Chapter: States of Matter

In the space provided, write the letter of the term or phrase that best completes each statement or best answers each question.

1. The kinetic-molecular theory of gases assumes that the particles of an ideal gas are separated by great distances. This implies that the gas particles are considered to have no definite
   a. mass.  
   b. volume.  
   c. density.  
   d. energy.

2. Under which conditions does a real gas behave very much like an ideal gas?
   a. high temperature and low pressure  
   b. high temperature and high pressure  
   c. low temperature and high pressure  
   d. low temperature and low pressure

3. If a gas and a liquid are at the same temperature and pressure, diffusion occurs much faster in the gas because
   a. there are more elastic collisions between the particles in a gas.  
   b. gases are more compressible.  
   c. the particles move faster in a gas and there is a greater distance between them.  
   d. gas molecules are in continuous motion.

4. If the particles in a sample of matter are attracted to each other but can move past each other easily, the matter is a
   a. solid.  
   b. liquid.  
   c. gas.  
   d. plasma.

5. According to the equation for the kinetic energy of a moving object, which gas would have the lowest average velocity, assuming all gases are at the same temperature?
   a. O₂  
   b. H₂  
   c. H₂O  
   d. O₃
6. Which factor is the most important in determining the average kinetic energy of gas particles?
   a. pressure
   b. temperature
   c. volume of the container
   d. mass of the container

7. Which gas is most likely to deviate from ideal gas behavior?
   a. Ne
   b. CO₂
   c. NH₃
   d. H₂

8. What is likely to happen to a liquid mixture of water and rubbing alcohol in an open flask as temperature is increased while pressure stays the same?
   a. Both liquids will vaporize at the same rate.
   b. Water will vaporize faster.
   c. Vaporization and condensation will reach equilibrium.
   d. Rubbing alcohol will vaporize faster.

9. Sublimation involves changing from a
   a. solid to a gas.
   b. liquid to a gas.
   c. gas to a liquid.
   d. gas to a solid.

10. Which characteristic accounts for the fluidity of gases and liquids?
    a. strong intermolecular forces
    b. elastic collisions between particles
    c. particle mobility
    d. small particle size

11. Liquids and solids are much denser than gases because the particles of liquids and solids have a
    a. greater mass.
    b. closer arrangement.
    c. greater volume.
    d. smaller volume.

12. An increase in pressure exerted on a liquid does not compress the liquid as much as the same increase in pressure compresses a gas because
    a. particles are more closely packed in liquids.
    b. liquids transmit pressure in all directions.
    c. intermolecular forces are stronger in liquids.
    d. particles in liquids are in constant movement.
13. The separation process of paper chromatography can be explained by
   a. vaporization of the ink.
   b. water vapor pressure.
   c. capillary action.
   d. pull of gravity.

14. When there is a small decrease in temperature, the average kinetic
   energy of the particles of a liquid
   a. decreases.
   b. becomes zero.
   c. is not changed.
   d. increases.

15. The movements of particles in solids can best be described as
   a. from point to point.
   b. vibrational.
   c. not in motion.
   d. like a lattice.

16. Amorphous solids behave like liquids at certain temperatures because
   of their
   a. particle fluidity.
   b. incompressibility.
   c. high density.
   d. random arrangement.

17. Covalent molecular crystals have very low melting points, while
   covalent network crystals have very high melting points because
   a. the forces that hold molecules together in molecular crystals are
      weaker than those that hold molecules or atoms together in
      network crystals.
   b. there are more molecules in molecular crystals than in network
      crystals.
   c. network crystals are more intricate crystals.
   d. molecular crystals can be either polar or nonpolar, while network
      crystals are always nonpolar.

18. Which of the following is true for the melting and freezing points of a
   pure substance?
   a. The melting point is higher than the freezing point.
   b. The melting point is lower than the freezing point.
   c. The melting point is the same as the freezing point.
   d. There is no relationship between the freezing point and the melting
      point.
19. In general, ionic compounds have
   a. high boiling points and low melting points.
   b. low boiling points and high melting points.
   c. high boiling points and high melting points.
   d. low boiling points and low melting points.

20. Water has an unusually high molar enthalpy of vaporization because
    of its
   a. covalent nature.
   b. hydrogen bonding.
   c. ionic interactions.
   d. polar nature.

21. A solid's molar enthalpy of fusion is the energy that is
    a. released when a solid melts.
    b. absorbed when a solid melts.
    c. needed to transform a solid to a gas.
    d. required for equilibrium.

22. One mole of benzene vapor condenses at its boiling point. The amount
    of energy released by the benzene as it completely condenses is
    known as its molar
   a. enthalpy of fusion.
   b. enthalpy of vaporization.
   c. entropy of fusion.
   d. entropy of vaporization.

23. A sample of carbon dioxide gas is in equilibrium with solid dry ice. If
    the temperature of the system increases,
   a. vapor pressure increases.
   b. vapor pressure decreases.
   c. more dry ice forms.
   d. carbon dioxide gas condenses.

24. A phase diagram relates the state of matter, pressure, and
    a. temperature.
    b. volume.
    c. mass.
    d. weight.

25. On a phase diagram, the point at which all equilibrium lines join is the
    a. melting point.
    b. boiling point.
    c. critical point.
    d. triple point.
40. \( \text{Zn}(s) + 2\text{HCl}(aq) \rightarrow \text{ZnCl}_2(aq) + \text{H}_2(g) \)
41. no reaction
42. \( \text{Ni}(s) + \text{CuCl}_2(aq) \rightarrow \text{NiCl}_2(aq) + \text{Cu}(s) \)
43. no reaction
44. \( \text{Mg}(s) + \text{Co(NO}_3)_2(aq) \rightarrow \text{Mg(NO}_3)_2(aq) + \text{Co}(s) \)

**Stoichiometry,**
*pp. 74–83*

**TEST A**
1. a  
2. b  
3. a  
4. a  
5. d  
6. c  
7. a  
8. d  
9. b  
10. d  
11. a  
12. c  
13. b  
14. a  
15. b  
16. d  
17. a  
18. c  
19. c  
20. b  
21. d  
22. a  
23. d  
24. a  
25. c

**TEST B**
1. c  
2. b  
3. d  
4. a  
5. a  
6. a  
7. a  
8. b  
9. given: mass of \( \text{NH}_3 \) = 500 g  
unknown: mass of \( \text{N}_2 \)  
10. given: mass of \( \text{H}_2\text{O} \) = 500 g  
unknown: moles of \( \text{H}_2 \)  
11. given: amount of \( \text{CO}_2 \) = 20 mol  
unknown: mass of \( \text{CO} \)  
12. given: amount of \( \text{H}_2\text{O} \) = 50 mol  
unknown: moles of \( \text{O}_2 \)  
13. given: mass of \( \text{SO}_2 \) = 800 g  
unknown: mass of \( \text{S} \)  
14. \( \text{percentage yield} = \frac{\text{actual yield}}{\text{theoretical yield}} \times 100 \)  
15. moles of \( \text{A} \rightarrow \) moles of \( \text{B} \)  
16. \( \frac{1}{\text{mol C}_7\text{H}_6\text{O}_3} \) \( 138.13 \text{ g C}_7\text{H}_6\text{O}_3 \)  
17. limiting reactant or reagent  
18. actual yield  
19. excess reactant  
20. 70.0 g

**States of Matter,**
*pp. 84–92*

**TEST A**
1. b  
2. a  
3. c  
4. b  
5. d  
6. b  
7. c  
8. d  
9. a  
10. c  
11. b  
12. a  
13. c  
14. a  
15. b  
16. d  
17. a  
18. c  
19. c  
20. b  
21. b  
22. b  
23. a  
24. a  
25. d

**TEST B**
1. a  
2. c  
3. a  
4. c  
5. c  
6. c  
7. a  
8. pressure  
9. temperature  
10. 760 mm  
11. \( \text{VP}' = \text{VP} \)  
12. \text{kinetic-molecular theory}  
13. \text{effusion}  
14. \text{ideal gas}  
15. \text{diffusion}  
16. pressure  
17. \text{newton}  
18. \text{barometer}  
19. \text{partial pressure}  
20. decrease  
21. \text{absolute zero}  
22. \text{elastic}  
23. \text{fluids}  
24. c  
25. d
26. According to the kinetic-molecular theory, the particles in a liquid can change relative positions but still are influenced by attractive forces. Their ability to move about explains the fluidity of liquids and their ability to diffuse. As some particles at the surface of a liquid gain energy, they overcome the attractive force and vaporize.

27. In ionic crystals, monatomic or polyatomic positive and negative ions are arranged in a regular pattern. In metallic crystals, metal atoms are surrounded by a sea of valence electrons. The electrons are donated by the metal atoms and belong to the crystal as a whole.

28. a. 10.7 kJ   b. 28.9 kJ
29. 9.83 kJ
30. 0.766 kJ

Equilibrium vapor pressure is the pressure exerted by a vapor in equilibrium with its corresponding liquid at a given temperature.

a. A liquid boils when its equilibrium vapor pressure is equal to atmospheric pressure. At high elevations, there is lowered atmospheric pressure. This means that the equilibrium vapor pressure will equal the lowered atmospheric pressure at a lower temperature.

b. Increasing the temperature of a liquid increases its average kinetic energy. That in turn increases the number of molecules that have enough energy to escape from the liquid phase into the vapor phase. This increased evaporation rate increases the concentration of molecules in the vapor phase, which increases the equilibrium vapor pressure.

11 Gases, pp. 93–103

TEST A
1. b   2. c
3. b   4. d
5. d   6. a
7. a   8. a
9. a   10. b
11. b  12. b
13. d  14. a

TEST B
1. c   2. b
3. c   4. b
5. b   6. b
7. a
8. Avogadro’s law
9. temperature
10. pressure
11. temperature
12. 760 mm
13. \( V'' P'' = VP \)
14. effusion
15. pressure
16. newton
17. barometer
18. partial pressure
19. decrease
20. absolute zero
21. c
22. d
23. i
24. j
25. a
26. e
27. h
28. k
29. b
30. \( 5.7 \times 10^2 \) mm Hg
31. 40. atm
32. 150°C
33. 459 mm Hg
34. 236 L
35. 16 g/mol
36. 2.05 g/L
37. 0.77 L
38. 22.3 g
39. 2.051

12 Solutions, pp. 104–113

TEST A
1. c   2. c
3. b   4. c
5. a   6. b
7. c   8. c
9. c   10. a