# Chapter 2 Chemistry and Measurements

## 2.1 Multiple-Choice Questions

1) The metric base unit for length is the
A) meter.
B) inch.
C) millimeter.
D) kilometer.
E) foot.
Answer: A
Objective: 2.1
Global Outcomes: GO2

2) The metric unit for volume is the
A) meter.
B) quart.
C) liter.
D) pint.
E) centimeter.
Answer: C
Objective: 2.1
Global Outcomes: GO2

3) Which of the following is the basic unit of mass in the SI?
A) pound
B) kilogram
C) milligram
D) microgram
E) gram
Answer: B
Objective: 2.1
Global Outcomes: GO2

4) Which of the following is a measurement of mass in the metric system?
A) milliliter
B) centimeter
C) kilogram
D) Celsius
E) meter
Answer: C
Objective: 2.1
Global Outcomes: GO2

5) Which of the following is a measurement of temperature in the metric system?
A) oz
B) lb
C) Celsius
D) kilogram
E) meter
Answer: C
Objective: 2.1
Global Outcomes: GO2

6) A value of 25 °C is a measurement of
A) distance.
B) volume.
C) temperature.
D) mass.
E) density.
Answer: C
Objective: 2.1
Global Outcomes: GO2

7) A value of 36 mL is a measure of
A) density.
B) mass.
C) temperature.
D) volume.
E) distance.
Answer: D
Objective: 2.1
Global Outcomes: GO2

8) A value of 345 cm is a measure of
A) density.
B) mass.
C) temperature.
D) volume.
E) distance.
Answer: E
Objective: 2.1
Global Outcomes: GO2

9) The amount of space occupied by a substance is its
A) mass.
B) density.
C) weight.
D) length.
E) volume.
Answer: E
Objective: 2.1
Global Outcomes: GO2

10) The measurement of the gravitational pull on an object is its
A) volume.
B) weight.
C) mass.
D) length.
E) size.
Answer: B
Objective: 2.1
Global Outcomes: GO2

11) Significant figures are important because they indicate
A) the accuracy of a measurement.
B) the number of digits on a calculator.
C) the number of measurements.
D) the precision of a measurement.
E) the accuracy of the conversion factor.
Answer: D
Objective: 2.2
Global Outcomes: GO2

12) Which of the following measurements has three significant figures?
A) 0.005 m
B) 510 m
C) 0.510 m
D) 0.051 m
E) 5100 m
Answer: C
Objective: 2.2
Global Outcomes: GO4

13) Which of the following measured numbers contains the designated CORRECT number of significant figures?
A) 0.04300 5 significant figures
B) 0.00302 2 significant figures
C) 156 000 3 significant figures
D) 1.04 2 significant figures
E) 3.0650 4 significant figures
Answer: C
Objective: 2.2
Global Outcomes: GO4

14) The number of significant figures in the measurement of 45.030 mm is
A) none.
B) three.
C) four.
D) five.
E) six.
Answer: D
Objective: 2.2
Global Outcomes: GO4

15) How many significant figures are in the measured number 0.00208 m?
A) six
B) two
C) three
D) four
E) five
Answer: C
Objective: 2.2
Global Outcomes: GO4

16) Which of the following examples illustrates a number that is correctly rounded to three significant figures?
A) 4.05438 grams to 4.054 grams
B) 0.03954 grams to 0.040 grams
C) 103.692 grams to 103.7 grams
D) 109,526 grams to 109 500 grams
E) 20.0332 grams to 20.0 grams
Answer: E
Objective: 2.2
Global Outcomes: GO2

17) A calculator answer of 423.6059 must be rounded off to three significant figures. What answer is reported?
A) 423
B) 424
C) 420
D) 423.6
E) 423.7
Answer: B
Objective: 2.3
Global Outcomes: GO4

18) Which of the answers for the following conversions contains the correct number of significant figures?

A) $2.543 \text{ m} \times \frac{39.4 \text{ in}}{1 \text{ m}} = 100.1942 \text{ in}$

B) $2 \text{ L} \times \frac{1.06 \text{ qt}}{1 \text{ L}} = 2.12 \text{ qt}$

C) $24.95 \text{ min} \times \frac{1 \text{ hr}}{60 \text{ min}} = 0.4158 \text{ hr}$

D) $12.0 \text{ ft} \times \frac{12 \text{ in.}}{1 \text{ ft}} \times \frac{2.54 \text{ cm}}{1 \text{ in}} = 370 \text{ cm}$

E) $24.0 \text{ kg} \times \frac{1 \text{ lb}}{2.20 \text{ kg}} = 11 \text{ lb}$

Answer: C
Objective: 2.3
Global Outcomes: GO4

19) What is the correct answer for the calculation of a volume (in mL) with measured numbers $\frac{28.58}{16 \times 8.02}$?

A) 0.22 mL
B) 0.223 mL
C) 57 mL
D) 14 mL
E) 14.3 mL
Answer: A
Objective: 2.3
Global Outcomes: GO4

20) A researcher added three samples of sodium chloride solution; the volumes were: 0.351 mL, 0.350 mL and 0.349 mL. The total volume should be reported as
A) 1.05 mL.
B) 1.0 mL.
C) 11 mL.
D) 1.050 mL.
E) 1.0500 mL.
Answer: D
Objective: 2.3
Global Outcomes: GO9

21) When 2610 + 11.7 + 0.22 are added, the answer to the correct number of decimal places is
A) 2621.92.
B) 2621.9.
C) 2621.
D) 2620.
E) 2600.
Answer: D
Objective: 2.3
Global Outcomes: GO4

22) What is the answer, with the correct number of decimal places, for this problem?

4.392 g + 102.40 g + 2.51 g =

A) 109.302 g
B) 109 g
C) 109.3 g
D) 109.30 g
E) 110 g
Answer: D
Objective: 2.3
Global Outcomes: GO4

23) The correct answer for the addition of 7.5 g + 2.26 g + 1.311 g + 2 g is
A) 13.071 g.
B) 13 g.
C) 13.0 g.
D) 10 g.
E) 13.1 g.
Answer: B
Objective: 2.3
Global Outcomes: GO4

24) What is the correct answer for the calculation $\frac{36 \times 0.12345}{6.77}$?

A) 0.65645
B) 0.656
C) 0.66
D) 1.52
E) 1.5
Answer: C
Objective: 2.3
Global Outcomes: GO4

25) 5.21 cm is the same distance as
A) 0.0521 m.
B) 52.1 dm.
C) 5.21 mm.
D) 0.00521 km.
E) 5210 m.
Answer: A
Objective: 2.4
Global Outcomes: GO2

26) Which of the following measurements are NOT equivalent?
A) 25 mg = 0.025 g
B) 183 L = 0.183 kL
C) 150. ms = 0.150 s
D) 84 cm = 8.4 mm
E) 24 dL = 2.4 L
Answer: D
Objective: 2.4
Global Outcomes: GO2

27) In which of the following is the metric unit paired with its correct abbreviation?
A) microgram / mg
B) milliliter / mL
C) centimeter / km
D) kilogram / cg
E) gram / gm
Answer: B
Objective: 2.4
Global Outcomes: GO2

28) Which of the following is the largest unit?
A) millimeter
B) micrometer
C) meter
D) decimeter
E) kilometer
Answer: E
Objective: 2.4
Global Outcomes: GO2

29) What is the metric relationship between grams and micrograms?
A) 1 g = 100 μg
B) 1 g = 1 000 000 μg
C) 1 g = 0.000 001 μg
D) 1 g = 1000 μg
E) 1 g = 0.001 μg
Answer: B
Objective: 2.4
Global Outcomes: GO2

30) Which of the following is the smallest unit?
A) gram
B) milligram
C) kilogram
D) decigram
E) microgram
Answer: E
Objective: 2.4
Global Outcomes: GO2

31) The cubic centimeter ($cm^3$ or cc) has the same volume as a
A) cubic inch.
B) cubic liter.
C) milliliter.
D) centimeter.
E) cubic decimeter.
Answer: C
Objective: 2.4
Global Outcomes: GO2

32) 9.31 g is the same mass as
A) 931 μg.
B) 931 kg.
C) 93.1 cg.
D) 9310 mg.
E) 0.0931 dg.
Answer: D
Objective: 2.4
Global Outcomes: GO2

33) What is the conversion factor for the relationship between millimeters and centimeters?
A) 1 mm/1 cm
B) 10 mm/1 cm
C) 1 cm/1 mm
D) 100 mm/1 cm
E) 10 cm/1 mm
Answer: B
Objective: 2.5
Global Outcomes: GO2

34) A conversion factor set up correctly to convert 15 inches to centimeters is
A) 100 cm/1 m.
B) 1 inch/2.54 cm.
C) 1 cm/10 mm.
D) 2.54 cm/1 inch.
E) 10 cm/1 inch.
Answer: D
Objective: 2.5
Global Outcomes: GO2

35) Which of the following conversion factors is a measured number?
A) 10 cm/dm
B) 12 in/ft
C) 16 oz/lb
D) 25 miles/gallon
E) 12 eggs/dozen
Answer: D
Objective: 2.5
Global Outcomes: GO2

36) According to the United States Food and Drug Administration, the recommended daily requirement of protein is 44 g. This is _____ oz of protein.
A) 1248.5
B) 320 000
C) 1.6
D) 0.0605
E) 150 000
Answer: C
Objective: 2.6
Global Outcomes: GO4

37) Which of the following setups would convert centimeters to feet?
A) $\text{cm} \times \frac{2.54\ \text{in.}}{1\ \text{cm}} \times \frac{1\ \text{ft}}{12\ \text{in.}}$
B) $\text{cm} \times \frac{2.54\ \text{cm}}{1\ \text{in.}} \times \frac{12\ \text{in.}}{1\ \text{ft}}$
C) $\text{cm} \times \frac{1\ \text{in.}}{2.54\ \text{cm}} \times \frac{1\ \text{ft}}{12\ \text{in.}}$
D) $\text{cm} \times \frac{1\ \text{in.}}{2.54\ \text{cm}} \times \frac{12\ \text{in.}}{1\ \text{ft}}$
E) $\text{cm} \times \frac{2.54\ \text{cm}}{1\ \text{in.}} \times \frac{1\ \text{ft}}{12\ \text{in.}}$
Answer: C
Objective: 2.6
Global Outcomes: GO2

38) The EPA limit for lead in the soil of play areas is 400 ppm. This is the same as
A) 400 mg lead in each gram of soil.
B) 400 g lead in each kilogram of soil.
C) 400 mg lead in each kilogram of soil.
D) 400 μg lead in each kilogram of soil.
E) 400 μg lead in each milligram of soil.
Answer: C
Objective: 2.6
Global Outcomes: GO2

39) How many pounds are in 3.5 kg?
A) 7.7 lb
B) 1.59 lb
C) 0.629 lb
D) 1.6 lb
E) 7.70 lb
Answer: A
Objective: 2.6
Global Outcomes: GO4

40) How many centimeters are there in 57.0 in.?
A) 22 cm
B) 0.0445 cm
C) 145 cm
D) 22.4 cm
E) 140 cm
Answer: C
Objective: 2.6
Global Outcomes: GO4

41) How many kilograms are in 30.4 lb?
A) 13.8 kg
B) 14 kg
C) 67 kg
D) 66.88 kg
E) 66.9 kg
Answer: A
Objective: 2.6
Global Outcomes: GO4

42) How many liters of soft drink are there in 5.25 qt?
A) 4950 L
B) 55.7 L
C) 4.95 L
D) 5.57 L
E) 5.0 L
Answer: C
Objective: 2.6
Global Outcomes: GO4

43) What is 6.5 m converted to inches?
A) 1700 in
B) 1651 in
C) 39 in
D) 260 in
E) 255.9 in
Answer: D
Objective: 2.6
Global Outcomes: GO4

44) 1.00 pint of milk has a volume of how many milliliters? (2 pints = 1 quart)
A) 472 mL
B) 530. mL
C) 1000 mL
D) 1890 mL
E) 106 mL
Answer: A
Objective: 2.6
Global Outcomes: GO4

45) What is the volume of a cube that measures 4.00 cm on each side?
A) 16.0 mL
B) 64.0 L
C) 64.0 mL
D) 64.00 mL
E) 0.640 L
Answer: C
Objective: 2.6
Global Outcomes: GO4

46) Grapes are $1.49 per pound. What is the cost of 1.20 kg of grapes?
A) $3.93
B) $2.73
C) $1.79
D) $0.81
E) $0.56
Answer: A
Objective: 2.6
Global Outcomes: GO4

47) A driver is traveling at 60 km/h. Is the driver speeding if the speed limit is 45 mph?
A) Yes
B) No
Answer: B
Objective: 2.6
Global Outcomes: GO4

48) How many kilograms are in 30.4 lb?
A) 13.8 kg
B) 14 kg
C) 67 kg
D) 66.88 kg
E) 66.9 kg
Answer: A
Objective: 2.6
Global Outcomes: GO4

49) A dose of aspirin of 5.0 mg per kilogram of body weight has been prescribed to reduce the fever of an infant weighing 8.5 pounds. The number of milligrams of aspirin that should be administered is
A) 19 mg.
B) 53 mg.
C) 1.6 mg.
D) 5.0 mg.
E) 0.59 mg.
Answer: A
Objective: 2.6
Global Outcomes: GO4

50) A doctor's order is 0.125 g of ampicillin. The liquid suspension on hand contains 250 mg/5.0 mL. How many milliliters of the suspension are required?
A) 0.0025 mL
B) 3.0 mL
C) 2.5 mL
D) 6.3 mL
E) 0.0063 mL
Answer: C
Objective: 2.7
Global Outcomes: GO4

51) A nugget of gold with a mass of 521 g is added to 50.0 mL of water. The water level rises to a volume of 77.0 mL. What is the density of the gold?
A) 10.4 g/mL
B) 6.77 g/mL
C) 1.00 g/mL
D) 0.0518 g/mL
E) 19.3 g/mL
Answer: E
Objective: 2.7
Global Outcomes: GO4

52) Which one of the following substances will float in gasoline, which has a density of 0.66 g/mL?
A) table salt (density = 2.16 g/mL)
B) balsa wood (density = 0.16 g/mL)
C) sugar (density = 1.59 g/mL)
D) aluminum (density = 2.70 g/mL)
E) mercury (density = 13.6 g/mL)
Answer: B
Objective: 2.7
Global Outcomes: GO4

53) What is the mass of 2.00 L of an intravenous glucose solution with a density of 1.15 g/mL?
A) 0.023 kg
B) 2.30 kg
C) 1.15 kg
D) 0.015 kg
E) 0.58 kg
Answer: B
Objective: 2.7
Global Outcomes: GO4

54) Mercury has a specific gravity of 13.6. How many milliliters of mercury have a mass of 0.35 kg?
A) 0.0257 mL
B) 0.026 mL
C) 25.7 mL
D) 26 mL
E) 4760 mL
Answer: D
Objective: 2.7
Global Outcomes: GO4

55) What is the density of a substance with a mass of 45.00 g and a volume of 26.4 mL?
A) 1.70 g/mL
B) 1.7 g/mL
C) 0.59 g/mL
D) 0.587 g/mL
E) 45.0 g/mL
Answer: A
Objective: 2.7
Global Outcomes: GO4

56) A liquid has a volume of 34.6 mL and a mass of 46.0 g. What is the density of the liquid?
A) 1.00 g/mL
B) 1.33 g/mL
C) 0.752 g/mL
D) 1330 g/mL
E) 0.663 g/mL
Answer: B
Objective: 2.7
Global Outcomes: GO4

57) What is the mass of 53 mL of ethanol, which has a density of 0.79 g/mL?
A) 67.1 g
B) 41.9 g
C) 42 g
D) 67 g
E) 53 g
Answer: C
Objective: 2.7
Global Outcomes: GO4

58) The density of a solution is 0.847 g/mL. Its specific gravity is
A) 11.8.
B) 0.118.
C) 0.847.
D) 1.18.
E) 1.2.
Answer: C
Objective: 2.7
Global Outcomes: GO4

59) The specific gravity of a solution is 1.18. Its density is
A) 11.8 g/mL.
B) 0.118 g/mL.
C) 0.847 g/mL.
D) 1.18 g/mL.
E) 1.2 g/mL.
Answer: D
Objective: 2.7
Global Outcomes: GO2

60) Diamond has a density of 3.52 g/mL. What is the volume in cubic centimeters of a diamond with a mass of 15.1 g?
A) 4.3 $cm^3$
B) 4.29 $cm^3$
C) 0.233 $cm^3$
D) 53 $cm^3$
E) 53.2 $cm^3$
Answer: B
Objective: 2.7
Global Outcomes: GO4

61) The ratio of the mass of a substance to its volume is its
A) specific gravity.
B) density.
C) buoyancy.
D) weight.
E) conversion factor.
Answer: B
Objective: 2.7
Global Outcomes: GO2

62) Which of the following is often used to determine an individual's percentage of body fat?
A) temperature
B) height
C) weight loss
D) weight gain
E) density
Answer: E
Objective: 2.7
Global Outcomes: GO2

63) A 50.0 mL urine sample has a mass of 50.7 g. The specific gravity of the urine is
A) 1.014 g/mL.
B) 0.986 g/L.
C) 1.01.
D) 0.986.
E) 50.7.
Answer: C
Objective: 2.7
Global Outcomes: GO4

## 2.2 Short Answer Questions

*Round off each of the following to three significant figures.*

1) 504.85
Answer: 505
Objective: 2.3
Global Outcomes: GO4

2) 8.3158
Answer: 8.32
Objective: 2.3
Global Outcomes: GO4

3) 25 225
Answer: 25 200
Objective: 2.3
Global Outcomes: GO4

4) 58.5422
Answer: 58.5
Objective: 2.3
Global Outcomes: GO4

5) $6.3477 \times 10^4$
Answer: $6.35 \times 10^4$
Objective: 2.3
Global Outcomes: GO4

6) 399870
Answer: $4.00 \times 10^5$
Objective: 2.3
Global Outcomes: GO4

7) 0.003 408 8
Answer: 0.003 41
Objective: 2.3
Global Outcomes: GO4

*State the number of significant figures in each of the following measurements.*

8) 0.008 090 cm
Answer: 4
Objective: 2.2
Global Outcomes: GO4

9) 680 000 km
Answer: 2
Objective: 2.2
Global Outcomes: GO4

10) 28.050 km
Answer: 5
Objective: 2.2
Global Outcomes: GO4

11) 0.0005 L
Answer: 1
Objective: 2.2
Global Outcomes: GO4

12) 75.00 m
Answer: 4
Objective: 2.2
Global Outcomes: GO4

13) $2.043 \times 10^4$ mm
Answer: 4
Objective: 2.2
Global Outcomes: GO4

14) $6.1 \times 10^{-5}$ mL
Answer: 2
Objective: 2.2
Global Outcomes: GO3

15) $9.00 \times 10^{6}$ g
Answer: 3
Objective: 2.2
Global Outcomes: GO4

## 2.3 True/False Questions

1) The basic unit of mass in the metric system is the pound.
Answer: FALSE
Objective: 2.1
Global Outcomes: GO2

2) The liter is a unit of volume in the metric system.
Answer: TRUE
Objective: 2.1
Global Outcomes: GO2

3) The number 0.0500 has four significant figures.
Answer: FALSE
Objective: 2.2
Global Outcomes: GO4

4) The number 650 000 has two significant figures.
Answer: TRUE
Objective: 2.2
Global Outcomes: GO4

5) When the measured number 0.0090 is multiplied by the measured number 87.10, the answer has two significant figures.
Answer: TRUE
Objective: 2.3
Global Outcomes: GO4

6) When the measured number 675 is added to the measured number 87.10, the answer should be rounded to the ones place.
Answer: TRUE
Objective: 2.3
Global Outcomes: GO4

7) A μg is larger than a mg.
Answer: FALSE
Objective: 2.4
Global Outcomes: GO2

8) There are 1000 μg in a mg.
Answer: TRUE
Objective: 2.4
Global Outcomes: GO2

9) A cubic centimeter is a unit of length.
Answer: FALSE
Objective: 2.4
Global Outcomes: GO2

10) 1 kilogram is the same as 1000 mg.
Answer: FALSE
Objective: 2.4
Global Outcomes: GO2

11) 1 milliliter is the same as 1000 L.
Answer: FALSE
Objective: 2.4
Global Outcomes: GO2

12) The density of water is 1 kg/mL.
Answer: FALSE
Objective: 2.7
Global Outcomes: GO2

13) Specific gravity has no units.
Answer: TRUE
Objective: 2.7
Global Outcomes: GO2

## 2.4 Matching Questions

*Are the numbers in each of the following statements measured or exact?*

A) measured
B) exact

1) In the U.S. system there are 5280 feet in one mile.
Objective: 2.2
Global Outcomes: GO2

2) The patient's blood sugar level is 350 mg/dL.
Objective: 2.2
Global Outcomes: GO2

3) There are 452 pages in a book.
Objective: 2.2
Global Outcomes: GO2

4) The rabbit weighs 2.5 pounds.
Objective: 2.2
Global Outcomes: GO2

5) There are 100 capsules in the bottle.
Objective: 2.2
Global Outcomes: GO2

6) I lost 14 pounds on my diet last month.
Objective: 2.2
Global Outcomes: GO2

7) 1 liter is equal to 1.06 quarts.
Objective: 2.2
Global Outcomes: GO2

8) The patient's temperature is 100.1 °F.
Objective: 2.2
Global Outcomes: GO2

Answers: 1) B 2) A 3) B 4) A 5) B 6) A 7) A 8) A

*Match the type of measurement to the unit given below.*

A) volume
B) mass
C) temperature
D) distance
E) density

9) milliliter
Objective: 2.1
Global Outcomes: GO2

10) mm
Objective: 2.1
Global Outcomes: GO2

11) gram
Objective: 2.1
Global Outcomes: GO2

12) 125 K
Objective: 2.1
Global Outcomes: GO2

13) kilometer
Objective: 2.1
Global Outcomes: GO2

14) milligram
Objective: 2.1
Global Outcomes: GO2

Answers: 9) A 10) D 11) B 12) C 13) D 14) B

*Select the correct prefix to complete the equality.*

A) $1 \times 10^{12}$
B) 1000
C) 1
D) 0.1
E) 0.01
F) 0.001
G) $1 \times 10^{-12}$
H) 10
I) 100

15) 1 g = _____ kg
Objective: 2.4
Global Outcomes: GO2

16) 1 m = _____ mm
Objective: 2.4
Global Outcomes: GO2

17) 1 cm = _____ mm
Objective: 2.4
Global Outcomes: GO2

18) 1 dL = _____ mL
Objective: 2.4
Global Outcomes: GO2

19) 1 kg = _____ g
Objective: 2.4
Global Outcomes: GO2

20) 1 pg = _____ g
Objective: 2.4
Global Outcomes: GO2

21) 1 g = _____ pg
Objective: 2.4
Global Outcomes: GO2

22) 1 mL = _____ cc
Objective: 2.4
Global Outcomes: GO2

Answers: 15) F 16) B 17) H 18) I 19) B 20) G 21) A 22) C