Honors Chemistry – Unit 5 Review

Chapter 13 – States of Matter

Vocabulary – Use with Questions 1-16

normal boiling point	unit cell	crystal	melting point
Avogadro's hypothesis	vaporization	amorphous	phase change
atmospheric pressure	boiling point	barometer	sublimation
vapor pressure	super-cooled liquid	kinetic theory	evaporation

1. _____ states that equal volumes of gases at the same temperature and pressure contain equal numbers of particles.
2. A _____ is a device used to measure atmospheric pressure.
3. _____ is the temperature at which a solid turns into liquid.
4. A _____ is a substance that has cooled to a rigid state without crystallizing.
5. The pressure resulting from the collision of air molecules with objects is called _____.
6. The temperature at which the vapor pressure of a liquid is just equal to the external pressure is called _____.
7. _____ is a form of solid lacking an ordered internal structure.
8. A _____ is a solid in which the atoms, ions, or molecules are arranged in an orderly pattern.
9. The pressure above a liquid in a sealed container caused by collision of vaporized particles with the walls of the container is called _____.
10. The smallest group of particles within a crystal that retains the shape of the crystal is called the _____.
11. _____ is the boiling point of a liquid at a pressure of 1 atm.
12. A change that occurs when the physical state of a substance changes is called a _____.
13. The evaporation of an uncontained liquid is called _____.
14. The _____ states that tiny particles in all forms of matter are in constant motion.
15. The conversion of a liquid to a gas below the boiling point is called _____.
16. The direct change of a substance from a solid to a gas is called _____.

Concepts

1. Most solids…
   a) are dense and incompressible
   b) have low melting points
   c) are amorphous in nature
   d) consist of particles in random motion
2. The escape of gas molecules from the surface of an uncontained liquid is known as:
   a) boiling b) sublimation c) evaporation d) condensation
3. The pressure of a gas in a container is 152 mm Hg. This is equivalent to:
   a) 0.2 atm b) 2 atm c) 0.3 atm d) 0.4 atm
4. Standard conditions when working with gases are defined as:
   a) 0 K and 1 atm b) 0 K and l mmHg c) 0°C and 1 atm d) 0°C and l mm Hg
5. The temperature at which the motion of particles theoretically ceases is:
   a) -273 K b) 0 K c) 0°C d) 273°C
6. The average kinetic energy of the particles of a substance is:
   a) not affected by the temperature of the substance
   b) raised as the temperature of the substance is lowered
   c) proportional to the temperature of the substance
   d) equal to the total thermal energy absorbed by the substance

Chapter 17 – Thermochemistry

1. Convert from one unit to the other:
   a. 1.69 Joules to calories
   b. 820.1 J to kilocalories
   c. 68 calories to kilocalories
   d. 20.0 calories to Joules

2. Determine the energy required (in Joules) when the temperature of 3.21 grams of water increases by 4.0 °C while remaining liquid.

3. Determine the energy required (in kilojoules) when cooling 456.2 grams of water at 89.2 °C to a final temperature of 5.9 °C.

4. Determine the energy required to boil 0.345 moles of water at 100.0 °C.

5. Determine the energy required to melt 74.5 grams of ice at 0.0 °C.

6. Determine the specific heat of a 150.0 gram object that requires 62.0 cal of energy to raise its temperature 12.0 °C.

7. When 80.0 grams of a certain metal at 90.0 °C was mixed with 100.0 grams of water at 30.0°C, the final equilibrium temperature of the mixture was 36.0 °C. What is the specific heat (J/ g°C) of the metal?

8. A piece of aluminum with a mass of 80.0 g at a temperature of 70.0˚C is dropped into an insulated container, which contains 250.0 mL water. The temperature of the water before adding the aluminum is 25.0˚C. The final temperature of the mixture is 28.5˚C What is the specific heat capacity of the aluminum?

9. How much energy is required to convert 100.0 g of water at 20.0 °C completely to steam at 100.0 °C?

10. Calculate the energy released when 10.0 g of steam at 120.0 °C are converted into ice at the –20.0 °C.

11. Given the following reaction:

$$2Al + Fe_2O_3 \rightarrow 2Fe + Al_2O_3 \quad \Delta H = -848.1 \text{ kJ}$$

    a. Is the reaction endothermic or exothermic?
    b. Write the thermochemical equation.
    c. You have 22.7 g of iron (III) oxide. How much heat is released when the iron (III) oxide reacts with excess aluminum?
    d. How many grams of iron are produced when 224.3 kJ of energy are released?

12. Given the following reaction:

$$2SO_3 \rightarrow 2SO_2 + O_2 \quad \Delta H = +197.8 \text{ kJ}$$

    a. Is the reaction endothermic or exothermic?
    b. Write the thermochemical equation.
    c. How many grams of SO_3 react when 575 kJ of heat is absorbed?

13. How much heat energy is released when 12.8 g of barium oxide react with excess sulfur trioxide?

$$BaO\ (s) + SO_3\ (g) \rightarrow BaSO_4\ (s) \quad \Delta H_{rxn}^{\circ} = -213.4 \text{ kJ}$$

14. You can find the amount of heat evolved in the combustion of carbon by carrying out the reaction in a combustion calorimeter. You burn 0.300 g of carbon (graphite) in an excess of O_2 (g) to give CO_2 (g).

$$C\ (\text{graphite}) + O_2\ (g) \rightarrow CO_2\ (g)$$

    The temperature of the calorimeter, which contains 775 g of water, increases from 25.0˚C to 27.38˚C. What quantity of heat is evolved per mole of carbon?

15. What is the enthalpy change, ΔH (in kJ) for the formation of hydrazine, $N_2H_4(l)$, from its elements?

$$N_2(g) + 2H_2(g) \rightarrow N_2H_4(l)$$

    Use the following data:

$$N_2H_4(l) + O_2(g) \rightarrow N_2(g) + 2H_2O(l) \quad \Delta H = -622.2 \text{ kJ}$$
$$H_2(g) + \tfrac{1}{2} O_2\ (g) \rightarrow H_2O(l) \quad \Delta H = -285.8 \text{ kJ}$$