SCH4U **WORKSHEET – HEAT**

1. An increase in temperature causes a (n) ___ in kinetic energy which is the energy related to the motion of the particles.

2. Where is the energy stored in a molecule?

3. What type of reactions absorbs heat? What type of reactions give off heat?

4. Indicate whether the following statements refer to endothermic or exothermic reactions.

a) Green plants need sunlight for growth.

b) Sodium metal dropped into a beaker of water causes an explosion.

c) Ice melts on a counter top.

d) The bottom of a plate feels warm after hot food is placed on it.

e) Sweat beads form on your forehead after a heavy workout.

f) The freezing of a substance.

5. What does it mean to say that the specific heat capacity of iron is greater than the specific heat capacity of gold?

6. Solar homes often use rock or water to collect heat from the sun by day to warm the home at night. If the temperature of 1000 kg of granite is raised 10°C in one house and 1000 kg of water is raised 10°C in another house, which house has collected more heat? (Cp = 0.80 J/g°C, for granite)

7. How much heat in joules is required to raise the temperature of 2.50 moles of water from 50.0°C to 70.0°C?

8. If 1.50×10^3 grams of mercury loses 3.50 kJ of heat, how much does the temperature drop? If the original temperature was 90.0°C, what is the final temperature? (Cp = 0.14 J/g°C, for mercury)

9. A sample of water is heated from 10.0°C to 50.0°C. During the process, 12.0 kJ of heat are added to the water.

a) What mass of water is heated?

b) How many moles of water are heated?

10. A chemical reaction occurs in 350.0 grams of water and raises water's temperature from 21.5°C to 56.3°C.

a) How much heat is involved?

b) Did the water gain or lose heat?

c) Did the reaction absorb or release heat?

d) Was the reaction endothermic or exothermic? Explain.

11. The reaction $2\ CO(g) + O2\ (g) \rightarrow 2\ CO2\ (g)$ is exothermic.

a) What is the sign of ΔH for this reaction? b) Draw an enthalpy diagram for this reaction.

c) What is the sign of ΔH for the reverse reaction?

d) Is the energy stored in the products greater or less than the energy stored in the reactants for the forward reaction?

12. For the reaction: $2\ Mg\ (s) + O2\ (g) \rightarrow 2\ MgO\ (s)$ $\Delta H = -288$ kcal.

a) Is the reaction exothermic or endothermic? b) Write the thermochemical equation.

c) Draw an enthalpy diagram for this reaction.

d) What is the value of ΔH for the reverse reaction?

e) Draw an enthalpy diagram for the reverse reaction.

13. The reaction involved in photosynthesis is:

$6\ CO2\ (g) + 6\ H2O\ (l) + 2802\ kJ \rightarrow C6H12O6\ (s) + 6\ O2\ (g)$

a) Is this reaction to be endothermic or exothermic? b) What is the sign for ΔH?

c) On an enthalpy diagram, would the products lie above or below the reactants?

14. Write the balanced chemical equation that shows the formation of ammonia gas ($NH3$) from its elements.

a) If ΔH for this reaction is - 22.08 kcals per mole of ammonia, write the thermochemical equation (in kJ). Hint: 1 calorie = 4.184 joules

b) Classify this as an endothermic or exothermic reaction.

c) Calculate the amount of heat produced when 85.0 grams of ammonia are formed.

d) If 750 kJ are involved, what volume of ammonia (at STP) would be produced?

e) How much heat is involved when 1.73×10^{25} molecules of hydrogen gas are completely reacted?

15. Given: $CaO\ (s) + SO3\ (g) \rightarrow CaSO4\ (s) + 96.0$ kcal

a) Classify this as an endothermic or exothermic reaction.

b) Calculate the mass of product formed to produce 24.0 kcal of heat.

16. Given: $Mg\ (s) + 2\ HCl\ (aq) \rightarrow MgCl2\ (aq) + H2\ (g) + 109.28$ kcal

a) How much heat is gained or lost when 12.0 grams of magnesium are used up?

b) What volume of hydrogen gas (at SATP) is formed when 750.0 kcals of heat are produced?

c) How many kilojoules of heat are involved when 150.0 ml of 2.50 mol/L HCl solution are completely reacted?

SCH4U

WORKSHEET – HEAT –ALL ANSWERS

1. Increase

2. Energy is stored in the chemical bonds.

3. Endothermic, exothermic

4. a) endo b) exo

c) endo d) exo

e) exo f) exo

5. For the same amount of energy, equal amounts of Fe absorb more heat than Au.

6. Since the heat capacity of water > heat capacity of granite, water absorbs more heat.

7. 3760 J

8. 73 C

9. a) 71.8 g

b) 3.99 mol

10. a) 5.09×10^4 J b) gain

c) release d) exo

11. a) negative

c) positive

d) less

12. a) exo

b) 2 Mg + O2 □ 2 MgO + 288 kcal

d) positive

13. a) endo

b) positive

c) products above reactants

14. a) 1/2N2(g) + 3/2 H2(g) □ NH3(g)+ 92.38 kJ b) exo

c) 462 kJ

d) 2.0×10^2 L

e) 1770 kJ

15. a) exo

b) 34.0 g

16. a) 54.0 kcal lost

b) 167 L

c) 85.7 kJ