

Principles of Chemistry: A Molecular Approach (Tro)
Chapter 1 Matter, Measurement, and Problem Solving

1) Molecules can be described as

- A) a mixture of two or more pure substances.
- B) a mixture of two or more elements that has a specific ratio between components.
- C) two or more atoms chemically joined together.
- D) a heterogeneous mixture
- E) a homogeneous mixture

Answer: C

Diff: 1 Page Ref: 1.1

2) Give the composition of water.

- A) two hydrogen atoms and two oxygen atoms.
- B) one hydrogen atom and one oxygen atom.
- C) two hydrogen atoms and one oxygen atom.
- D) one hydrogen atom and two oxygen atoms.

Answer: C

Diff: 1 Page Ref: 1.1

3) Dalton's Atomic Theory states

- A) that all elements have several isotopes.
- B) that matter is composed of small indestructible particles.
- C) that the properties of matter are determined by the properties of atoms.
- D) that energy is neither created nor destroyed during a chemical reaction.
- E) that an atom is predominantly empty space.

Answer: B

Diff: 1 Page Ref: 1.2

4) The statement, "In a chemical reaction, matter is neither created nor destroyed." is called

- A) The Law of Conservation of Mass
- B) Dalton's Atomic Theory
- C) The Scientific Method
- D) The Law of Multiple Proportions
- E) The Law of Definite Proportions

Answer: A

Diff: 1 Page Ref: 1.2

5) Which of the following represents a *hypothesis*?

- A) Sodium reacts with water to form sodium hydroxide and hydrogen gas.
- B) Nitrogen gas is a fairly inert substance.
- C) Nickel has a silvery sheen.
- D) When a substance combusts, it combines with air.
- E) When wood burns, heat is given off.

Answer: D

Diff: 1 Page Ref: 1.2

6) Which of the following represent a valid hypothesis?

- A) Neon does not react with oxygen.
- B) Sodium metal reacts violently with water.
- C) Lead is soft and malleable.
- D) Oxygen is a gas at room temperature.
- E) Metals tend to lose electrons.

Answer: E

Diff: 1 Page Ref: 1.2

7) The Scientific Method

- A) is just a theory.
- B) is a strict set of rules and procedures that lead to inarguable fact.
- C) isn't used much in modern chemistry.
- D) is based on continued observation and experiment.
- E) is a framework for proving an argument you know to be true.

Answer: D

Diff: 1 Page Ref: 1.2

8) Which of the following statements is TRUE?

- A) A scientific law is fact.
- B) Once a theory is constructed, it is considered fact.
- C) A hypothesis is speculation that is difficult to test.
- D) An observation explains why nature does something.
- E) A scientific law summarizes a series of related observations.

Answer: E

Diff: 1 Page Ref: 1.2

9) Identify a liquid.

- A) Definite volume and definite shape.
- B) Definite volume and no definite shape.
- C) No definite shape and definite volume.
- D) No definite shape and no definite volume.

Answer: B

Diff: 1 Page Ref: 1.3

10) Choose the pure substance from the list below.

- A) sea water
- B) sugar
- C) air
- D) lemonade
- E) milk

Answer: B

Diff: 1 Page Ref: 1.3

11) Choose the pure substance from the list below.

- A) tea
- B) a casserole
- C) carbon monoxide
- D) sugar water
- E) pomegranate juice

Answer: C

Diff: 1 Page Ref: 1.3

12) Choose the heterogeneous mixture from the list below.

- A) Gatorade
- B) chlorine gas
- C) black coffee
- D) chicken noodle soup
- E) carbon (graphite)

Answer: D

Diff: 1 Page Ref: 1.3

13) Choose the homogeneous mixture from the list below.

- A) Kool-aid
- B) mud
- C) ice water
- D) salad dressing
- E) salsa

Answer: A

Diff: 1 Page Ref: 1.3

14) Which of the following statements about crystalline and amorphous solids is TRUE?

- A) A crystalline solid is composed of atoms or molecules arranged with long-range repeating order.
- B) An example of a crystalline solid is glass.
- C) An example of an amorphous solid is table salt (NaCl).
- D) An amorphous solid is composed of atoms or molecules with a majority of its volume empty.
- E) All of the above statements are TRUE.

Answer: A

Diff: 1 Page Ref: 1.3

15) Which of the following statements about the phases of matter is TRUE?

- A) In both solids and liquids, the atoms or molecules pack closely to one another.
- B) Solids are highly compressible.
- C) Gaseous substances have long-range repeating order.
- D) There is only one type of geometric arrangement that the atoms or molecules in any solid can adopt.
- E) Liquids have a large portion of empty volume between molecules.

Answer: A

Diff: 1 Page Ref: 1.3

- 16) A substance that can't be chemically broken down into simpler substances is considered to be
- A) a homogeneous mixture.
 - B) an element.
 - C) a heterogeneous mixture.
 - D) a compound.
 - E) an electron.

Answer: B

Diff: 1 Page Ref: 1.3

- 17) A substance composed of 2 or more elements in a fixed, definite proportion is considered
- A) a homogeneous mixture.
 - B) a heterogeneous mixture.
 - C) a compound.
 - D) a solution.
 - E) an alloy.

Answer: C

Diff: 1 Page Ref: 1.3

- 18) Two or more substances in variable proportions, where the composition is constant throughout are considered

- A) a compound.
- B) an element.
- C) a heterogeneous mixture.
- D) a homogeneous mixture.
- E) a crystalline solid.

Answer: D

Diff: 1 Page Ref: 1.3

- 19) Two or more substances in variable proportions, where the composition is variable throughout are considered

- A) a solution.
- B) a homogeneous mixture.
- C) a compound.
- D) an amorphous solid..
- E) a heterogeneous mixture.

Answer: E

Diff: 1 Page Ref: 1.3

- 20) Choose the homogeneous mixture from the list below.

- A) soda (pop)
- B) air
- C) concrete
- D) trail mix
- E) blood

Answer: B

Diff: 2 Page Ref: 1.3

21) Which of the following are examples of physical change?

- A) sugar is dissolved in water.
- B) coffee is brewed.
- C) dry ice sublimates.
- D) ice (solid water) melts.
- E) All of these are examples of physical change.

Answer: E

Diff: 1 Page Ref: 1.4

22) Which of the following are examples of physical change?

- A) dew forms on a blade of grass
- B) a halloween light stick glows after shaking
- C) an egg solidifies during cooking
- D) a hydrogen balloon explodes when contacted with a flame
- E) None of the above are physical changes.

Answer: A

Diff: 1 Page Ref: 1.4

23) Which of the following are examples of a chemical change?

- A) Copper building materials develop a green patina over time.
- B) a match burns
- C) ethanol evaporates
- D) Both A and B are examples of chemical change.
- E) All of the above are examples of chemical change.

Answer: D

Diff: 1 Page Ref: 1.4

24) Which of the following are examples of a chemical change?

- A) coffee brewing
- B) water boiling
- C) leaves turning color in the fall
- D) salt dissolves in water
- E) None of the above are chemical changes.

Answer: C

Diff: 1 Page Ref: 1.4

25) A physical change

- A) occurs when iron rusts.
- B) occurs when sugar is heated into caramel.
- C) occurs when glucose is converted into energy within your cells.
- D) occurs when water is evaporated.
- E) occurs when propane is burned for heat.

Answer: D

Diff: 1 Page Ref: 1.4

26) A chemical change

- A) occurs when methane gas is burned.
- B) occurs when paper is shredded.
- C) occurs when water is vaporized.
- D) occurs when salt is dissolved in water.
- E) occurs when Kool-aid is stirred into water.

Answer: A

Diff: 1 Page Ref: 1.4

27) Which of the following represents a physical property?

- A) Sodium metal is extremely reactive with chlorine gas.
- B) Mercury is a silver liquid at room temperature.
- C) the tendency of aluminum to "rust"
- D) the flammability of butane fuel
- E) the unreactive nature of argon gas

Answer: B

Diff: 1 Page Ref: 1.4

28) Which of the following represents a chemical property of hydrogen gas?

- A) It is gaseous at room temperature.
- B) It is less dense than air.
- C) It reacts explosively with oxygen.
- D) It is colorless.
- E) It is tasteless.

Answer: C

Diff: 1 Page Ref: 1.4

29) Which of the following statements about energy is FALSE?

- A) Energy can be converted from one type to another.
- B) The total energy of a system remains constant.
- C) Potential energy is the energy associated with its position or composition.
- D) Energy is the capacity to do work.
- E) Systems tend to change in order to lower their potential energy.

Answer: C

Diff: 1 Page Ref: 1.5

30) Define thermal energy.

- A) Energy associated with the temperature of an object.
- B) Energy associated with the motion of an object.
- C) Energy associated with the force of an object.
- D) Energy associated with the gravity of an object.

Answer: A

Diff: 1 Page Ref: 1.5

31) All of the following are SI base units of measurement, EXCEPT

- A) meter
- B) gram
- C) second
- D) kelvin
- E) mole

Answer: B

Diff: 1 Page Ref: 1.6

32) Which of the following are examples of intensive properties?

- A) density
- B) volume
- C) mass
- D) None of the above are examples of intensive properties.
- E) All of the above are examples of intensive properties.

Answer: A

Diff: 1 Page Ref: 1.6

33) Which of the following are examples of extensive properties?

- A) mass
- B) color
- C) density
- D) temperature
- E) taste

Answer: A

Diff: 1 Page Ref: 1.6

34) If the temperature is 178°F, what is the temperature in degrees celsius?

- A) 352°C
- B) 451°C
- C) 67°C
- D) 81.1°C
- E) 378°C

Answer: D

Diff: 2 Page Ref: 1.6

35) If a solution has a temperature of 355 K, what is its temperature in degrees celsius?

- A) 165°C
- B) 628°C
- C) 179°C
- D) 179°C
- E) 82°C

Answer: E

Diff: 2 Page Ref: 1.6

36) Determine the density of an object that has a mass of 149.8 g and displaces 12.1 mL of water when placed in a graduated cylinder.

- A) 8.08 g/mL
- B) 1.38 g/mL
- C) 12.4 g/mL
- D) 18.1 g/mL
- E) 11.4 g/mL

Answer: C

Diff: 2 Page Ref: 1.6

37) Determine the volume of an object that has a mass of 455.6 g and a density of 19.3 g/cm³.

- A) 87.9 mL
- B) 42.4 mL
- C) 18.5 mL
- D) 23.6 mL
- E) 31.2 mL

Answer: D

Diff: 2 Page Ref: 1.6

38) Determine the mass of an object that has a volume of 88.6 mL and a density of 9.77 g/mL.

- A) 298 g
- B) 1100 g
- C) 907 g
- D) 568 g
- E) 866 g

Answer: E

Diff: 2 Page Ref: 1.6

39) The outside air temperature is 30°F, what is the temperature in Kelvin?

- A) 303 K
- B) 307 K
- C) 274 K
- D) 272 K

Answer: D

Diff: 3 Page Ref: 1.6

40) A student performs an experiment to determine the density of a sugar solution. She obtains the following results: 4.11 g/mL, 4.81 g/mL, 4.95 g/mL, 3.75 g/mL. If the actual value for the density of the sugar solution is 4.75 g/mL, which statement below best describes her results?

- A) Her results are precise, but not accurate.
- B) Her results are accurate, but not precise.
- C) Her results are both precise and accurate
- D) Her results are neither precise nor accurate.
- E) It isn't possible to determine with the information given.

Answer: D

Diff: 1 Page Ref: 1.7

41) A student performs an experiment to determine the density of a sugar solution. She obtains the following results: 4.71 g/mL, 4.73 g/mL, 4.67 g/mL, 4.69 g/mL. If the actual value for the density of the sugar solution is 4.40 g/mL, which statement below best describes her results?

- A) Her results are precise, but not accurate.
- B) Her results are accurate, but not precise.
- C) Her results are both precise and accurate
- D) Her results are neither precise nor accurate.
- E) It isn't possible to determine with the information given.

Answer: A

Diff: 1 Page Ref: 1.7

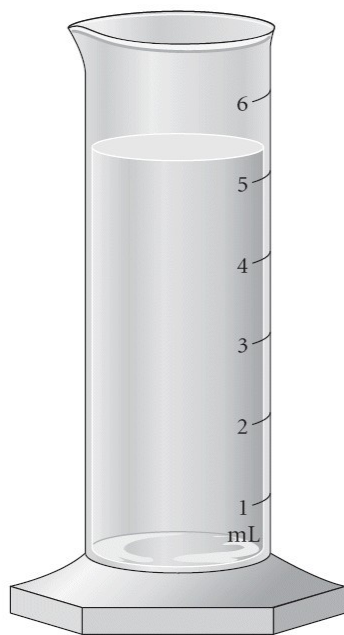
42) Systematic error is defined as

- A) error that tends to be too high or too low.
- B) error that is too high and too low.
- C) error that averages out with repeated trials.
- D) error that is random.

Answer: A

Diff: 1 Page Ref: 1.7

43) Read the water level with the correct number of significant figures.

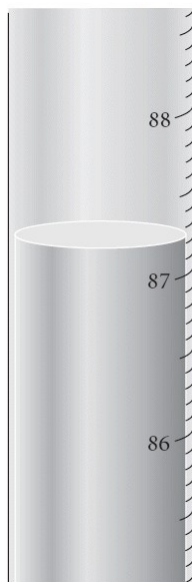


- A) 5 mL
- B) 5.3 mL
- C) 5.32 mL
- D) 5.320 mL
- E) 5.3200 mL

Answer: B

Diff: 2 Page Ref: 1.7

44) Read the temperature with the correct number of significant figures.

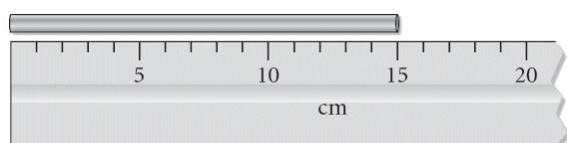


- A) 87°C
- B) 87.2°C
- C) 87.20°C
- D) 87.200°C
- E) 87.2000°C

Answer: C

Diff: 2 Page Ref: 1.7

45) Read the length of the metal bar with the correct number of significant figures.

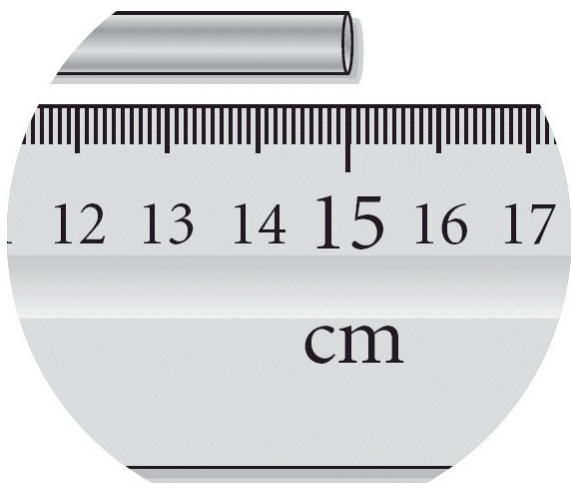


- A) 20 cm
- B) 15 cm
- C) 15.0 cm
- D) 15.00 cm
- E) 15.000 cm

Answer: C

Diff: 2 Page Ref: 1.7

46) Read the length of the metal bar with the correct number of significant figures.



- A) 20 cm
- B) 15 cm
- C) 15.0 cm
- D) 15.00 cm
- E) 15.000 cm

Answer: D

Diff: 2 Page Ref: 1.7

47) How many significant figures are in 1009.630 mL?

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

Answer: E

Diff: 2 Page Ref: 1.7

48) How many significant figures are in 3.408×10^4 m?

- A) 3
- B) 4
- C) 5
- D) 7
- E) 8

Answer: B

Diff: 2 Page Ref: 1.7

49) How many significant figures are in the measurement, 463.090 m?

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

Answer: E

Diff: 2 Page Ref: 1.7

50) How many significant figures are in the measurement, 0.0005890 g?

- A) 4
- B) 5
- C) 6
- D) 7
- E) 8

Answer: A

Diff: 2 Page Ref: 1.7

51) What answer should be reported, with the correct number of significant figures, for the following calculation? $(433.621 - 333.9) \times 11.900$

- A) 1.19×10^3
- B) 1.187×10^3
- C) 1.1868×10^3
- D) 1.18680×10^3
- E) 1.186799×10^3

Answer: A

Diff: 2 Page Ref: 1.7

52) What answer should be reported, with the correct number of significant figures, for the following calculation? $(249.362 + 41) / 63.498$

- A) 4.6
- B) 4.57
- C) 4.573
- D) 4.5728
- E) 4.57277

Answer: B

Diff: 3 Page Ref: 1.7

53) What answer should be reported, with the correct number of significant figures, for the following calculation? $(965.43 \times 3.911) + 9413.4136$

- A) 13189
- B) 13189.2
- C) 1.32×10^4
- D) 1.3×10^4
- E) 1.319×10^4

Answer: A

Diff: 3 Page Ref: 1.7

54) What wavelength of light would you report in units of nm, if the light had a wavelength of 7.60×10^{-10} m?

- A) 7.60×10^{-3} nm
- B) 7.60×10^{-19} nm
- C) 1.32 nm
- D) 0.760 nm
- E) 760 nm

Answer: D

Diff: 2 Page Ref: 1.8

55) How many mg does a 433 kg sample contain?

- A) 4.33×10^{-4} mg
- B) 4.33×10^7 mg
- C) 4.33×10^{-3} mg
- D) 4.33×10^6 mg
- E) 4.33×10^8 mg

Answer: E

Diff: 2 Page Ref: 1.8

56) How many kL does a 1.25×10^8 cL sample contain?

- A) 1.25×10^3 kL
- B) 1.25×10^{13} kL
- C) 1.25×10^4 kL
- D) 1.25×10^{12} kL
- E) 1.25×10^2 kL

Answer: A

Diff: 2 Page Ref: 1.8

57) How many cm^3 are contained in 3.77×10^4 mm^3 ?

- A) 3.77×10^4 cm^3
- B) 3.77×10^1 cm^3
- C) 3.77×10^{-10} cm^3
- D) 3.77×10^{20} cm^3
- E) 3.77×10^6 cm^3

Answer: B

Diff: 2 Page Ref: 1.8

58) If an object has a density of 8.65 g/cm^3 , what is its density in units of kg/m^3 ?

A) $8.65 \times 10^{-3} \text{ kg/m}^3$

B) $8.65 \times 10^{-7} \text{ kg/m}^3$

C) $8.65 \times 10^3 \text{ kg/m}^3$

D) $8.65 \times 10^1 \text{ kg/m}^3$

E) $8.65 \times 10^{-1} \text{ kg/m}^3$

Answer: C

Diff: 3 Page Ref: 1.8

59) If a room requires 25.4 square yards of carpeting, what is the area of the floor in units of ft^2 ?

(3 ft = 1 yd)

A) 76.2 ft^2

B) 8.47 ft^2

C) 282 ft^2

D) 229 ft^2

E) 68.6 ft^2

Answer: D

Diff: 3 Page Ref: 1.8

60) A person weighs 77.1 kg. What is their weight in pounds?

A) 154 pounds

B) 170 pounds

C) 35.0 pounds

D) 162 pounds

Answer: B

Diff: 3 Page Ref: 1.8

61) If the walls in a room are 955 square feet in area, and a gallon of paint covers 15 square yards, how many gallons of paint are needed for the room? (3 ft = 1 yd)

A) 47 gallons

B) 21 gallons

C) 7.1 gallons

D) 24 gallons

E) 2.3 gallons

Answer: C

Diff: 4 Page Ref: 1.8

62) Gas is sold for \$1.399 per liter in Toronto, Canada. Your car needs 12.00 gallons. How much will your credit card be charged in American dollars?

A) \$16.79

B) \$67.15

C) \$4.44

D) \$63.54

Answer: D

Diff: 5 Page Ref: 1.8

63) kilo A) 10⁻²
Diff: 1 Page Ref: 1.6

64) centi B) 10^3
Diff: 1 Page Ref: 1.6

65) milli
Diff: 1 Page Ref: 1.6 D) 10^{-3}

| | |
|----------------------------|---------------------|
| 66) nano | E) 10 ⁻⁹ |
| Diff: 1 Page Ref: 1.6 | F) 10 ⁻⁶ |

67) micro
Diff: 1 Page Ref: 1.6

63) B 64) A 65) D 66) E 67) F

68) Define matter.

Answer: Matter is anything that occupies space and has mass.

Diff: 1 Page Ref: 1.3

69) What is the difference between a physical property and a chemical property? Give an example of each.

Answer: A physical property is something that can be observed without changing the chemical identity of the substance, such as color or scent. A chemical property can only be observed while the chemical identity of a substance is changing, such as sodium metals tendency to react with water to form hydrogen gas and sodium hydroxide.

Diff: 1 Page Ref: 1.4

70) Define the law of the conservation of energy.

Answer: Energy is neither created or destroyed.

Diff: 1 Page Ref: 1.5

71) A sample of liquid isopropyl alcohol is placed in a sealed container. Some of the volatile isopropyl alcohol vaporizes. Does the mass of the sealed container and its contents change during the vaporization? Explain.

Answer: No. The vaporized isopropyl alcohol is just in a different physical state. It still has mass and therefore the gas plus the remaining liquid and container have the same total mass after the vaporization of some of the isopropyl alcohol.

Diff: 1 Page Ref: 1.6

72) A flash drive contains 4 gigabytes. How many bytes does it contain?

Answer: 4,000,000,000 bytes or 4,292,967,296 byte if someone is computer literate

Diff: 1 Page Ref: 1.6

73) Describe the difference between an intensive and extensive property using examples.

Answer: An intensive property does NOT depend on the amount of the substance present, such as color or density. An extensive property is one that does depend on the amount of the substance, such as mass or volume.

Diff: 1 Page Ref: 1.6

74) What happens to the density of a sample of iron metal as it is heated from room temperature to 100°C? (This is below the melting point of iron)

Answer: Since the mass of the iron stays constant, but the volume increases as the temperature is raised, the density of the iron decreases upon heating.

Diff: 1 Page Ref: 1.6

75) What does it mean to be an exact number? Give an example of an exact number.

Answer: An exact number has an infinite number of significant figures even though we typically don't write many of them out. If there are 26 people in a classroom, there are exactly 26.00000.... people in that room. There is no possibility of a half person, so this is an exact whole number with no ambiguity.

Diff: 1 Page Ref: 1.7