

# Test Bank by General Chemistry The Essential Concepts 7th Edition by Chang and Goldsby ISBN 0073402753 9780073402758

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## Chapter 01: Introduction

1. A tentative explanation for a set of observations that can be tested by further experimentation is referred to as  
A) a hypothesis. B) a law. C) a theory. D) none of the above.  
Ans: A Category: Easy Section: 1.2
2. A concise verbal or mathematical statement of a relationship between phenomena that is always the same under the same conditions is referred to as  
A) a hypothesis. B) a law. C) a theory. D) none of the above.  
Ans: B Category: Easy Section: 1.2
3. A unifying principle that explains a body of facts and relations is referred to as  
A) a hypothesis. B) a law. C) a theory. D) none of the above.  
Ans: C Category: Easy Section: 1.2
4. Complete the following sentence. A *hypothesis* is  
A) a tentative explanation for a set of observations that can be tested by further experimentation.  
B) a statement describing a relationship between phenomena that is always the same under the same conditions.  
C) a unifying principle that explains a body of facts and relations.  
D) a model used to visualize the invisible.  
Ans: A Category: Easy Section: 1.2

5. Complete the following sentence. A *scientific law* is
- A) a tentative explanation for a set of observations that can be tested by further experimentation.
  - B) a statement describing a relationship between phenomena that is always the same under the same conditions.
  - C) a unifying principle that explains a body of facts and relations.
  - D) a model used to visualize the invisible.
- Ans: B Category: Easy Section: 1.2
6. Complete the following sentence. A *theory* is
- A) a tentative explanation for a set of observations that can be tested by further experimentation.
  - B) a statement describing a relationship between phenomena that is always the same under the same conditions.
  - C) a unifying principle that explains a body of facts and relations.
  - D) a model used to visualize the invisible.
- Ans: C Category: Easy Section: 1.2
7. Choose the response that includes all the items listed below that are pure substances.  
i. orange juice ii. steam iii. ocean water iv. oxygen v. vegetable soup
- A) i, iii, v
  - B) ii, iv
  - C) i, iii, iv
  - D) iv only
  - E) all of them are pure
- Ans: B Category: Easy Section: 1.2
8. Which of the following is an example of a *physical* property?
- A) corrosiveness of sulfuric acid
  - B) toxicity of cyanide
  - C) flammability of gasoline
  - D) neutralization of stomach acid with an antacid
  - E) lead becomes a liquid when heated to 601°C
- Ans: E Category: Easy Section: 1.4
9. Which one of the following is an example of a *physical* property?
- A) dynamite explodes
  - B) meat rots if it is not refrigerated
  - C) gasoline burns
  - D) ice floats on top of liquid water
  - E) a silver platter tarnishes
- Ans: D Category: Easy Section: 1.4
10. Which one of the following represents a *physical* change?
- A) water, when heated to 100°C, forms steam
  - B) bleach turns hair yellow
  - C) sugar, when heated, becomes brown
  - D) milk turns sour
  - E) apples, when exposed to air, turn brown
- Ans: A Category: Easy Section: 1.4

11. All of the following are properties of sodium. Which one is a *physical* property of sodium?
- A) It is a surface turns black when first exposed to air.
  - B) It is a solid at 25°C and changes to a liquid when heated to 98°C.
  - C) When placed in water it sizzles and a gas is formed.
  - D) When placed in contact with chlorine it forms a compound that melts at 801°C.
  - E) Sodium is never found as the pure metal in nature.

Ans: B Category: Easy Section: 1.4

12. All of the following are properties of tin. Which one is a *chemical* property of tin?
- A) Tin can be hammered into a thin sheet.
  - B) At -40°C a sheet of tin crumbles to a gray powder.
  - C) Tin melts at 231.9°C.
  - D) When a bar of tin is bent, it emits an audible “cry”.
  - E) Tin erodes when added to hydrochloric acid, and a clear gas forms.

Ans: E Category: Medium Section: 1.4

13. Which one of the following represents a *chemical* change?

- A) boiling water to form steam
- B) burning a piece of coal
- C) heating lead until it melts
- D) mixing iron filings and sand at room temperature
- E) breaking glass

Ans: B Category: Medium Section: 1.4

14. Which of the following does *not* represent a *chemical* change?

- A) a freshly cut apple turns brown
- B) milk turns sour on standing at room temperature
- C) when cooled to 0°C, liquid water becomes ice
- D) frying an egg
- E) fermentation of sugar to alcohol

Ans: C Category: Easy Section: 1.4

15. The SI prefixes *nano* and *deci* represent, respectively:

- A)  $10^{-9}$  and  $10^{-6}$ .
- B)  $10^6$  and  $10^{-3}$ .
- C)  $10^3$  and  $10^{-3}$ .
- D)  $10^9$  and  $10^{-6}$ .
- E)  $10^{-9}$  and  $10^{-1}$ .

Ans: E Category: Easy Section: 1.7

16. The SI prefixes *milli* and *mega* represent, respectively:

- A)  $10^6$  and  $10^{-6}$ .
- B)  $10^{-3}$  and  $10^6$ .
- C)  $10^3$  and  $10^{-6}$ .
- D)  $10^{-3}$  and  $10^9$ .
- E)  $10^{-6}$  and  $10^{-3}$ .

Ans: B Category: Easy Section: 1.7

17. The SI prefixes *kilo* and *centi* represent, respectively:

- A)  $10^3$  and  $10^{-2}$ .  
 B)  $10^6$  and  $10^{-1}$ .  
 C)  $10^{-3}$  and  $10^{-2}$ .
- D)  $10^{-6}$  and  $10^2$ .  
 E)  $10^2$  and  $10^{-3}$ .

Ans: A Category: Easy Section: 1.7

18. A nanometer corresponds to:

- A)  $10^{-2}$  meters.  
 B)  $10^{-3}$  meters.  
 C)  $10^{-6}$  meters.
- D)  $10^{-9}$  meters.  
 E)  $10^{-12}$  meters.

Ans: D Category: Easy Section: 1.7

19. A microliter corresponds to:

- A)  $10^{-2}$  liters. B)  $10^{-3}$  liters. C)  $10^{-6}$  liters. D)  $10^{-9}$  liters. E)  $10^{-12}$  liters.

Ans: C Category: Easy Section: 1.7

20. 6.0 km is how many micrometers?

- A)  $6.0 \times 10^6 \mu\text{m}$   
 B)  $1.7 \times 10^{-7} \mu\text{m}$   
 C)  $6.0 \times 10^9 \mu\text{m}$
- D)  $1.7 \times 10^{-4} \mu\text{m}$   
 E)  $6.0 \times 10^3 \mu\text{m}$

Ans: C Category: Medium Section: 1.7

21. 2.4 km is how many millimeters?

- A) 2,400 mm  
 B)  $2.4 \times 10^4$  mm  
 C)  $2.4 \times 10^5$  mm
- D)  $2.4 \times 10^6$  mm  
 E)  $2.4 \times 10^{-5}$  mm

Ans: D Category: Medium Section: 1.7

22. How many milliliters is 0.005 L?

- A) 0.5 mL B) 5 mL C) 0.50 mL D) 0.000005 mL E) 200 mL

Ans: B Category: Medium Section: 1.7

23. Express 7,500 nm as picometers.

- A) 7.50 pm B) 75.0 pm C) 750 pm D)  $7.5 \times 10^6$  pm E)  $7.5 \times 10^{12}$  pm

Ans: D Category: Medium Section: 1.7

24. The diameter of Earth is 12.7 Mm. Express this diameter in centimeters.

- A)  $1.27 \times 10^5$  cm  
 B)  $1.27 \times 10^6$  cm  
 C)  $1.27 \times 10^7$  cm
- D)  $1.27 \times 10^8$  cm  
 E)  $1.27 \times 10^9$  cm

Ans: E Category: Medium Section: 1.7

25. In 1828, the diameter of the U.S. dime was changed to approximately 18 mm. What is this diameter when expressed in nanometers?

- A)  $1.8 \times 10^9$  nm                      D)  $1.8 \times 10^{-5}$  nm  
B)  $1.8 \times 10^7$  nm                      E)  $1.8 \times 10^{-10}$  nm  
C)  $1.8 \times 10^1$  nm

Ans: B    Category: Medium    Section: 1.7

26. Which of the following represents the largest mass?

- A)  $2.0 \times 10^2$  mg                      D)  $2.0 \times 10^2$  cg  
B) 0.0010 kg                          E) 10.0 dg  
C)  $1.0 \times 10^5$  ng

Ans: D    Category: Medium    Section: 1.7

27. Lead melts at 601.0°C. What temperature is this in °F?

- A) 302°F    B) 365°F    C) 1,050°F    D) 1,082°F    E) 1,114°F

Ans: E    Category: Medium    Section: 1.7

28. The element gallium melts at 29.8°C. What temperature is this in °F?

- A) -54.1°F    B) -7.8°F    C) +13.5°F    D) +51.3°F    E) +85.6°F

Ans: E    Category: Medium    Section: 1.7

29. Many home freezers maintain a temperature of 0°F. Express this temperature in °C.

- A) -32°C    B) -18°C    C) 0°C    D) 18°C    E) 57.6°C

Ans: B    Category: Medium    Section: 1.7

30. The highest temperature ever recorded in Phoenix, Arizona, was 122°F. Express this temperature in °C.

- A) 50.0°C    B) 64.4°C    C) 67.8°C    D) 162.0°C    E) 219.6°C

Ans: A    Category: Medium    Section: 1.7

31. Dry ice (carbon dioxide) changes from a solid to a gas at -78.5°C. What is this temperature in °F?

- A) -173°F  
B) -12.6°F  
C) -109°F  
D) -75.6°F  
E) none of them are within 2°F of the right answer

Ans: C    Category: Medium    Section: 1.7

32. Liquid nitrogen boils at  $-195.8^{\circ}\text{C}$ . Express the boiling point of liquid nitrogen in kelvin.

- A)  $-469.0\text{ K}$
- B)  $-77.4\text{ K}$
- C) all temperatures are  $0\text{ K}$  on the Kelvin scale
- D)  $77.4\text{ K}$
- E)  $469.0\text{ K}$

Ans: D Category: Medium Section: 1.7

33. Liquid nitrogen boils at  $-195.8^{\circ}\text{C}$ . Express the boiling point of liquid nitrogen in  $^{\circ}\text{F}$ .

- A)  $-384.4^{\circ}\text{F}$
- B)  $-352.4^{\circ}\text{F}$
- C)  $-320.4^{\circ}\text{F}$
- D)  $-140.8^{\circ}\text{F}$
- E)  $-76.8^{\circ}\text{F}$

Ans: C Category: Medium Section: 1.7

34. Express the number 26.7 in scientific notation.

- A)  $2.67 \times 10^{-2}$
- B)  $2.67 \times 10^{-1}$
- C)  $2.67 \times 10^1$
- D)  $2.67 \times 10^2$
- E) 26.7 is already written in scientific notation

Ans: C Category: Easy Section: 1.6

35. Express the number 0.000053 in scientific notation.

- A)  $5.3 \times 10^{-2}$
- B)  $5.3 \times 10^{-3}$
- C)  $5.3 \times 10^{-4}$
- D)  $5.3 \times 10^{-5}$
- E)  $5.3 \times 10^{-6}$

Ans: D Category: Easy Section: 1.6

36. The number  $1.050 \times 10^9$  has how many significant figures?

- A) 2
- B) 3
- C) 4
- D) 9
- E) 13

Ans: C Category: Easy Section: 1.6

37. How many significant figures are there in 1.3070 g?

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

Ans: B Category: Easy Section: 1.6

38. Express the fraction  $1/23$  as a decimal to 4 significant figures.

- A) 0.0434
- B) 0.0435
- C) 0.04347
- D) 0.04348
- E) 0.04350

Ans: D Category: Medium Section: 1.6

39. Express the fraction  $1/51$  in scientific notation to 3 significant figures.

- A)  $2 \times 10^{-2.00}$
- B)  $2.0 \times 10^{-2.00}$
- C)  $1.96 \times 10^{-2}$
- D)  $1.97 \times 10^{-2}$
- E)  $2.00 \times 10^{-2}$

Ans: C Category: Medium Section: 1.6

40. After carrying out the following operations, how many significant figures are appropriate to show in the result?

$$(13.7 + 0.027) \div 8.221$$

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

Ans: C Category: Medium Section: 1.6

41. How many significant figures does the result of the following operation contain?

$$8.52010 \times 7.9$$

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

Ans: A Category: Easy Section: 1.6

42. How many significant figures does the result of the following sum contain?

$$8.5201 + 1.93$$

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

Ans: D Category: Easy Section: 1.6

43. How many significant figures does the result of the following sum contain?

$$8.520 + 2.7$$

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

Ans: C Category: Easy Section: 1.6

44. How many significant figures does the difference  $218.7201 - 218.63$  contain?

A) 1 B) 2 C) 3 D) 5 E) 7

Ans: A Category: Easy Section: 1.6

45. Do the indicated arithmetic and give the answer to the correct number of significant figures.

$$(1.5 \times 10^{-4} \times 61.3) + 2.01 =$$

A) 2.0192 B) 2.0 C) 2.019 D) 2.02 E) 2.019195

Ans: D Category: Medium Section: 1.6

46. When  $7.02^{\circ}\text{C}$  is converted to the Fahrenheit scale, how many significant figures are there in the  $^{\circ}\text{F}$  result?

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

Ans: C Category: Medium Section: 1.6

47. How many cubic inches are in 1.00 liter?

A)  $61.0 \text{ in}^3$  B)  $155 \text{ in}^3$  C)  $394 \text{ in}^3$  D)  $1.64 \times 10^4 \text{ in}^3$  E) none of them

Ans: A Category: Medium Section: 1.7

48. Convert 500. milliliters to quarts. (1L = 1.06 qt)

A) 1.88 qt B) 0.472 qt C) 0.528 qt D)  $4.72 \times 10^5 \text{ qt}$  E)  $5.28 \times 10^5 \text{ qt}$

Ans: C Category: Medium Section: 1.7

49. A US barrel is 4.21 cubic feet. Express this volume in liters.  
 A)  $3.99 \times 10^{-5}$  L B)  $1.99 \times 10^{-2}$  L C) 19.9 L D) 105 L E) 119 L  
 Ans: E Category: Medium Section: 1.7
50. A barrel of oil contains 42.0 gallons. How many liters is this? (1L = 1.06 qt)  
 A) 9.9 L B) 11 L C) 142 L D) 158 L E) 178 L  
 Ans: D Category: Easy Section: 1.7
51. The average distance from Earth to the sun is  $9.3 \times 10^7$  miles. How many kilometers is this?  
 A)  $1.5 \times 10^8$  km D)  $1.7 \times 10^{-8}$  km  
 B)  $1.5 \times 10^5$  km E)  $1.5 \times 10^{11}$  km  
 C)  $5.6 \times 10^7$  km  
 Ans: A Category: Medium Section: 1.7
52. What is the area, in square centimeters, of an 8.5 inch by 11 inch sheet of paper?  
 A)  $94 \text{ cm}^2$  B)  $240 \text{ cm}^2$  C)  $420 \text{ cm}^2$  D)  $6.0 \times 10^2 \text{ cm}^2$  E)  $1.2 \times 10^4 \text{ cm}^2$   
 Ans: D Category: Medium Section: 1.7
53. Suppose a house has a floor area of 2,250 square feet. What is this area in units of square centimeters?  
 A)  $2.42 \text{ cm}^2$  D)  $6.86 \times 10^4 \text{ cm}^2$   
 B)  $2.09 \times 10^6 \text{ cm}^2$  E)  $101 \text{ cm}^2$   
 C)  $5.02 \times 10^4 \text{ cm}^2$   
 Ans: B Category: Medium Section: 1.7
54. What is the volume, in cubic inches, of a brick that is  $4.0 \text{ in} \times 2.7 \text{ in} \times 8.0 \text{ in}$ ?  
 A)  $15 \text{ in}^3$  B)  $51 \text{ in}^3$  C)  $78 \text{ in}^3$  D)  $87 \text{ in}^3$  E)  $150 \text{ in}^3$   
 Ans: D Category: Easy Section: 1.7
55. What is the volume, in cubic centimeters, of a brick that is  $4.0 \text{ in} \times 2.7 \text{ in} \times 8.0 \text{ in}$ ?  
 A)  $5.3 \text{ cm}^3$  B)  $53 \text{ cm}^3$  C)  $87 \text{ cm}^3$  D)  $4.8 \times 10^2 \text{ cm}^3$  E)  $1.4 \times 10^3 \text{ cm}^3$   
 Ans: E Category: Medium Section: 1.7
56. How many square kilometers are equivalent to  $28.5 \text{ cm}^2$ ?  
 A)  $2.85 \times 10^{-9} \text{ km}^2$  D)  $2.85 \times 10^{-4} \text{ km}^2$   
 B)  $2.85 \times 10^{-6} \text{ km}^2$  E) none of these  
 C)  $285 \text{ km}^2$   
 Ans: A Category: Medium Section: 1.7



57. How many cubic centimeters are there in exactly one cubic meter?  
 A)  $1 \times 10^{-6} \text{ cm}^3$  D)  $1 \times 10^4 \text{ cm}^3$   
 B)  $1 \times 10^{-3} \text{ cm}^3$  E)  $1 \times 10^6 \text{ cm}^3$   
 C)  $1 \times 10^{-2} \text{ cm}^3$   
 Ans: E Category: Easy Section: 1.7
58. If a car has an EPA mileage rating of 30 miles per gallon, what is this rating in kilometers per liter? (1 L = 1.06 qt)  
 A) 200 km/L B) 180 km/L C) 70 km/L D) 13 km/L E) 11 km/L  
 Ans: D Category: Medium Section: 1.7
59. If the price of gasoline is \$2.99 per U.S. gallon, what is the cost per liter? (1 L = 1.06 qt)  
 A) \$0.30/L B) \$0.79/L C) \$1.27/L D) \$2.99/L E) \$12.66/L  
 Ans: B Category: Medium Section: 1.7
60. An aluminum beverage can contains 12.0 fluid ounces of liquid. Express this volume in liters. (1 fl oz = 29.6 mL)  
 A)  $4.07 \times 10^{-2} \text{ L}$  B) 0.355 L C) 0.407 L D) 2.46 L E)  $3.55 \times 10^2 \text{ L}$   
 Ans: B Category: Easy Section: 1.7
61.  $157.2 \times 10^6$  troy oz of silver were used in the United States in 1980. How many gigagrams is this? (1 troy oz = 31.1 g)  
 A)  $4.89 \times 10^9 \text{ Gg}$  D) 3.12 Gg  
 B) 4.89 Gg E)  $5.05 \times 10^{-3} \text{ Gg}$   
 C)  $5.05 \times 10^{-9} \text{ Gg}$   
 Ans: B Category: Medium Section: 1.7
62. A piece of metal with a mass of 611 g is placed into a graduated cylinder that contains 25.1 mL of water, raising the water level to 56.7 mL. What is the density of the metal?  
 A)  $2.70 \text{ g/cm}^3$  B)  $7.13 \text{ g/cm}^3$  C)  $8.96 \text{ g/cm}^3$  D)  $10.5 \text{ g/cm}^3$  E)  $19.3 \text{ g/cm}^3$   
 Ans: E Category: Medium Section: 1.7
63. A piece of a metal alloy with a mass of 114 g was placed into a graduated cylinder that contained 25.0 mL of water, raising the water level to 42.5 mL. What is the density of the metal?  
 A)  $0.154 \text{ g/cm}^3$  D)  $6.51 \text{ g/cm}^3$   
 B)  $0.592 \text{ g/cm}^3$  E)  $7.25 \text{ g/cm}^3$   
 C)  $2.68 \text{ g/cm}^3$   
 Ans: D Category: Medium Section: 1.7

64. A block of iron has a mass of 826 g. What is the mass of a block of magnesium that has the same volume as the block of iron? The following densities at 25°C are provided: magnesium, 1.7 g/cm<sup>3</sup>; graphite, 1.8 g/cm<sup>3</sup>; iron, 7.9 g/cm<sup>3</sup>.

- A) 1,400 g
- B) 3,800 g
- C) 830 g
- D) 180 g
- E) none of them are within 10 g of the right answer.

Ans: D Category: Medium Section: 1.7

65. A block of iron has a mass of 483 g. What is the mass of a block of graphite that has the same volume as the block of iron? The following densities at 25°C are provided: magnesium, 1.7 g/cm<sup>3</sup>; graphite, 1.8 g/cm<sup>3</sup>; iron, 7.9 g/cm<sup>3</sup>.

- A) 110 g
- B) 2120 g
- C) 6870 g
- D) 34 g
- E) none of them are within 10 g of the right answer.

Ans: A Category: Medium Section: 1.7

66. Calculate the mass of the air contained in a room that measures 2.50 m × 5.50 m × 3.00 m (density of air = 1.29 g/dm<sup>3</sup> at 25°C).

- A)  $3.13 \times 10^{-5}$  g
- B) 32.0 kg
- C) 53.2 g
- D) 53.2 g
- E) None of the above.

Ans: C Category: Medium Section: 1.7

67. The density of lead is 11.4 g/cm<sup>3</sup> at 25°C. Calculate the volume occupied by 25.0 g of lead.

- A) 2.19 cm<sup>3</sup>
- B) 0.456 cm<sup>3</sup>
- C) 285 cm<sup>3</sup>
- D) 1.24 cm<sup>3</sup>
- E) 6.05 cm<sup>3</sup>

Ans: A Category: Easy Section: 1.7

68. Iron has a density of 7.86 g/cm<sup>3</sup>. The volume occupied by 55.85 g of iron is

- A) 0.141 cm<sup>3</sup>.
- B) 7.11 cm<sup>3</sup>.
- C) 2.8 cm<sup>3</sup>.
- D) 439 cm<sup>3</sup>.
- E) None of the above.

Ans: B Category: Easy Section: 1.7

69. Iridium is essentially tied with osmium for the distinction of being called the “densest element” with a density of 22.5 g/cm<sup>3</sup>. What would be the mass in pounds of a 1.0 ft × 1.0 ft × 1.0 ft cube of iridium? (1 lb = 453.6 g)

- A) 1.5 lb
- B) 5.2 lb
- C) 6.20 lb
- D)  $1.4 \times 10^3$  lb
- E)  $6.4 \times 10^5$  lb

Ans: D Category: Medium Section: 1.7

70. Bromine is a red liquid at 25°C. Its density is 3.12 g/cm<sup>3</sup>. What is the volume of 28.1 g of liquid bromine?

- A) 87.7 cm<sup>3</sup>                      D) 28.1 cm<sup>3</sup>  
B) 0.111 cm<sup>3</sup>                      E) None of the above.  
C) 9.01 cm<sup>3</sup>

Ans: C    Category: Easy    Section: 1.7

71. The Hope diamond weighs 44.0 carats. Determine the volume occupied by the diamond, given that its density is 3.5 g/cm<sup>3</sup> at 20°C, and that 1 carat = 0.200 g.

- A) 2.5 cm<sup>3</sup>    B) 0.40 cm<sup>3</sup>    C) 0.016 cm<sup>3</sup>    D) 63 cm<sup>3</sup>    E) 150 cm<sup>3</sup>

Ans: A    Category: Medium    Section: 1.7

72. What is the volume of a 2.5 g block of metal if its density is 4.75 g/cm<sup>3</sup>?

- A) 0.53 cm<sup>3</sup>    B) 1.9 cm<sup>3</sup>    C) 2.5 cm<sup>3</sup>    D) 4.75 cm<sup>3</sup>    E) 11.9 cm<sup>3</sup>

Ans: A    Category: Easy    Section: 1.7

73. The density of mercury is 13.6 g/cm<sup>3</sup>. What is the mass in pounds of 1.0 gallons of mercury? (1 lb = 453.6 g; 1 gal = 3.785 L)

- A) 0.11 lb    B) 30. lb    C) 51 lb    D) 83 lb    E) 110 lb

Ans: E    Category: Medium    Section: 1.7

74. The density of mercury is 13.6 g/cm<sup>3</sup>. What volume (in quarts) is occupied by 100. g of Hg? (1 L = 1.06 qt)

- A) 144 qt    B) 7.35 qt    C) 7.79 qt    D) 7.79 × 10<sup>-3</sup> qt    E) 1.44 × 10<sup>-4</sup> qt

Ans: D    Category: Medium    Section: 1.7

75. The "escape velocity" from Earth (the speed required to escape Earth's gravity) is 2.5 × 10<sup>4</sup> miles per hour. What is this speed in m/s? (1 mile = 1609 m)

- A) 4.2 × 10<sup>-3</sup> m/s                      D) 1.1 × 10<sup>4</sup> m/s  
B) 6.9 m/s                                E) 4.0 × 10<sup>7</sup> m/s  
C) 4.2 × 10<sup>2</sup> m/s

Ans: D    Category: Medium    Section: 1.7

76. Which of the following speeds is the greatest? (1 mile = 1609 m)

- A) 40 mi/h                                D) 0.74 km/min  
B) 2.0 × 10<sup>5</sup> mm/min                      E) 400 m/min  
C) 40 km/h

Ans: A    Category: Medium    Section: 1.7

77. Iron has a density of  $7.87 \text{ g/cm}^3$ . What mass of iron would be required to cover a football playing surface of  $120 \text{ yds} \times 60 \text{ yds}$  to a depth of  $1.0 \text{ mm}$ ? ( $1 \text{ inch} = 2.54 \text{ cm}$ ;  $1 \text{ lb} = 453.6 \text{ g}$ )

- |                                 |                                 |
|---------------------------------|---------------------------------|
| A) $6.4 \times 10^3 \text{ lb}$ | D) $4.7 \times 10^7 \text{ lb}$ |
| B) $6.4 \times 10^4 \text{ lb}$ | E) $4.7 \times 10^8 \text{ lb}$ |
| C) $1.0 \times 10^5 \text{ lb}$ |                                 |

Ans: C    Category: Difficult    Section: 1.7

78. Americans combined drive about  $4.0 \times 10^9$  miles per day and their vehicles get an average of 20 miles per gallon of fuel used. For each  $1 \text{ kg}$  of gasoline that is burned, about  $3.0 \text{ kg}$  of carbon dioxide are produced. How many kilograms of  $\text{CO}_2$  are emitted into the atmosphere each day by cars in the U.S.? One gallon of gas weighs about  $3.5 \text{ kg}$ .

- |                                    |                  |
|------------------------------------|------------------|
| A) $2.1 \times 10^9 \text{ kg}$    | D) 93 kg         |
| B) $8.4 \times 10^{11} \text{ kg}$ | E) none of these |
| C) $1.7 \times 10^8 \text{ kg}$    |                  |

Ans: A    Category: Difficult    Section: 1.7

79. How many cubic centimeters of an ore containing only 0.22% gold (by mass) must be processed to obtain  $\$100$  worth of gold? The density of the ore is  $8.0 \text{ g/cm}^3$  and the price of gold is  $\$818$  per troy ounce. ( $14.6 \text{ troy oz} = 1.0$  ordinary pound, called an avoirdupois pound;

$1 \text{ lb} = 454 \text{ g}$ )

- |                                   |                                   |
|-----------------------------------|-----------------------------------|
| A) $0.48 \text{ cm}^3$            | D) $1.7 \times 10^3 \text{ cm}^3$ |
| B) $220 \text{ cm}^3$             | E) $1.8 \times 10^4 \text{ cm}^3$ |
| C) $1.4 \times 10^3 \text{ cm}^3$ |                                   |

Ans: B    Category: Difficult    Section: 1.7

80. Radio waves travel at the speed of light, which is  $3.00 \times 10^8 \text{ m/s}$ . How many minutes does it take for a radio message to reach Earth from Saturn if Saturn is  $7.9 \times 10^8 \text{ km}$  from Earth?

- |                                     |            |
|-------------------------------------|------------|
| A) $4.4 \times 10^{-2} \text{ min}$ | D) 44 min  |
| B) $1.6 \times 10^5 \text{ min}$    | E) 2.6 min |
| C) $4.0 \times 10^{15} \text{ min}$ |            |

Ans: D    Category: Medium    Section: 1.7

81. Radio waves travel at the speed of light, which is  $3.00 \times 10^8 \text{ m/s}$ . How many kilometers will radio messages travel in exactly one year?

- |                                     |                                     |
|-------------------------------------|-------------------------------------|
| A) $9.46 \times 10^{15} \text{ km}$ | D) $9.46 \times 10^{12} \text{ km}$ |
| B) $7.30 \times 10^8 \text{ km}$    | E) $3.33 \times 10^{-3} \text{ km}$ |
| C) $7.10 \times 10^{10} \text{ km}$ |                                     |

Ans: D    Category: Medium    Section: 1.7

82. The city of Los Angeles is now approximately 2400 miles south of Alaska. It is moving slowly northward as the San Andreas fault slides along. If Los Angeles is to arrive near Anchorage, Alaska, in 76 million years, at what average rate will it have to move in mm per month?

- A)  $2.0 \times 10^{-10}$  mm/mo.                      D) 9.5 mm/mo.  
B)  $6.6 \times 10^{-6}$  mm/mo.                      E) 51 mm/mo.  
C) 4.2 mm/mo.

Ans: C    Category: Medium    Section: 1.7

83. The recommended daily allowance (RDA) of calcium is 1.2 g. Calcium carbonate contains 12.0% calcium by mass. How many grams of calcium carbonate are needed to provide the RDA of calcium?

- A) 0.10 g    B) 0.14 g    C) 1.2 g    D) 10 g    E) 14 g

Ans: D    Category: Medium    Section: 1.7

84. The radius of the Earth is approximately 6370 km. If one could dig down straight towards the center of the Earth, one would find that the outermost 2890 km (the crust and the mantle) has an average density of about  $4.5 \text{ g/cm}^3$ . Farther down is the core. If the average density of the Earth is  $5.5 \text{ g/cm}^3$ , what is the average density of the Earth's core? (Recall that the volume of a sphere is given by  $V = (4/3)\pi r^3$ .)

- A)  $11. \text{ g/cm}^3$                                       D)  $1.9 \text{ g/cm}^3$   
B)  $57. \text{ g/cm}^3$                                       E) not enough data is provided  
C)  $6.2 \text{ g/cm}^3$

Ans: A    Category: Difficult    Section: 1.7

85. The radius of the Earth is approximately 6370 km. If one could dig down straight towards the center of the Earth, one would find that the innermost 3480 km (the core) has an average density of about  $11. \text{ g/cm}^3$ . Above that are the mantle and crust. If the average density of the Earth is  $5.5 \text{ g/cm}^3$ , what is the average density of the Earth's mantle and crust? (Recall that the volume of a sphere is given by  $V = (4/3)\pi r^3$ .)

- A)  $57. \text{ g/cm}^3$                                       D)  $5.3 \text{ g/cm}^3$   
B)  $4.5 \text{ g/cm}^3$                                       E) not enough data is provided  
C)  $8.7 \text{ g/cm}^3$

Ans: B    Category: Difficult    Section: 1.7

86. An object sinks when placed in water if the mass of the object is greater than the mass of the water that the object displaces. Which of the following objects will sink when dropped into a bucket of water?

(Given: density of water =  $1.00 \text{ g/cm}^3$ )

- A) a cube of aluminum (density =  $2.702 \text{ g/cm}^3$ )  
B) a diamond (density =  $3.51 \text{ g/cm}^3$ )  
C) a chunk of dry ice (density =  $1.56 \text{ g/cm}^3$ )  
D) a chunk of sodium (density =  $0.91 \text{ g/cm}^3$ )  
E) a sphere of magnesium (density =  $1.74 \text{ g/cm}^3$ )

Ans: D    Category: Easy    Section: 1.7

87. An object will float at the surface of a liquid if the mass of the object is less than the mass of the liquid that it displaces. A spherical vessel (diameter = 2.00 cm) when empty has a mass of 2.00 g. What is the greatest volume of water that can be placed in the vessel and still have the vessel float at the surface of water?  
(Given: density of water =  $1.00 \text{ g/cm}^3$ )  
A) 2.00 mL  
B) 31.5 mL  
C) 2.19 mL  
D) 4.19 mL  
E) the vessel will not float even when empty  
Ans: C Category: Difficult Section: 1.7
88. An object will float at the surface of a liquid if the mass of the object is less than the mass of the liquid that it displaces. A spherical vessel (diameter = 5.00 cm) when empty has a mass of 12.00 g. What is the greatest volume of water that can be placed in the vessel and still have the vessel float at the surface of benzene?  
(Given: density of water =  $1.00 \text{ g/cm}^3$ ; density of benzene =  $0.879 \text{ g/cm}^3$ )  
A) 45.5 mL B) 448 mL C) 53.4 mL D) 57.5 mL E) 65.4 mL  
Ans: A Category: Difficult Section: 1.7
89. One of the common intravenous fluids, called physiological saline, is a homogeneous mixture of NaCl in water. In this mixture, 0.89% of the mass is contributed by the NaCl. What mass of NaCl is found in 450. mL of physiological saline?  
(Given: density of physiological saline =  $1.005 \text{ g/cm}^3$ )  
A) 2.0 g B) 4.0 g C) 5.1 g D) 508 g E) 400 g  
Ans: B Category: Medium Section: 1.7
90. A special flask used in the determination of densities, called a pycnometer, has a mass of 16.3179 g when empty, and it has a mass of 48.0250 g when filled with water at  $20.0^\circ\text{C}$ . When this same pycnometer is filled with ethyl alcohol at  $20.0^\circ\text{C}$ , it is found to have a mass of 41.3934 g. Find the density of ethyl alcohol at  $20.0^\circ\text{C}$ .  
(Given: at  $20.0^\circ\text{C}$ , the density of water is  $0.9982 \text{ g/mL}$ )  
A) 0.7894 g/mL D) 1.303 g/mL  
B) 0.7923 g/mL E) 0.7674 g/mL  
C) 0.7908 g/mL  
Ans: A Category: Medium Section: 1.7
91. A particular flask has a mass of 17.4916 g when empty. When filled with ordinary water at  $20.0^\circ\text{C}$  (density =  $0.9982 \text{ g/mL}$ ), the mass of the flask is now 43.9616 g. The density of so-called "heavy water" at  $20.0^\circ\text{C}$  is  $1.1053 \text{ g/mL}$ . What will the mass of the flask be when filled with heavy water at  $20.0^\circ\text{C}$ ?  
A) 29.2573 g B) 46.8016 g C) 46.7489 g D) 29.3100 g E) 43.9140 g  
Ans: B Category: Medium Section: 1.7

92. Define *matter*.  
Ans: Matter is anything that occupies space and has mass.  
Category: Easy Section: 1.4
93. What are the three states of matter?  
Ans: Solid, liquid, and gas  
Category: Easy Section: 1.5
94. What are the common names for the three states of the compound water?  
Ans: Ice, water, and steam  
Category: Easy Section: 1.5
95. Define *pure substance*.  
Ans: Something that has a definite composition  
Category: Easy Section: 1.4
96. Give three examples of pure substances.  
Ans: (Answers will vary.) Gold, sugar, oxygen, argon, water, methane  
Category: Easy Section: 1.4
97. Define *mixture*.  
Ans: A mixture is a combination of two or more substances in which the substances retain their distinct identities.  
Category: Easy Section: 1.4
98. Name two types of mixtures.  
Ans: Homogeneous mixture and heterogeneous mixture  
Category: Easy Section: 1.4
99. Give three examples of mixtures.  
Ans: (Answers will vary.) Air, gasoline, sea water, salt and sand, iron filings and sand  
Category: Easy Section: 1.4
100. Define *element*.  
Ans: An element is a substance that cannot be separated into simpler substances by chemical means.  
Category: Easy Section: 1.4
101. Define *compound*.  
Ans: A compound is a substance composed of atoms of two or more elements chemically united in fixed proportions.  
Category: Easy Section: 1.4

102. Give examples of three physical properties.  
Ans: (Answers will vary.) Melting point, boiling point, density, color  
Category: Easy Section: 1.4
103. Give an example of an *extensive* property.  
Ans: (Answers will vary.) Mass, length, and volume  
Category: Easy Section: 1.4
104. Give an example of an *intensive* property.  
Ans: (Answers will vary.) Temperature, density, melting point, boiling point  
Category: Easy Section: 1.4
105. Identify the following as a *physical* or *chemical* change: Bacteria convert milk to yogurt.  
Ans: Chemical  
Category: Easy Section: 1.4
106. Identify the following as a *physical* or *chemical* change: Water is broken down into hydrogen and oxygen.  
Ans: Chemical  
Category: Easy Section: 1.4
107. Identify the following as a *physical* or *chemical* change: Formation of snowflakes.  
Ans: Physical  
Category: Easy Section: 1.4
108. Identify the following as a *physical* or *chemical* change: Rusting of a piece of iron.  
Ans: Chemical  
Category: Easy Section: 1.4
109. Identify the following as a *physical* or *chemical* change: Ripening of fruit.  
Ans: Chemical  
Category: Easy Section: 1.4
110. Identify the following as a *physical* or *chemical* change: Fashioning a table leg from a piece of wood.  
Ans: Physical  
Category: Easy Section: 1.4
111. Identify the following as a *physical* or *chemical* change: Fermenting grapes.  
Ans: Chemical  
Category: Easy Section: 1.4



112. Classify the following as a *physical* or *chemical* change: Antifreeze boils out of a radiator.  
Ans: Physical  
Category: Easy Section: 1.4
113. Classify the following as a *physical* or *chemical* change: Food spoils.  
Ans: Chemical  
Category: Easy Section: 1.4
114. Classify the following as a *physical* or *chemical* change: Alcohol evaporates.  
Ans: Physical  
Category: Easy Section: 1.4
115. Classify the following as either a *physical* or a *chemical* property: Ice melts at 0°C.  
Ans: Physical  
Category: Easy Section: 1.4
116. Classify the following as either a *physical* or a *chemical* property: Newspaper burns.  
Ans: Chemical  
Category: Easy Section: 1.4
117. Classify the following as either a *physical* or a *chemical* property: The vitamin content of foods in contact with air falls.  
Ans: Chemical  
Category: Easy Section: 1.4
118. Classify the following as a *pure substance* or a *mixture*: Ice cream.  
Ans: Mixture  
Category: Easy Section: 1.4
119. Classify the following as a *pure substance* or a *mixture*: Bread.  
Ans: Mixture  
Category: Medium Section: 1.4
120. Classify the following as a *pure substance* or a *mixture*: Seven-Up®.  
Ans: Mixture  
Category: Easy Section: 1.4
121. Classify the following as an *element*, a *compound*, or a *mixture*: Air.  
Ans: Mixture  
Category: Easy
122. Classify the following as an *element*, a *compound*, or a *mixture*: Table salt (non-iodized).  
Ans: Compound  
Category: Medium

123. Classify the following as an *element*, a *compound*, or a *mixture*: Chicken broth.  
Ans: Mixture  
Category: Easy
124. Classify the following as an *element*, a *compound*, or a *mixture*: Oxygen gas.  
Ans: Element  
Category: Easy
125. Classify the following as a *mixture*, a *compound*, or an *element*: Brewed coffee, ready to drink.  
Ans: Mixture  
Category: Easy Section: 1.4
126. Classify the following as a *mixture*, a *compound*, or an *element*: Sugar to put in a cup of coffee.  
Ans: Compound  
Category: Easy Section: 1.4
127. Classify the following as a *mixture*, a *compound*, or an *element*: Orange juice.  
Ans: Mixture  
Category: Easy Section: 1.4
128. A pure yellow crystalline substance, when heated in a vacuum, releases a greenish gas and a red powder. Is the original yellow crystalline substance a compound or element?  
Ans: Compound  
Category: Medium Section: 1.4
129. In the process of fixing breakfast you:  
1. break open the egg  
2. fry it  
3. cut the fried egg into pieces  
4. toast a slice of bread  
5. cut the toast in half  
Which of these are chemical processes?  
Ans: 2 (frying the egg) and 4 (toasting the bread)  
Category: Medium Section: 1.4
130. An organic liquid has a density of  $0.8 \text{ g/cm}^3$ . What is the mass of a 42.0 mL sample of this liquid?  
Ans: 30 g  
Category: Easy Section: 1.7
131. What is the density of copper if  $11.8 \text{ cm}^3$  of copper has a mass of 105.2 g?  
Ans:  $8.92 \text{ g/cm}^3$   
Category: Easy Section: 1.7

132. An automobile engine has a piston displacement of  $1,600 \text{ cm}^3$ . Express this volume in liters.  
Ans: 1.6 L  
Category: Easy Section: 1.7
133. An automobile engine has a piston displacement of  $1,600 \text{ cm}^3$ . Express this volume in cubic inches. (1 in = 2.54 cm)  
Ans:  $98 \text{ in}^3$   
Category: Easy Section: 1.7
134. An investor paid market price for a chunk of gold that he was told was pure. The gold bar had a mass of 440 g, but was slightly irregular so an exact volume could not be calculated. The investor filled a large graduated cylinder with water, immersed the chunk of gold, and observed an increase in the apparent volume of material in the graduated cylinder of 25.0 mL. Pure gold has a density of  $19.3 \text{ g/cm}^3$ . Did the investor get her money's worth? Why or why not?  
Ans: No. The investor's metal density is  $17.6 \text{ g/cm}^3$ , thus the bar must not be pure gold.  
Category: Medium Section: 1.7
135. An American engineer who had been transferred to Europe was asked to build bridge pilings exactly as he had in the United States. Each piling required 20.0 cubic yards of concrete in the United States. How many cubic meters of concrete are required for each piling? Given: 1 yd = 0.914 m.  
Ans:  $15.3 \text{ m}^3$   
Category: Medium Section: 1.7
136. A soft drink costs 75 cents for a 12-oz can. A two-liter bottle costs \$1.25. In which form is the soft drink more expensive? How much more expensive? (1.0 L = 1.057 qt, 1 qt = 32 oz)  
Ans: The two-liter bottle is the better value. The can is over three times more expensive by volume.  
Category: Medium Section: 1.7
137. A person weighs 150 lb, and the correct dosage of a drug is given as 1.50 mg per kilogram of body weight. How many milligrams of the drug should be given? (2.20 lb = 1 kg)  
Ans: 102 mg  
Category: Medium Section: 1.7

138. You just measured a block of wood and obtained the following information:

mass = 55.120 g

length = 8.5 cm

height = 4.3 cm

width = 3.3 cm

Determine the volume and density of the wood block.

Ans: Volume of the wood block =  $120 \text{ cm}^3$ ; density of the wood block =  $0.46 \text{ g/cm}^3$ .

Category: Medium Section: 1.7

139. You just measured a metal cylinder and obtained the following information:

mass = 3.543 g

diameter = 0.53 cm

height = 4.4 cm

Determine the volume (V) and density of the cylinder. ( $V = \pi r^2 h$ , where r = radius, h = height,  $\pi = 3.14$ )

Ans: Volume of the cylinder =  $0.97 \text{ cm}^3$ ; density of the cylinder =  $3.7 \text{ g/cm}^3$ .

Category: Medium Section: 1.7

140. You just measured a sugar cube and obtained the following information:

mass = 3.48 g

height = length = width = 1.3 cm

Determine the volume and density of the cube. Suppose the sugar cube was added to a cup of water. Before it dissolves, will the sugar cube float or sink to the bottom?

Ans: Volume of the sugar cube =  $2.2 \text{ cm}^3$ ; density of the sugar cube =  $1.6 \text{ g/cm}^3$ . Before dissolving, the sugar cube will sink in a cup of water.

Category: Medium Section: 1.7

141. An archeologist finds a huge monolith in the desert. In order to estimate the weight of this object; he estimates the dimensions of the monolith and removes some chips from the rock with his hammer, collecting the following data:

dimensions of the monolith =  $1.5 \text{ m} \times 5.2 \text{ m} \times 13 \text{ m}$

mass of rock chips = 41.73 g

volume of rock chips =  $15.2 \text{ cm}^3$

Determine the mass of the monolith in pounds, assuming it is of uniform composition. (1 lb = 453.6 g)

Ans:  $6.1 \times 10^5 \text{ lb}$

Category: Difficult Section: 1.7

142. What is the density of a salt solution if 50.0 mL of the solution has a mass of 57.0 g?

Ans:  $1.14 \text{ g/mL}$

Category: Easy Section: 1.7

143. An excavator is preparing to dig a basement for a new house. Part of his contract reads that he must dispose of all the dirt he removes while digging the basement in an EPA approved landfill. He will dig a hole that is 40 feet wide by 50 feet long and 7.5 feet deep. He first uses his shovel and scoops up 1.00 kg of dirt, and then determines that the dirt has a volume of  $600 \text{ cm}^3$ . The excavator knows that his dump truck can only carry 8,000 kg of dirt. How many dump-truck loads will it take to haul the dirt away?  
Ans: 89 dump-truck loads  
Category: Difficult Section: 1.7
144. How many significant figures does the number 30.340 contain?  
Ans: 5  
Category: Easy Section: 1.6
145. How many significant figures does the number 0.00721 contain?  
Ans: 3  
Category: Easy Section: 1.6
146. The number  $9.64870 \times 10^5$  contains how many significant figures?  
Ans: 6  
Category: Easy Section: 1.6
147. What will be the cost of gasoline for a 3,700-mile trip in a car that gets 23 miles per gallon, if the average price of gas is \$2.90 per gallon?  
Ans: \$470  
Category: Medium Section: 1.7
148. What will be the cost of gasoline for a 4,700-mile automobile trip if the car gets 41 miles per gallon, and the average price of gas is \$2.79 per gallon?  
Ans: \$320  
Category: Medium Section: 1.7
149. The volume of a sphere is given by  $V = (4/3)\pi r^3$  where  $r$  is the radius. What is the mass of a magnesium sphere with a radius of 0.80 cm? (The density of magnesium is  $1.74 \text{ g/cm}^3$ .)  
Ans: 3.7 g  
Category: Medium Section: 1.7
150. The density of lead is  $11.4 \text{ g/cm}^3$ . Express this density in pounds per cubic foot.  
Ans: 711 lbs/ft<sup>3</sup>  
Category: Medium Section: 1.7
151. What is the mass of  $1.00 \text{ dm}^3$  of mercury? The density of mercury is  $13.6 \text{ g/cm}^3$ .  
Ans:  $1.36 \times 10^4 \text{ g}$   
Category: Medium Section: 1.7

152. The weight of a body varies according to the force of gravity exerted on the body.  
Ans: True Category: Medium Section: 1.7
153. The mass of a body varies according to the force of gravity exerted on the body.  
Ans: False Category: Medium Section: 1.7
154. The SI base unit of length is the centimeter.  
Ans: False Category: Easy Section: 1.7
155. Mass, length, and volume are extensive properties, but density is an intensive property.  
Ans: True Category: Easy Section: 1.4
156. 20°C is colder than 40°F.  
Ans: False Category: Medium Section: 1.7
157. 16 megagrams (Mg) is equal to  $1.6 \times 10^7$  g.  
Ans: True Category: Easy Section: 1.7
158. The conversion of water into steam is an example of a *chemical* change.  
Ans: False Category: Easy Section: 1.4