\_\_.

- A) be part of a heterogeneous mixture
- B) be part of a homogeneous mixture
- C) be separated into other substances by chemical means
- D) interact with other elements to form compounds
- E) be a pure substance

Answer: C

Diff: 2 Page Ref: Sec. 1.2

15) Homogeneous mixtures are also known as \_\_\_\_\_.

- A) solids
- B) compounds
- C) elements
- D) substances
- E) solutions

Answer: E

Diff: 1 Page Ref: Sec. 1.2

16) The law of constant composition says \_\_\_\_\_.

- A) that the composition of a compound is always the same
- B) that all substances have the same composition
- C) that the composition of an element is always the same
- D) that the composition of a homogeneous mixture is always the same
- E) that the composition of a heterogeneous mixture is always the same

Answer: A

Diff: 1 Page Ref: Sec. 1.2

17) Which of the following is an illustration of the law of constant composition?

- A) Water boils at 100°C at 1 atm pressure.
- B) Water is 11% hydrogen and 89% oxygen by mass.
- C) Water can be separated into other substances by a chemical process.
- D) Water and salt have different boiling points.
- E) Water is a compound.

Answer: B

Diff: 3 Page Ref: Sec. 1.2

18) In the following list, only \_\_\_\_\_ is not an example of a chemical reaction.

- A) dissolution of a penny in nitric acid
- B) the condensation of water vapor
- C) a burning candle
- D) the formation of polyethylene from ethylene
- E) the rusting of iron

Answer: B

Diff: 2 Page Ref: Sec. 1.3

19) Gases and liquids share the property of \_\_\_\_\_.

- A) compressibility
- B) definite volume
- C) incompressibility
- D) indefinite shape
- E) definite shape

Answer: D

Diff: 1 Page Ref: Sec. 1.3

20) Of the following, only \_\_\_\_\_ is a chemical reaction.

- A) melting of lead
- B) dissolving sugar in water
- C) tarnishing of silver
- D) crushing of stone
- E) dropping a penny into a glass of water

Answer: C

Diff: 1 Page Ref: Sec. 1.3

21) Which one of the following is not an intensive property?

- A) density
- B) temperature
- C) melting point
- D) mass
- E) boiling point

Answer: D

Diff: 2 Page Ref: Sec. 1.3

22) Which one of the following is an intensive property?

- A) mass
- B) temperature
- C) heat content
- D) volume
- E) amount

Answer: B

Diff: 2 Page Ref: Sec. 1.3

23) Of the following, only \_\_\_\_\_ is an extensive property.

- A) density
- B) mass
- C) boiling point
- D) freezing point
- E) temperature

Answer: B

Diff: 2 Page Ref: Sec. 1.3

24) Which of the following are chemical processes?

1. rusting of a nail
2. freezing of water
3. decomposition of water into hydrogen and oxygen gases
4. compression of oxygen gas

A) 2, 3, 4

B) 1, 3, 4

C) 1, 3

D) 1, 2

E) 1, 4

Answer: C

Diff: 3 Page Ref: Sec. 1.3

25) In the following list, only \_\_\_\_\_ is not an example of a chemical reaction.

- A) burning a plastic water bottle
- B) the production of hydrogen gas from water
- C) the tarnishing of a copper penny
- D) chopping a log into sawdust
- E) charging a cellular phone

Answer: C

Diff: 2 Page Ref: Sec. 1.3

26) Of the following, \_\_\_\_\_ is the smallest mass.

- A) 25 kg
- B)  $2.5 \times 10^{-2}$  mg
- C)  $2.5 \times 10^{15}$  pg
- D)  $2.5 \times 10^9$  fg
- E)  $2.5 \times 10^{10}$  ng

Answer: D

Diff: 2 Page Ref: Sec. 1.4

27) Of the following, \_\_\_\_\_ is the largest mass.

- A) 25 kg
- B)  $2.5 \times 10^{-2}$  mg
- C)  $2.5 \times 10^{15}$  pg
- D)  $2.5 \times 10^9$  fg
- E)  $2.5 \times 10^{10}$  ng

Answer: A

Diff: 2 Page Ref: Sec. 1.4

28) Which one of the following is the highest temperature?

- A) 38 °C
- B) 96 °F
- C) 302 K
- D) none of the above
- E) the freezing point of water

Answer: A

Diff: 3 Page Ref: Sec. 1.4

29) Which one of the following is the highest temperature?

- A) The boiling point of water
- B) 220 °F
- C) 373 K
- D) 100°C
- E) All of the above are identical temperatures

Answer: B

Diff: 3 Page Ref: Sec. 1.4

30) Which of the following is (are) the lowest temperature?

A) The freezing point of water

B) 5 °C

C) 30 °F

D) 280 K

E) A and D

Answer: C

Diff: 3 Page Ref: Sec 1.4

31) Which one of the following is true about the liter?

A) It is the SI base unit for volume.

B) It is equivalent to a cubic decimeter.

C) It is slightly smaller than a quart.

D) It contains  $10^6$  cubic centimeters.

E) It is slightly smaller than a gallon.

Answer: B

Diff: 4 Page Ref: Sec. 1.4

32) Of the objects below, \_\_\_\_\_ is the most dense.

A) an object with a volume of 2.5 L and a mass of 12.5 kg

B) an object with a volume of 139 mL and a mass of 93 g

C) an object with a volume of  $0.00212 \text{ m}^3$  and a mass of  $4.22 \times 10^4 \text{ mg}$

D) an object with a volume of  $3.91 \times 10^{-24} \text{ nm}^3$  and a mass of  $7.93 \times 10^{-1} \text{ ng}$

E) an object with a volume of  $13 \text{ dm}^3$  and a mass of  $1.29 \times 10^3 \text{ g}$

Answer: D

Diff: 4 Page Ref: Sec. 1.4

33) Which calculation clearly shows a conversion between temperatures in degrees Celsius,  $t(^{\circ}\text{C})$ , and temperature in Kelvins,  $T(\text{K})$ ?

A)  $T(\text{K}) = t(^{\circ}\text{C}) + 273.15$

B)  $T(\text{K}) = 273.15 - t(^{\circ}\text{C})$

C)  $T(\text{K}) = [t(^{\circ}\text{C}) - 32] / 1.8$

D)  $T(\text{K}) = [t(^{\circ}\text{C}) + 32] \times 1.8$

E)  $T(\text{K}) = t(^{\circ}\text{C})$

Answer: A

Diff: 1 Page Ref: Sec. 1.4

34) Express the temperature, 422.35 K, in degrees Celsius.

A) 792.23 °C

B) 149.20 °C

C) 695.50 °C

D) 50.89 °C

E) 22.78 °C

Answer: B

Diff: 2 Page Ref: Sec. 1.4

35) Which of the following liquids has the greatest density?

- A)  $13 \text{ cm}^3$  with a mass of 23 g
- B)  $3.5 \text{ cm}^3$  with a mass of 10 g
- C)  $0.022 \text{ cm}^3$  with a mass of 0.10 g
- D)  $54 \text{ cm}^3$  with a mass of 45 g
- E)  $210 \text{ cm}^3$  with a mass of 12 g

Answer: C

Diff: 2 Page Ref: Sec. 1.4

36) You have to calculate the mass of a 30.0 mL liquid sample with density of 1.52 g/mL, but you have forgotten the formula. Which way of reasoning would help you in finding the correct mass?

- A) If 1 mL of a liquid has the mass of 1.52 g, then 30.0 mL has the mass of \_\_\_\_\_ g.
- B) If 1.52 mL of a liquid has the mass of 1 g, then 30.0 mL has the mass of \_\_\_\_\_ g.

Answer: A

Diff: 2 Page Ref: Sec. 1.4

37) You have to calculate the volume of a gas sample with mass of  $1.000 \times 10^3 \text{ g}$  and density of 1.027 g/L, but you have forgotten the formula. Which way of reasoning would help you in finding the correct mass?

- A) If 1.027 g of a gas takes up a volume of 1 L, then  $1.000 \times 10^3 \text{ g}$  of the same gas takes up a volume of \_\_\_\_\_.
- B) If 1.027 L of gas has a mass of 1 g, then \_\_\_\_\_ L has the mass of  $1.000 \times 10^3 \text{ g}$ .

Answer: A

Diff: 2 Page Ref: Sec. 1.4

38) Osmium has a density of  $22.6 \text{ g/cm}^3$ . What volume (in  $\text{cm}^3$ ) would be occupied by a 21.8 g sample of osmium?

- A) 0.965
- B) 1.04
- C) 493
- D)  $2.03 \times 10^{-3}$
- E)  $2.03 \times 10^3$

Answer: A

Diff: 2 Page Ref: Sec. 1.4

39) Gold has a density of  $0.01932 \text{ kg/cm}^3$ . What volume (in  $\text{cm}^3$ ) would be occupied by a 33.3 g sample of gold?

- A) 0.663
- B)  $5.80 \times 10^{-4}$
- C) 5.80
- D) 0.581
- E) 1.72

Answer: E

Diff: 1 Page Ref: Sec. 1.4

40) Iron has a density of  $7.9 \text{ g/cm}^3$ . What is the mass of a cube of iron with the length of one side equal to 55.0 mm?

- A)  $2.1 \times 10^4 \text{ g}$
- B)  $4.3 \times 10^2 \text{ g}$
- C)  $1.3 \times 10^3 \text{ g}$
- D) 1.4 g
- E)  $2.3 \times 10^{-2} \text{ g}$

Answer: C

Diff: 1 Page Ref: Sec. 1.4

41) A cube of an unknown metal measures 1.61 mm on one side. The mass of the cube is 36 mg. Which of the following is most likely the unknown metal?

| Metal     | Density ( $\text{g/cm}^3$ ) |
|-----------|-----------------------------|
| rhodium   | 12.4                        |
| copper    | 8.96                        |
| niobium   | 8.57                        |
| vanadium  | 6.11                        |
| zirconium | 6.51                        |

- A) copper
- B) rhodium
- C) niobium
- D) vanadium
- E) zirconium

Answer: C

Diff: 3 Page Ref: Sec. 1.4

42) Precision refers to \_\_\_\_\_.

- A) how close a measured number is to other measured numbers
- B) how close a measured number is to the true value
- C) how close a measured number is to the calculated value
- D) how close a measured number is to zero
- E) how close a measured number is to infinity

Answer: A

Diff: 1 Page Ref: Sec. 1.4

43) Accuracy refers to \_\_\_\_\_.

- A) how close a measured number is to zero
- B) how close a measured number is to the calculated value
- C) how close a measured number is to other measured numbers
- D) how close a measured number is to the true value
- E) how close a measured number is to infinity

Answer: D

Diff: 1 Page Ref: Sec. 1.4

44) Which of the following has the same number of significant figures as the number 1.00310?

A)  $1 \times 10^6$

B) 199.791

C) 8.66

D) 5.119

E) 100

Answer: B

Diff: 2 Page Ref: Sec. 1.4

45) Acceleration due to gravity of a free-falling object is  $9.8 \text{ m/s}^2$ . Express this in millimeters/millisecond<sup>2</sup>.

A)  $9.8 \times 10^{-9}$

B)  $9.8 \times 10^3$

C)  $9.8 \times 10^{-6}$

D)  $9.8 \times 10^6$

E)  $9.8 \times 10^{-3}$

Answer: E

Diff: 2 Page Ref: Sec. 1.4

46) If an object is accelerating at a rate of  $25 \text{ m/s}^2$ , how long (in seconds) will it take to reach a speed of 550 m/s? (Assume an initial velocity of zero.)

A) 22

B)  $1.4 \times 10^4$

C) 0.045

D)  $1.2 \times 10^4$

E)  $2.3 \times 10^2$

Answer: A

Diff: 4 Page Ref: Sec. 1.4

47) If an object is accelerating at a rate of  $25 \text{ m/s}^2$ , how fast will it be moving (in m/s) after 1.50 min? (Assume an initial velocity of zero.)

A) 17

B) 3.6

C) 38

D)  $2.3 \times 10^3$

E) 0.060

Answer: D

Diff: 4 Page Ref: Sec. 1.4

48) A wooden object has a mass of 10.782 g and occupies a volume of 13.72 mL. What is the density of the object determined to an appropriate number of significant figures?

- A)  $8 \times 10^{-1}$  g/mL
- B)  $7.9 \times 10^{-1}$  g/mL
- C)  $7.86 \times 10^{-1}$  g/mL
- D)  $7.859 \times 10^{-1}$  g/mL
- E)  $7.8586 \times 10^{-1}$  g/mL

Answer: D

Diff: 2 Page Ref: Sec. 1.4, 1.5

49) Expressing a number in scientific notation \_\_\_\_\_.

- A) changes its value
- B) removes ambiguity as to the significant figures
- C) removes significant zeros
- D) allows to increase the number's precision
- E) all of the above

Answer: B

Diff: 2 Page Ref: Sec. 1.5

50) The number with the most significant zeros is \_\_\_\_\_.

- A) 0.00002510
- B) 0.02500001
- C) 250000001
- D)  $2.501 \times 10^{-7}$
- E) 2.5100000

Answer: C

Diff: 1 Page Ref: Sec. 1.5

51) How many significant figures are in the number 0.0034050?

- A) 3
- B) 4
- C) 5
- D) 6
- E) 7

Answer: C

Diff: 2 Page Ref: Sec. 1.5

52) How many significant figures should be retained in the result of the following calculation?

$$12.00000 \times 0.9893 + 13.00335 \times 0.0107$$

- A) 2
- B) 3
- C) 4
- D) 5
- E) 6

Answer: B

Diff: 2 Page Ref: Sec. 1.5

53) In which one of the following numbers are all of the zeros significant?

- A) 100.090090
- B) 0.143290
- C) 0.05843
- D) 0.1000
- E) 00.0030020

Answer: A

Diff: 1 Page Ref: Sec. 1.5

54) Which of the following is not an exact number?

- A) The number of seconds in a year.
- B) The number of millimeters in a kilometer.
- C) The number of liters in a gallon.
- D) The number of centimeters in an inch.
- E) The number of grams in a kilogram.

Answer: C

Diff: 1 Page Ref: Sec. 1.5

55) In which one of the following numbers are none of the zeros significant?

- A) 100.0
- B) 1065
- C) 0.0100
- D) 1.003450
- E) 0.00001

Answer: E

Diff: 1 Page Ref: Sec 1.5

56) Round the number 0.007222 to three significant figures.

- A) 0.007
- B) 0.00722
- C) 0.0072
- D) 0.00723
- E) 0.007225

Answer: B

Diff: 1 Page Ref: Sec. 1.5

57) Round the number 3456.5 to two significant figures.

- A) 3400.0
- B) 3400
- C) 3000
- D) 3500
- E) 3000.0

Answer: D

Diff: 1 Page Ref: Sec. 1.5

58) Round the number 0.08535 to two significant figures.

- A) 0.09
- B) 0.086
- C) 0.0854
- D) 0.085
- E) 0.08535

Answer: D

Diff: 1 Page Ref: Sec. 1.5

59) One angstrom, symbolized Å, is  $10^{-10}$  m.  $1 \text{ cm}^3 = \underline{\hspace{2cm}} \text{ Å}^3$

- A)  $10^{24}$
- B)  $10^{-24}$
- C)  $10^{30}$
- D)  $10^{-30}$
- E)  $10^{-9}$

Answer: A

Diff: 3 Page Ref: Sec. 1.6

## 1.2 Bimodal Questions

1) Solids have a \_\_\_\_\_ shape and are not appreciably \_\_\_\_\_.

- A) definite, compressible
- B) definite, incompressible
- C) indefinite, compressible
- D) indefinite, incompressible
- E) sharp, convertible

Answer: A

Diff: 1 Page Ref: Sec. 1.2

2) \_\_\_\_\_ is the chemical symbol for elemental sodium.

- A) S
- B) W
- C) So
- D) Na
- E) Sn

Answer: D

Diff: 1 Page Ref: Sec. 1.2

3) If matter is uniform throughout and cannot be separated into other substances by physical processes, but can be decomposed into other substances by chemical processes, it is called a (an) \_\_\_\_\_.

- A) heterogeneous mixture
- B) element
- C) homogeneous mixture
- D) compound
- E) mixture of elements

Answer: D

Diff: 3 Page Ref: Sec. 1.2

4) A separation process that depends on differing abilities of substances to form gases is called \_\_\_\_\_.

- A) filtration
- B) solvation
- C) distillation
- D) chromatography
- E) All of the above are correct.

Answer: C

Diff: 3 Page Ref: Sec. 1.3

5) The initial or tentative explanation of an observation is called a(n) \_\_\_\_\_.

- A) law
- B) theory
- C) hypothesis
- D) experiment
- E) test

Answer: C

Diff: 2 Page Ref: Sec. 1.4

6) A concise verbal statement or mathematical equation that summarizes a broad variety of observations and experiences is called a(n) \_\_\_\_\_.

- A) law
- B) theory
- C) hypothesis
- D) experiment
- E) test

Answer: A

Diff: 2 Page Ref: Sec. 1.4

7) The SI unit for mass is \_\_\_\_\_.

- A) kilogram
- B) gram
- C) pound
- D) troy ounce
- E) none of the above

Answer: A

Diff: 1 Page Ref: Sec. 1.4

8) A one degree of temperature difference is the smallest on the \_\_\_\_\_ temperature scale.

- A) Kelvin
- B) Celsius
- C) Fahrenheit
- D) Kelvin and Celsius
- E) Fahrenheit and Celsius

Answer: C

Diff: 3 Page Ref: Sec. 1.4

9) \_\_\_\_\_ is the abbreviation for the prefix mega-.

- A) k
- B) m
- C) M
- D) n
- E) d

Answer: C

Diff: 1 Page Ref: Sec. 1.4

10) Milli is the abbreviation for the prefix \_\_\_\_\_.

- A) k
- B) m
- C) M
- D) n
- E) d

Answer: B

Diff: 1 Page Ref: Sec. 1.4

11) A common English set of units for expressing velocity is miles/hour. The SI unit for velocity is \_\_\_\_\_.

- A) km/hr
- B) km/s
- C) m/hr
- D) m/s
- E) cm/s

Answer: D

Diff: 3 Page Ref: Sec. 1.4

12) The density of a gold nugget is  $19.3 \text{ g/cm}^3$ . If the volume of the gold nugget is  $0.00369 \text{ L}$ , the mass of the nugget is \_\_\_\_\_.

- A) 71.2
- B) 0.191
- C) 19.3
- D) 5.23
- E) none of the above

Answer: A

Diff: 2 Page Ref: Sec. 1.4

13) The length of the side of a cube having a density of  $12.6 \text{ g/ml}$  and a mass of  $7.65 \text{ g}$  is \_\_\_\_\_ cm.

- A) 3.20
- B) 0.847
- C) 1.02
- D) 0.584
- E) 1.32

Answer: B

Diff: 4 Page Ref: Sec. 1.4

14) The unit of force in the English measurement system is  $\frac{\text{lb} \cdot \text{ft}}{\text{s}^2}$ . The SI unit of force is the Newton, which is \_\_\_\_\_ in base SI units.

A)  $\frac{\text{g} \cdot \text{cm}}{\text{s}^2}$

B)  $\frac{\text{kg} \cdot \text{m}}{\text{hr}^2}$

C)  $\frac{\text{kg} \cdot \text{m}}{\text{s}^2}$

D)  $\frac{\text{g} \cdot \text{m}}{\text{s}^2}$

E)  $\frac{\text{g} \cdot \text{m}}{\text{s}}$

Answer: C

Diff: 3 Page Ref: Sec. 1.4

15) Momentum is defined as the product of mass and velocity. The SI unit for momentum is \_\_\_\_\_.

A)  $\frac{\text{kg} \cdot \text{m}}{\text{s}}$

B)  $\frac{\text{kg} \cdot \text{m}}{\text{hr}}$

C)  $\frac{\text{g} \cdot \text{m}}{\text{s}}$

D)  $\frac{\text{g} \cdot \text{km}}{\text{s}}$

E)  $\frac{\text{kg} \cdot \text{km}}{\text{hr}}$

Answer: A

Diff: 3 Page Ref: Sec. 1.4

16) The SI unit of temperature is \_\_\_\_\_.

A) K

B) °C

C) °F

D) t

E) T

Answer: A

Diff: 2 Page Ref: Sec. 1.4

17) The freezing point of water at 1 atm pressure is \_\_\_\_\_.

A) 0 °F

B) 0 K

C) 0 °C

D) -273 °C

E) -32 °F

Answer: C

Diff: 2 Page Ref: Sec. 1.4

18) A temperature of \_\_\_\_\_ K is the same as 63°F.

- A) 17
- B) 276
- C) 290
- D) 29
- E) 336

Answer: C

Diff: 2 Page Ref: Sec. 1.4

19) 1 nanometer = \_\_\_\_\_ picometers

- A) 1000
- B) 0.1
- C) 0.01
- D) 1
- E) 10

Answer: A

Diff: 2 Page Ref: Sec. 1.4

20) 1 picometer = \_\_\_\_\_ centimeters

- A)  $1 \times 10^{10}$
- B)  $1 \times 10^{-10}$
- C)  $1 \times 10^8$
- D)  $1 \times 10^{-8}$
- E)  $1 \times 10^{-12}$

Answer: B

Diff: 2 Page Ref: Sec. 1.4

21) 1 kilogram = \_\_\_\_\_ milligrams

- A)  $1 \times 10^{-6}$
- B) 1,000
- C) 10,000
- D) 1,000,000
- E) none of the above

Answer: D

Diff: 2 Page Ref: Sec. 1.4

22) "Absolute zero" refers to \_\_\_\_\_.

- A) 0 Kelvin
- B) 0° Fahrenheit
- C) 0° Celsius
- D)  $^{\circ}\text{C} + 9/5(^{\circ}\text{F} - 32)$
- E) 273.15 °C

Answer: A

Diff: 1 Page Ref: Sec. 1.4

23) The density (in  $\text{g/cm}^3$ ) of a gold nugget that has a volume of  $1.68 \text{ cm}^3$  and a mass of  $32.4 \text{ g}$  is \_\_\_\_\_.

A) 0.0519

B) 19.3

C) 54.4

D) 0.0184

E) 32.4

Answer: B

Diff: 1 Page Ref: Sec. 1.4

24) A certain liquid has a density of  $2.67 \text{ g/cm}^3$ .  $1340 \text{ g}$  of this liquid would occupy a volume of \_\_\_\_\_ L.

A)  $1.99 \times 10^{-3}$

B) 50.2

C) 3.58

D) 35.8

E) 0.502

Answer: E

Diff: 2 Page Ref: Sec. 1.4

25) A certain liquid has a density of  $2.67 \text{ g/cm}^3$ .  $30.5 \text{ mL}$  of this liquid would have a mass of \_\_\_\_\_ Kg.

A) 81.4

B) 11.4

C) 0.0875

D) 0.0814

E) 0.0114

Answer: D

Diff: 2 Page Ref: Sec. 1.4

26) Osmium has a density of  $22.6 \text{ g/cm}^3$ . The mass of a block of osmium that measures  $1.01 \text{ cm} \times 0.233 \text{ cm} \times 0.648 \text{ cm}$  is \_\_\_\_\_ g.

A)  $6.75 \times 10^{-3}$

B) 3.45

C) 148

D)  $6.75 \times 10^3$

E) 34.5

Answer: B

Diff: 3 Page Ref: Sec. 1.4

27)  $3.337 \text{ g/cm}^3 = \underline{\hspace{2cm}} \text{ kg/m}^3$

- A)  $3.337 \times 10^{-9}$
- B)  $3.337 \times 10^{-5}$
- C) 3337
- D) 0.3337
- E) 333.7

Answer: C

Diff: 2 Page Ref: Sec. 1.4

28) One side of a cube measures 1.55 m. The volume of this cube is  $\underline{\hspace{2cm}} \text{ cm}^3$ .

- A)  $2.40 \times 10^4$
- B)  $3.72 \times 10^6$
- C) 2.40
- D) 3.72
- E) 155

Answer: B

Diff: 4 Page Ref: Sec. 1.4

29) The length of the side of a cube (in cm) having a volume of 44.4 L is  $\underline{\hspace{2cm}}$ .

- A) 875
- B) 35.4
- C) 6.66
- D) 66.6
- E) 0.354

Answer: B

Diff: 4 Page Ref: Sec. 1.4

30)  $45 \text{ m/s} = \underline{\hspace{2cm}} \text{ km/hr}$

- A) 2.7
- B) 0.045
- C)  $1.6 \times 10^2$
- D)  $2.7 \times 10^3$
- E)  $1.6 \times 10^5$

Answer: C

Diff: 2 Page Ref: Sec. 1.4

31) If an object, beginning at rest, is moving at a speed of 700 m/s after 2.75 min, its rate of acceleration (in  $\text{m/s}^2$ ) is  $\underline{\hspace{2cm}}$ . (Assume that the rate of acceleration is constant.)

- A)  $1.16 \times 10^5$
- B) 255
- C) 193
- D) 4.24
- E)  $1.53 \times 10^4$

Answer: D

Diff: 4 Page Ref: Sec. 1.4

32) The correct answer (reported to the proper number of significant figures) to the following is \_\_\_\_\_.

$$6.3 \times 3.25 = \underline{\hspace{2cm}}$$

- A) 20.
- B) 20.475
- C) 20.48
- D) 20.5
- E) 21

Answer: A

Diff: 2 Page Ref: Sec. 1.5

33) The correct answer (reported to the proper number of significant figures) to the following is \_\_\_\_\_.

$$(2.05631)(6.9391136) / 12.59326 = \underline{\hspace{2cm}}$$

- A) 1.1330639
- B) 1.13306
- C) 1.133064
- D) 1.1361
- E) none of the above

Answer: B

Diff: 2 Page Ref: Sec. 1.5

34) The correct answer (reported to the proper number of significant figures) to the following is \_\_\_\_\_.

$$12.75 \times 1.3621 = \underline{\hspace{2cm}}$$

- A) 17.367
- B) 17.40
- C) 17.37
- D) 17.4
- E) 17.0

Answer: C

Diff: 2 Page Ref: Sec. 1.5

35) The correct answer (reported to the proper number of significant figures) to the following is \_\_\_\_\_.

$$(12.67 + 19.2)(3.99) / (1.36 + 11.366) = \underline{\hspace{2cm}}$$

- A) 9.99851
- B) 9.9985
- C) 9.999
- D)  $1.00 \times 10^1$
- E) none of the above

Answer: D

Diff: 3 Page Ref: Sec. 1.5

36) The number 1.00430 has \_\_\_\_\_ significant figures.

- A) 2
- B) 3
- C) 5
- D) 6
- E) 4

Answer: D

Diff: 1 Page Ref: Sec. 1.5

37) The correct result (indicating the proper number of significant figures) of the following addition is \_\_\_\_\_.

$$\begin{array}{r} 12 \\ 1.2 \\ 0.12 \\ + 0.012 \\ \hline \end{array}$$

- A) 13
- B) 13.3
- C) 13.33
- D) 13.332
- E) none of the above

Answer: A

Diff: 2 Page Ref: Sec. 1.5

38)  $\frac{(0.002843)(12.80184)}{0.00032} = \underline{\hspace{2cm}}$

- A) 113.73635
- B) 113.736
- C) 113.74
- D) 113.7
- E)  $1.1 \times 10^2$

Answer: E

Diff: 3 Page Ref: Sec. 1.5

39) The correct result of the molecular mass calculation for  $\text{H}_2\text{SO}_4$  is \_\_\_\_\_.

$$4 \times 15.9994 + 32.066 + 2 \times 1.0079 =$$

- A) 98.08
- B) 98.079
- C) 98.074
- D) 98.838
- E) 98.84

Answer: B

Diff: 3 Page Ref: Sec. 1.5

40) The volume of a regular cylinder is  $V = \pi r^2 h$ . Using the value 3.1416 for the constant  $\pi$ , the volume ( $\text{cm}^3$ ) of a cylinder of radius 2.34 cm and height 19.91 cm expressed to the correct number of significant figures is \_\_\_\_\_.

- A) 342.49471
- B) 342.495
- C) 342.49
- D) 343
- E) 342

Answer: E

Diff: 4 Page Ref: Sec. 1.5

41) There are \_\_\_\_\_ significant figures in the answer to the following computation:

$$\frac{(29.2 - 20.0)(1.79 \times 10^5)}{1.39}$$

- A) 1
- B) 2
- C) 3
- D) 4
- E) 5

Answer: B

Diff: 1 Page Ref: Sec. 1.5

42) There should be \_\_\_\_\_ significant figures in the answer to the following computation.

$$\frac{(10.07 + 7.395)}{2.5}$$

- A) 1
- B) 2
- C) 3
- D) 4
- E) 5

Answer: B

Diff: 2 Page Ref: Sec. 1.5

43) \_\_\_\_\_ significant figures should be retained in the result of the following calculation.

$$\frac{(11.13 - 2.6) \times 10^4}{(103.05 + 16.9) \times 10^{-6}}$$

- A) 1
- B) 2
- C) 3
- D) 4
- E) 5

Answer: B

Diff: 2 Page Ref: Sec. 1.5

44) The density of a 167.4 g sample of magnesium having a volume of 96.32 ml is \_\_\_\_\_ g/cm<sup>3</sup>.

- A) 0.5754
- B) 7128
- C) 3.625
- D) 2.663
- E) 1.738

Answer: E

Diff: 1 Page Ref: Sec. 1.6

45) The output of a plant is 4335 pounds of ball bearings per week (five days). If each ball bearing weighs 0.0113 g, how many ball bearings does the plant make in a single day? (Indicate the number in proper scientific notation with the appropriate number of significant figures.)

- A)  $3.84 \times 10^5$
- B)  $7.67 \times 10^4$
- C) 867
- D)  $3.49 \times 10^7$
- E)  $2.91 \times 10^6$

Answer: D

Diff: 4 Page Ref: Sec. 1.6

46) The density of mercury is 13.6 g/cm<sup>3</sup>. The density of mercury is \_\_\_\_\_ kg/m<sup>3</sup>.

- A)  $1.36 \times 10^{-2}$
- B)  $1.36 \times 10^4$
- C)  $1.36 \times 10^8$
- D)  $1.36 \times 10^{-5}$
- E)  $1.36 \times 10^{-4}$

Answer: B

Diff: 4 Page Ref: Sec. 1.6

47) The distance from the Earth to the Moon is approximately 240,000 miles. If a rocket travels at a speed of 7.50 km/sec, it will take \_\_\_\_\_ days to travel between the Earth and Moon.

- A) 0.60
- B) 1.7
- C) 3.9
- D) 7.3
- E) 5.6

Answer: A

Diff: 3 Page Ref: Sec. 1.6

48)  $1.55 \text{ kg/m}^3$  is equivalent to \_\_\_\_\_ g/L.

A)  $3.58 \times 10^{12}$

B)  $1.95 \times 10^3$

C) 6.83

D)  $1.60 \times 10^9$

E) 1.55

Answer: E

Diff: 3 Page Ref: Sec. 1.6

49) An iron mine produces  $1.67 \times 10^4$  tons of raw ore per day. If the ore is 26.39% elemental iron, the mine produces \_\_\_\_\_ pounds of elemental iron per year. (Assume the mine operates 365 days per year.)

A)  $1.221 \times 10^{10}$

B)  $8.814 \times 10^6$

C)  $3.217 \times 10^9$

D)  $1.611 \times 10^6$

E)  $3.66 \times 10^{11}$

Answer: C

Diff: 4 Page Ref: Sec. 1.6

50) A 4.369 g sample of metal is placed in a flask. Water is added to the flask and the total volume in the flask is read to be 126.4 ml. The mass of the water, flask, and metal is 268.5 g. If the mass of the flask is 139.3 g and the density of water is 1.000 g/ml, the density of the solid is \_\_\_\_\_ g/cm<sup>3</sup>.

A) 0.366

B) 1.56

C) 0.641

D) 2.73

E) 3.21

Answer: D

Diff: 4 Page Ref: Sec. 1.6

51) The quantity  $1.0 \text{ mg/cm}^2$  is the same as  $1.0 \times$  \_\_\_\_\_ kg/m<sup>2</sup>.

A)  $10^{-4}$

B)  $10^4$

C)  $10^{-6}$

D)  $10^{-2}$

E)  $10^4$

Answer: D

Diff: 3 Page Ref: Sec. 1.6

52) A rectangular water tank is 14.5 cm long and 4.63 cm wide. If 368.5 g of water completely fills the tank, the height of the tank is \_\_\_\_\_ cm. (Assume the density of water is 1.000 g/ml.)

A) 6.45

B) 5.49

C) 14.0

D) 3.68

E) 4.62

Answer: B

Diff: 2 Page Ref: Sec. 1.6

53) There are \_\_\_\_\_ ng in a pg.

A) 0.001

B) 1000

C) 0.01

D) 100

E) 10

Answer: A

Diff: 2 Page Ref: Sec. 1.6

54) One edge of a cube is measured and found to be 13 cm. The volume of the cube in  $\text{m}^3$  is \_\_\_\_\_.

A)  $2.2 \times 10^{-3}$

B)  $2.2 \times 10^{-6}$

C) 2.2

D)  $2.2 \times 10^3$

E)  $2.2 \times 10^6$

Answer: A

Diff: 4 Page Ref: Sec. 1.6

55) The density of lead is  $11.4 \text{ g/cm}^3$ . The mass of a lead ball with a radius of 0.50 mm is \_\_\_\_\_ g. ( $\pi = 3.1416$ ;  $V_{\text{sphere}} = 4\pi r^3/3$ )

A) 6.0

B)  $4.6 \times 10^{-2}$

C)  $4.6 \times 10^{-5}$

D)  $6.0 \times 10^{-3}$

E) 4.6

Answer: D

Diff: 4 Page Ref: Sec. 1.6

### 1.3 Algorithmic Questions

1) The symbol for the element calcium is \_\_\_\_\_.

- A) Pt
- B) P
- C) Ca
- D) S
- E) K

Answer: C

Diff: 1 Page Ref: Sec. 1.2

2) The symbol for the element magnesium is \_\_\_\_\_.

- A) Rb
- B) Mn
- C) Ne
- D) Si
- E) Mg

Answer: E

Diff: 1 Page Ref: Sec. 1.2

3) The symbol for the element mercury is \_\_\_\_\_.

- A) Me
- B) Pb
- C) Sn
- D) Hg
- E) Na

Answer: D

Diff: 2 Page Ref: Sec. 1.2

4) The temperature of  $-25^{\circ}\text{C}$  is \_\_\_\_\_ in Kelvins.

- A) 138
- B) 166
- C) 103
- D) 298
- E) 248

Answer: E

Diff: 1 Page Ref: Sec. 1.4

5) An object will sink in a liquid if the density of the object is greater than that of the liquid. The mass of a sphere is 4.69 g. If the volume of this sphere is less than \_\_\_\_\_  $\text{cm}^3$ , then the sphere will sink in liquid mercury (density =  $13.6 \text{ g/cm}^3$ ).

- A) 0.345
- B) 2.90
- C) 1.08
- D) 7.48
- E) none of the above

Answer: A

Diff: 3 Page Ref: Sec. 1.4

6) What decimal power does the abbreviation f represent?

- A)  $1 \times 10^6$
- B)  $1 \times 10^3$
- C)  $1 \times 10^{-1}$
- D)  $1 \times 10^{-15}$
- E)  $1 \times 10^{-12}$

Answer: D

Diff: 2 Page Ref: Sec. 1.4

7) What decimal power does the abbreviation pico represent?

- A)  $1 \times 10^6$
- B)  $1 \times 10^9$
- C)  $1 \times 10^{-1}$
- D)  $1 \times 10^{-12}$
- E)  $1 \times 10^{-15}$

Answer: D

Diff: 1 Page Ref: Sec. 1.4

8) A temperature of 300. K is the same as \_\_\_\_\_ °F.

- A) 81
- B) 260
- C) 711
- D) 351
- E) 63

Answer: A

Diff: 2 Page Ref: Sec. 1.4

9) What is the volume (in  $\text{cm}^3$ ) of a 63.4 g piece of metal with a density of  $12.86 \text{ g/cm}^3$ ?

- A) 4.93
- B) 19.5
- C) .425
- D) 6.65
- E) none of the above

Answer: A

Diff: 2 Page Ref: Sec. 1.4

10) The density of silver is  $10.5 \text{ g/cm}^3$ . A piece of silver with a mass of 125 g would occupy a volume of \_\_\_\_\_  $\text{cm}^3$ .

- A) 0.171
- B) 644
- C) 10.5
- D) 0.00155
- E) 11.9

Answer: E

Diff: 2 Page Ref: Sec. 1.4

11) The density of silver is  $10.5 \text{ g/cm}^3$ . A piece of silver that occupies a volume of  $63.1 \text{ cm}^3$  would have a mass of \_\_\_\_\_ g.

- A) 663
- B) .445
- C) 2.25
- D) 112
- E) 23.6

Answer: A

Diff: 2 Page Ref: Sec. 1.4

12) The correct answer (reported to the proper number of significant figures) to the following is \_\_\_\_\_.

$$11.5 \times 8.78 = \underline{\hspace{2cm}}$$

Answer: 101

Diff: 2 Page Ref: Sec. 1.4

13) The correct answer (reported to the proper number of significant figures) to the following is \_\_\_\_\_.

$$(1815-1806) \times (9.11 \times 7.92) = \underline{\hspace{2cm}}$$

Answer: 600

Diff: 4 Page Ref: Sec. 1.4

14)  $38.325 \text{ lbs} = \underline{\hspace{2cm}} \text{ grams}$ . ( $1 \text{ lb} = 454 \text{ g}$ )

Answer: 17400

Diff: 4 Page Ref: Sec 1.4, 1.5

15) The number 0.00430 has \_\_\_\_\_ significant figures.

- A) 2
- B) 3
- C) 5
- D) 4
- E) 6

Answer: B

Diff: 1 Page Ref: Sec. 1.5

16) How many significant figures are in the measurement  $5.34 \text{ g}$ ?

- A) 1
- B) 2
- C) 4
- D) 3
- E) 5

Answer: D

Diff: 1 Page Ref: Sec. 1.5

17) The width, length, and height of a large, custom-made shipping crate are 1.20 m, 2.12 m, and 0.54 m, respectively. The volume of the box using the correct number of significant figures is \_\_\_\_\_ m<sup>3</sup>.

- A) 1.37376
- B) 1.4
- C) 1.37
- D) 1.374
- E) 1.3738

Answer: B

Diff: 2 Page Ref: Sec. 1.5

18) The estimated costs for remodelling the interior of an apartment are: three 1-gallon cans of paint at \$13.22 each, two paint brushes at \$9.53 each, and \$135 for a helper. The total estimated cost with the appropriate significant figures is \$\_\_\_\_\_.

- A) 193.72
- B)  $1.9 \times 10^2$
- C) 194
- D)  $2 \times 10^2$
- E) 193.7

Answer: C

Diff: 3 Page Ref: Sec. 1.5

19) Round the following number to four significant figures and express the result in standard exponential notation: 229.613

- A)  $0.2296 \times 10^3$
- B) 229.6
- C)  $2.296 \times 10^{-2}$
- D)  $2.296 \times 10^2$
- E)  $22.96 \times 10^{-1}$

Answer: D

Diff: 2 Page Ref: Sec. 1.5

20) The quantity \_\_\_\_\_ m is the same as 5 km.

- A) 5000
- B) 500
- C) 0.005
- D) 0.05
- E) 50

Answer: A

Diff: 2 Page Ref: Sec. 1.6

21) How many liters of wine can be held in a wine barrel whose capacity is 26.0 gal?

1 gal = 4 qt = 3,7854 L.

A)  $1.46 \times 10^{-4}$

B) 0.146

C) 98.4

D)  $6.87 \times 10^3$

E) 6.87

Answer: C

Diff: 3 Page Ref: Sec. 1.6

22) The recommended adult dose of Elixophyllin<sup>®</sup>, a drug used to treat asthma, is 6.00 mg/kg of body mass. Calculate the dose in milligrams for a 115-lb person. 1 lb = 453.59 g.

A) 24

B) 1,521

C) 1.5

D) 313

E)  $3.1 \times 10^5$

Answer: D

Diff: 3 Page Ref: Sec. 1.6

23) The density of air under ordinary conditions at 25 °C is 1.19 g/L. How many kilograms of air are in a room that measures 11.0 ft x 11.0 ft and has an 10.0 ft ceiling? 1 in. = 2.54 cm (exactly);

1 L =  $10^3 \text{ cm}^3$

A) 3.66

B) 0.152

C)  $4.08 \times 10^4$

D) 0.0962

E) 40.8

Answer: E

Diff: 3 2 Page Ref: Sec. 1.6

24) How many liters of air are in a room that measures 10.0 ft x 11.0 ft and has an 8.00 ft ceiling?

1 in. = 2.54 cm (exactly); 1 L =  $10^3 \text{ cm}^3$

A)  $2.49 \times 10^4$

B) 92.8

C) 26.8

D)  $2.68 \times 10^7$

E)  $8.84 \times 10^5$

Answer: A

Diff: 3 2 Page Ref: Sec. 1.6

## 1.4 Short Answer Questions

1) Gases do not have a fixed \_\_\_\_\_ as they are able to be \_\_\_\_\_.

Answer: volume, compressed

Diff: 1 Page Ref: Sec. 1.2

2) The symbol for the element phosphorus is \_\_\_\_\_.

Answer: P

Diff: 1 Page Ref: Sec. 1.2

3) Sn is the symbol for the element \_\_\_\_\_.

Answer: Tin

Diff: 1 Page Ref: Sec. 1.2

4) Si is the symbol for the element \_\_\_\_\_.

Answer: Silicon

Diff: 1 Page Ref: Sec. 1.2

5) Cu is the symbol for the element \_\_\_\_\_.

Answer: Copper

Diff: 2 Page Ref: Sec. 1.2

6) Mass and volume are often referred to as \_\_\_\_\_ properties of substances.

Answer: extensive

Diff: 4 Page Ref: Sec. 1.3

7) 1 milligram = \_\_\_\_\_ micrograms

Answer: 1,000

Diff: 1 Page Ref: Sec. 1.4

8)  $1.035 \times 10^{-4}$  L = \_\_\_\_\_ mL

Answer: 0.1035

Diff: 1 Page Ref: Sec. 1.4

## 1.5 True/False Questions

1) Water is considered to be a diatomic molecule because it is composed of two different atoms.

Answer: FALSE

Diff: 1 Page Ref: Sec. 1.2

2) A scientific theory is a concise statement or an equation that summarizes a broad variety of observations.

Answer: FALSE

Diff: 2 Page Ref: Sec. 1.3

3)  $3.2 \text{ cm}^3 = 0.0032 \text{ L}$

Answer: TRUE

Diff: 2 Page Ref: Sec. 1.4

4) Temperature is a physical property that determines the direction of heat flow.

Answer: TRUE

Diff: 3 Page Ref: Sec. 1.4

5) There are 6 significant figures in the number 0.003702.

Answer: FALSE

Diff: 2 Page Ref: Sec. 1.5