

***General, Organic, and Biological Chemistry, 3e (Frost)***  
**Chapter 1 Chemistry Basics - Matter and Measurement**

1.1 Multiple-Choice

1) Which of the following is an example of a heterogeneous mixture?

- A) Sugar water
- B) Blood
- C) Air
- D) Vodka

Answer: B

Diff: 1

Section: 1-1

Global: G1

LO: 1.1

2) Which of the following is a pure substance?

- A) Sugar
- B) Sand
- C) Gold
- D) Maple syrup

Answer: C

Diff: 1

Section: 1-1

Global: G1

LO: 1.1

3) Which of the following represents a homogeneous mixture?

- A) Brass (an alloy)
- B) Chocolate chip ice cream
- C) Blood
- D) Fog

Answer: A

Diff: 1

Section: 1-1

Global: G1

LO: 1.1

4) All the different kinds of substances that make up all of the material of the universe are known collectively as:

- A) elements
- B) compounds
- C) matter
- D) electrolytes

Answer: C

Diff: 1

Section: 1-1

Global: G1

LO: 1.1

5) Which of the following is an element?

- A) Carbon dioxide
- B) Sodium
- C) Ammonia
- D) Sand

Answer: B

Diff: 1

Section: 1-1

Global: G1

LO: 1.1

6) Which of the following is a homogeneous mixture?

- A) A cup of black coffee
- B) A package of cake mixture
- C) Iron filings and sulfur
- D) Oil and vinegar salad dressing

Answer: A

Diff: 1

Section: 1-1

Global: G1

LO: 1.1

7) What is the correct symbol for the element copper?

- A) Ca
- B) Cr
- C) Co
- D) Cu

Answer: D

Diff: 1

Section: 1-2

Global: G1

LO: 1.2

8) What is the correct element symbol for palladium?

- A) P
- B) Pa
- C) Pd
- D) Pm

Answer: C

Diff: 1

Section: 1-2

Global: G1

LO: 1.2

9) Which of the following combinations represents only alkali metals?

- I. Li
  - II. Ba
  - III. Rb
  - IV. Ca
- A) I + II
  - B) III + IV
  - C) I + III
  - D) II + IV

Answer: C

Diff: 2

Section: 1-2

Global: G1

LO: 1.2

10) Which of the following combinations represents only halogens?

- I. O
  - II. He
  - III. I
  - IV. Br
- A) I + II
  - B) III + IV
  - C) II + III
  - D) I + IV

Answer: B

Diff: 2

Section: 1-2

Global: G1

LO: 1.2

11) Which of the following is a metal?

- A) Chlorine
- B) Silicon
- C) Magnesium
- D) Hydrogen

Answer: C

Diff: 1

Section: 1-2

Global: G1

LO: 1.2

12) Which of the following is a metal?

- A) Boron
- B) Aluminium
- C) Germanium
- D) Phosphorus

Answer: B

Diff: 1

Section: 1-2

Global: G1

LO: 1.2

13) Which of the following is a nonmetal?

- A) Chlorine
- B) Magnesium
- C) Sodium
- D) Aluminum

Answer: A

Diff: 1

Section: 1-2

Global: G1

LO: 1.2

14) Which of the following is a metalloid?

- A) Bromine
- B) Silicon
- C) Iron
- D) Copper

Answer: B

Diff: 1

Section: 1-2

Global: G1

LO: 1.2

15) Which of the following is a nonmetal?

- A) Tellurium
- B) Germanium
- C) Antimony
- D) Selenium

Answer: D

Diff: 2

Section: 1-2

Global: G1

LO: 1.2

16) Which of the following combinations represents compounds rather than elements?

I. O<sub>3</sub>

II. CCl<sub>4</sub>

III. S<sub>8</sub>

IV. H<sub>2</sub>O

A) I + II

B) III + IV

C) I + III

D) II + IV

Answer: D

Diff: 2

Section: 1-2

Global: G1

LO: 1.2

17) How many O atoms are in the formula unit GaO(NO<sub>3</sub>)<sub>2</sub>?

A) 3

B) 4

C) 5

D) 7

Answer: D

Diff: 1

Section: 1-2

Global: G1

LO: 1.2

18) How many H atoms are in the molecule  $C_6H_3(C_3H_7)_2(C_2H_5)$ ?

- A) 10
- B) 15
- C) 22
- D) 27

Answer: C

Diff: 2

Section: 1-2

Global: G1

LO: 1.2

19) Which of the following is a mass unit?

- A) cg
- B) mL
- C) dm
- D) yd

Answer: A

Diff: 1

Section: 1-3

Global: G1

LO: 1.3

20) Which of the following is the correct unit for length?

- A) cg
- B) mL
- C) dm
- D) gal

Answer: C

Diff: 1

Section: 1-3

Global: G1

LO: 1.3

21) Which of the following conversion factors is correct for converting from grams to kilogram?

- A)  $1\text{ g} = 1000\text{ kg}$
- B)  $1000\text{ g} = 1\text{ kg}$
- C)  $100\text{ g} = 1\text{ kg}$
- D)  $1\text{ g} = 100\text{ kg}$

Answer: B

Diff: 1

Section: 1-3

Global: G3

LO: 1.3

22) Which of the following is the correct conversion factor to convert mL to L?

- A)  $1000 \text{ L} = 1 \text{ mL}$
- B)  $10 \text{ L} = 1 \text{ mL}$
- C)  $1 \text{ L} = 1000 \text{ mL}$
- D)  $1 \text{ L} = 100 \text{ mL}$

Answer: C

Diff: 1

Section: 1-3

Global: G3

LO: 1.3

23) How many mL of solution are there in 0.0500 L?

- A) 50.0 mL
- B) 0.50 mL
- C) 500. mL
- D) 0.0000500 mL

Answer: A

Diff: 1

Section: 1-3

Global: G4

LO: 1.3

24) How long is 1 cm?

- A) 0.01 mm
- B) 1 mm
- C) 10 mm
- D) 100 mm

Answer: C

Diff: 1

Section: 1-3

Global: G3

LO: 1.3

25) Convert 152 miles into kilometers, using proper significant figures, given that 1 mile = 1.609 km.

- A) 94.4 km
- B) 94 km
- C) 244.57 km
- D) 245 km

Answer: D

Diff: 2

Section: 1-3

Global: G4

LO: 1.3

26) How many significant figures are there in the following number: 53,000 pounds?

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

Answer: B

Diff: 1

Section: 1-3

Global: G3

LO: 1.3

27) How many significant figures are there in the following number: 0.00458 grams?

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

Answer: C

Diff: 1

Section: 1-3

Global: G3

LO: 1.3

28) Round the following number to 3 significant figures: 546.85 grams

- A) 546
- B) 547
- C) 546.9
- D) 540

Answer: B

Diff: 1

Section: 1-3

Global: G3

LO: 1.3

29) Round the following number to 2 significant figures: 105,006

- A) 100,000
- B) 110,000
- C)  $1.1 \times 10^5$
- D)  $1.1 \times 10^6$

Answer: C

Diff: 1

Section: 1-3

Global: G3

LO: 1.3



30) Write the numerical value for  $56,000 \div 7.89$  with the correct number of significant figures:

A) 70.976

B) 71

C) 70.98

D) 71.0

Answer: B

Diff: 2

Section: 1-3

Global: G4

LO: 1.3

31)  $47.462 + 22.53 + 0.11443$

A) 70.10643

B) 70.106

C) 70.11

D) 70.1

Answer: C

Diff: 2

Section: 1-3

Global: G4

LO: 1.3

32) Which of these samples has the smallest mass?

A) 160  $\mu\text{g}$

B) 0.016 g

C) 0.00016 mg

D) 0.000000016 kg

Answer: C

Diff: 1

Section: 1-3

Global: G3

LO: 1.3

33) What is the percent by mass of salt in a mixture that contains 150 g of salt, 1.2 kg of flour and 650 g of sugar?

A) 0.075%

B) 7.5%

C) 8.1%

D) 19%

Answer: B

Diff: 1

Section: 1-3

Global: G4

LO: 1.3

34) Which of the following statements best describes a liquid?

- A) Definite shape and volume
- B) Indefinite shape and volume
- C) Indefinite shape but definite volume
- D) Definite shape but indefinite volume

Answer: C

Diff: 1

Section: 1-4

Global: G1

LO: 1.4

35) Which of the following statements best describes a solid?

- A) Definite shape and volume
- B) Indefinite shape and volume
- C) Indefinite shape but definite volume
- D) Definite shape but indefinite volume

Answer: A

Diff: 1

Section: 1-4

Global: G1

LO: 1.4

36) Which of the following statements best describes a gas?

- A) Definite shape and volume
- B) Indefinite shape and volume
- C) Indefinite shape but definite volume
- D) Definite shape but indefinite volume

Answer: B

Diff: 1

Section: 1-4

Global: G1

LO: 1.4

37) Matter is nearly incompressible in which of these states?

- A) Gas
- B) Liquid
- C) Solid
- D) Solid and liquid

Answer: D

Diff: 1

Section: 1-4

Global: G1

LO: 1.4

38) Identify the correct ordering of attractions among particles in the three states of matter.

- A) Solid < liquid < gas
- B) Solid > liquid > gas
- C) Gas < solid < liquid
- D) Solid < gas < liquid

Answer: B

Diff: 2

Section: 1-4

Global: G2

LO: 1.4

39) Which of the following substances has the lowest density?

- A) A mass of 1.5 kg and a volume of 1.2 L
- B) A mass of 25 g and a volume of 20 mL
- C) A mass of 750 g and a volume of 70 dL
- D) A mass of 5 mg and a volume of 25 uL

Answer: D

Diff: 2

Section: 1-4

Global: G3

LO: 1.4

40) Using Table 1.4 in the text, determine which of these substances would show the largest temperature increase, if equal masses of each were heated with the same quantity of energy.

- A) Air
- B) Gold
- C) Iron
- D) Paraffin wax

Answer: B

Diff: 1

Section: 1-4

Global: G2

LO: 1.4

41) What is the total dose required for a 140 lb patient if the amount required is 28 mg/kg bodyweight?

- A) 1.8 mg
- B) 1.8 g
- C) 3.9 mg
- D) 3.9 g

Answer: B

Diff: 2

Section: 1-5

Global: G4

LO: 1.5

42) Which of the following is not a *physical change*?

- A) Boiling water
- B) Dissolving kool-aid
- C) Frying an egg
- D) Liquefying oxygen

Answer: C

Diff: 1

Section: 1-6

Global: G1

LO: 1.6

43) Which of the following is a chemical reaction?

- A) Rusting of iron
- B) Slicing a ham
- C) Liquefying oxygen
- D) Melting ice

Answer: A

Diff: 1

Section: 1-6

Global: G1

LO: 1.6

44) An example of a chemical reaction is:

- A) TNT is explosive
- B) gasoline is flammable
- C) zinc reacts with hydrochloric acid to produce hydrogen gas
- D) all the above

Answer: D

Diff: 1

Section: 1-6

Global: G1

LO: 1.6

45) What is the coefficient of  $\text{HClO}_4$  when the following equation is balanced with smallest whole numbers?



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

Answer: B

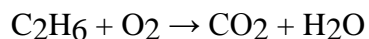
Diff: 1

Section: 1-6

Global: G2

LO: 1.6

46) What is the coefficient for O<sub>2</sub> when this equation is balanced with the lowest whole number coefficients?



A) 3

B) 4

C) 6

D) 7

Answer: D

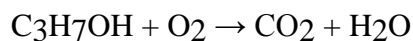
Diff: 3

Section: 1-6

Global: G2

LO: 1.6

47) What is the coefficient for O<sub>2</sub> when this equation is balanced with the lowest whole number coefficients?



A) 4

B) 5

C) 9

D) 10

Answer: C

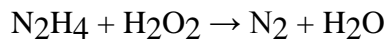
Diff: 3

Section: 1-6

Global: G2

LO: 1.6

48) What is the total of all the coefficients when the following equation is balanced with the lowest whole number coefficients?



A) 4

B) 8

C) 10

D) 12

Answer: B

Diff: 3

Section: 1-6

Global: G2

LO: 1.6

## 1.2 True/False

1) Air is a pure substance.

Answer: FALSE

Diff: 1

Section: 1-1

Global: G1

LO: 1.1

2) Steam is a mixture.

Answer: FALSE

Diff: 1

Section: 1-1

Global: G1

LO: 1.1

3) Selenium is a nonmetal.

Answer: TRUE

Diff: 1

Section: 1-2

Global: G1

LO: 1.2

4) A group is a vertical column on the periodic table.

Answer: TRUE

Diff: 1

Section: 1-2

Global: G1

LO: 1.2

5) Radon is a noble gas.

Answer: TRUE

Diff: 1

Section: 1-2

Global: G1

LO: 1.2

6) Antimony is a metal.

Answer: FALSE

Diff: 1

Section: 1-2

Global: G1

LO: 1.2

7) Iron is an example of a micronutrient.

Answer: TRUE

Diff: 1

Section: 1-2

Global: G1

LO: 1.2

8)  $1 \text{ m} = 10^{-6} \mu\text{m}$

Answer: FALSE

Diff: 1

Section: 1-3

Global: G3

LO: 1.3

9) Kinetic energy is stored energy.

Answer: FALSE

Diff: 1

Section: 1-4

Global: G1

LO: 1.4

10) A Calorie is equivalent to 1000 calories.

Answer: TRUE

Diff: 1

Section: 1-4

Global: G3

LO: 1.4

### 1.3 Short Answer

1) Classify each of the following as a *pure substance* or a *mixture*; if a mixture, indicate whether it is *homogeneous* or *heterogeneous*.

- A) Concrete
- B) Iodine crystals
- C) Gasoline
- D) White chocolate macadamia nut cookies
- E) Vegetable soup
- F) Aluminum metal

Answer:

- A) heterogenous mixture
- B) pure substance
- C) homogeneous mixture
- D) heterogenous mixture
- E) heterogenous mixture
- F) pure substance

Diff: 1

Section: 1-1

Global: G1

LO: 1.1

2) Identify the number of particles of each element in the following compounds:

- A)  $\text{H}_2\text{O}_2$  — hydrogen peroxide
- B)  $\text{C}_6\text{H}_{12}\text{O}_6$  — glucose
- C)  $\text{CaCO}_3$  — chalk

Answer:

- A) 2 hydrogen atoms, 2 oxygen atoms
- B) 6 carbon atoms, 12 hydrogen atoms, 6 oxygen atoms
- C) 1 calcium atom, 1 carbon atom, 3 oxygen atoms

Diff: 1

Section: 1-2

Global: G2

LO: 1.2

3) A horizontal row in the periodic table is called a \_\_\_\_\_.

Answer: period

Diff: 1

Section: 1-2

Global: G1

LO: 1.2



4) Write the total number of atoms in each of the following formulas.

A)  $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$

B)  $(\text{NH}_4)_3\text{PO}_4$

C)  $\text{C}_6\text{H}_4(\text{CH}_3)(\text{C}_2\text{H}_5)$ ?

D)  $\text{AlO}(\text{NO}_3)_2$

E)  $\text{Fe}_3(\text{PO}_4)_2$

Answer: A) 21, B) 20, C) 21, D) 10, E) 13

Diff: 1

Section: 1-2

Global: G2

LO: 1.2

5) A vertical column in the periodic table is called a \_\_\_\_\_.

Answer: group

Diff: 1

Section: 1-2

Global: G1

LO: 1.2

6) What is the number of *significant figures* in each of the following numbers?

A) 20.03 kg \_\_\_\_\_

B) 190. L \_\_\_\_\_

C) 120 M \_\_\_\_\_

D) 0.00067  $\text{cm}^3$  \_\_\_\_\_

E) 0.0580 in \_\_\_\_\_

F) 35,500 people \_\_\_\_\_

Answer: A) 4; B) 3; C) 2; D) 2; E) 3; F) 3

Diff: 1

Section: 1-3

Global: G3

LO: 1.3

7) Express the following numbers in scientific notation.

A) 109,000

B) 0.00065

C) 61,000,000,000

D) 26

E) 0.00000720

Answer: A)  $1.09 \times 10^5$ , B)  $6.5 \times 10^{-4}$ , C)  $6.1 \times 10^{10}$ , D)  $2.6 \times 10^1$ ,  $7.20 \times 10^{-6}$

Diff: 2

Section: 1-3

Global: G3

LO: 1.3

8) Express the following in *exponential form*:

- A) 5765
- B) 0.000365
- C) 102,000
- D) 0.00000240
- E) 602,000,000,000
- F) 2000

Answer: A)  $5.765 \times 10^3$ ; B)  $3.65 \times 10^{-4}$ ; C)  $1.02 \times 10^5$ ; D)  $2.40 \times 10^{-6}$ ; E)  $6.02 \times 10^{11}$ ; F)  $2 \times 10^3$

Diff: 2

Section: 1-3

Global: G3

LO: 1.3

9) Rewrite the following as *ordinary numbers*:

- A)  $6.75 \times 10^5$
- B)  $4.66 \times 10^{-4}$
- C)  $2.020 \times 10^3$
- D)  $1.11 \times 10^{-2}$
- E)  $23 \times 10^{-5}$

Answer: A) 675,000; B) 0.000466; C) 2020.; D) 0.0111; E) 0.000023

Diff: 2

Section: 1-3

Global: G3

LO: 1.3

10) Perform the following mathematical operations. Give the answer with the proper number of significant figures.

- A)  $(2.45 \times 10^5)(5.6 \times 10^4) =$
- B)  $(7.5 \times 10^7) \div (8.566 \times 10^5) =$
- C)  $(3.45 \times 10^{-9}) + (0.326 \times 10^{-9}) =$

Answer: A)  $1.4 \times 10^{10}$ ; B) 88; C)  $3.78 \times 10^{-9}$

Diff: 3

Section: 1-3

Global: G4

LO: 1.3

11) Calculate the following percentages.

A) 30% of 300

B) 7.5% of  $4.0 \times 10^5$

C) 0.50% of 0.060

Answer: A) 90, B)  $3.0 \times 10^4$ , C)  $3.0 \times 10^{-4}$

Diff: 2

Section: 1-3

Global: G4

LO: 1.3

12) Perform the following conversions within the metric system.

A) 55 cm = \_\_\_\_\_ m

B) 9535 m = \_\_\_\_\_ km

C) 87 dg = \_\_\_\_\_ g

D) 0.00376 L = \_\_\_\_\_ mL

Answer: A) 0.55 m; B) 9.535 km; C) 8.7 g; D) 3.76 mL

Diff: 1

Section: 1-3

Global: G4

LO: 1.3

13) Perform the following conversions.

A) 56 cm = \_\_\_\_\_ in

B)  $2.0 \text{ ft}^2 = \text{_____ cm}^2$

C) 19.8 qt = \_\_\_\_\_ L

D) 78.2 lb = \_\_\_\_\_ kg

Answer: A) 22 in, B)  $1.9 \times 10^3 \text{ cm}^2$ , C) 18.7 L, D) 35.5 kg

Diff: 2

Section: 1-3

Global: G4

LO: 1.3

14) Calculate the percentage by mass of the active ingredient in an antacid tablet that weighs 1.36 g if it contains 520 mg of calcium carbonate.

Answer: 38.2%

Diff: 1

Section: 1-3

Global: G4

LO: 1.3

15) Convert the following temperatures to the indicated units:

A) 549 °F to °C

B) 254 K to °C

C) 947 K to °F

D) 84°C to °F

E) 236°F to K

Answer: A) 287°C; B) -19°C; C) 1245°F; D) 183°F E) 386 K

Diff: 2

Section: 1-4

Global: G4

LO: 1.4

16) Express the following quantities in joules.

A) 74.6 cal

B)  $1.45 \times 10^4$  kcal

C) 296 Cal

Answer: A) 312 J, B)  $6.07 \times 10^7$  J, C)  $1.24 \times 10^6$  J

Diff: 2

Section: 1-4

Global: G4

LO: 1.4

17) Express the following quantities in calories (cal).

A) 98.3 J

B)  $236 \times$  kJ

C) 127 kCal

Answer: A) 23.5 cal, B)  $5.64 \times 10^4$  cal, C)  $1.27 \times 10^8$  cal

Diff: 2

Section: 1-4

Global: G4

LO: 1.4

18) Calculate the densities of the following objects. in g/mL

A) A mass of 86 g and a volume of 95 mL.

B) A mass of 1.6 kg and a volume of 1.3 L

C) A mass of 17 kg and a volume of 850 mL

D) A mass of 870 g and a volume of 25 dL

E) A mass of 45 mg and a volume of 45  $\mu$ L

Answer: all answers in g/mL: A) 0.91, B) 1.2, C) 20, D) 0.35, E) 1.0

Diff: 2

Section: 1-4

Global: G4

LO: 1.4

19) Calculate the mass of sugar in 250 g of a mixture that contains 35 mass percent sugar.

Answer: 88 g

Diff: 1

Section: 1-4

Global: G4

LO: 1.4

20) Calculate the total amount of drug required for a patient that weighs 160 lb if the dose is 25 mg/kg bodyweight.

Answer: 1.8 g

Diff: 1

Section: 1-5

Global: G4

LO: 1.5

21) Calculate the mass percent of fat in a candy bar that contains 12 g fat, 26 g carbohydrate, 6 g protein and 4 g of other material.

Answer: 25%

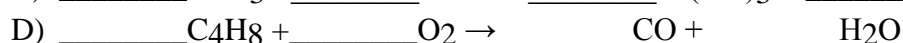
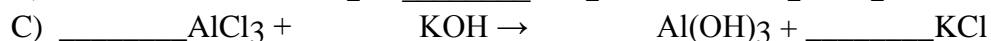
Diff: 1

Section: 1-5

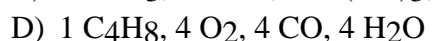
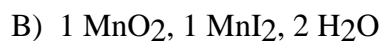
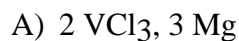
Global: G4

LO: 1.5

22) Insert the coefficients to balance the following equations.



Answer:



Diff: 3

Section: 1-6

Global: G2

LO: 1.6