odd + #6

2.

Bob's Calorimetry Problems Review Worksheet Name_____

1. $2\ Na + Cl_2 \rightarrow 2\ NaCl \quad \Delta H = -822\ kJ$

   a) How much heat is released when 46.0 g of Na reacts?

$$\frac{46\ g\ Na \mid 1\ mol\ Na \mid -822\ kJ}{22.99\ g \mid 2\ mol\ Na} = -822\ kJ$$

   b) If 1200 kJ of heat was produced, how much Cl_2 reacted?

$$\frac{-1200\ kJ \mid 1\ mol\ Cl_2 \mid 70.9\ g\ Cl_2}{-822\ kJ \mid 1\ mol\ Cl_2} = 104\ g = 1.0 \times 10^2\ g$$

   c) How much heat is produced if 35.5 g of NaCl is produced?

$$\frac{35.5\ g\ NaCl \mid 1\ mol\ NaCl \mid -822\ kJ}{58.44\ g \mid 2\ mol\ NaCl} = -250.\ kJ$$

2. $2\ S + 3\ O_2 \rightarrow 2\ SO_3 \quad \Delta H = -790\ kJ$

   a) If 250 mol of SO_3 is produced, how much heat is released?

$$\frac{250\ mol\ SO_3 \mid -790\ kJ}{2\ mol\ SO_3} = -98,800\ kJ = -4.0 \times 10^5\ kJ$$

   b) How much heat is produced when 64.0 g of O_2 is reacted?

$$\frac{64\ g\ O_2 \mid 1\ mol\ O_2 \mid -790\ kJ}{32\ g\ O_2 \mid 3\ mol\ O_2} = -527\ kJ$$

   c) If 723 kJ of heat was produced, what mass of SO_3 was produced?

$$\frac{-723\ kJ \mid 2\ mol\ SO_3 \mid 80.07\ g\ SO_3}{-790\ kJ \mid 1\ mol\ SO_3} = 147\ g$$

Problems 3 - 4: $2\ Al(s) + 3\ O_2(g) \rightarrow 2\ Al_2O_3(s) \quad \Delta H = -3351\ kJ$

3. Calculate the amount of heat produced when 75.0 g of $O_2(g)$ reacts.

$$\frac{75\ g\ O_2 \mid 1\ mol\ O_2 \mid -3351\ kJ}{32\ g\ O_2 \mid 3\ mol\ O_2} = -2617 = -2620\ kJ$$

4. What mass of Al_2O_3 is produced if 2250 kJ of heat is produced?

$$\frac{-2250\ kJ \mid 2\ mol\ Al_2O_3 \mid 102.0\ g}{-3351\ kJ \mid 1\ mol\ Al_2O_3} = 137\ g$$

5. A 36.0 g sample of metal with a temperature of 100.0 °C is placed in a calorimeter holding 80.0 g of water at 20.0 °C. The temperature of the water rises to 25.0 °C. What is the specific heat of the metal?

$$(36\ g)\,c\,(25 - 100) = -(80\ g)\left(4.184\ \tfrac{J}{g\,^\circ C}\right)(25 - 20\ ^\circ C)$$

$$-75 \qquad 5$$

$$c = .620\ \tfrac{J}{g\,^\circ C}$$

6. 2.50 grams of a substance loses 14.4 Joules of heat as its temperature drops from 25.0 °C to 20.0 °C. What is the substance's specific heat?

$$c = \frac{-14.4\ J}{(2.5\ g)(20-25\ ^\circ C)} = 1.15\ J/g^\circ C$$

$-5^\circ C$

7. Lead has a specific heat of 0.128 J/g°C. How much heat would a 150.0 g piece of lead give off as its temperature drops from 85.0 °C to 50.0 °C?

-35

$$heat = (150\ g)(.128\ J/g^\circ C)(50-85\ ^\circ C) = -672\ J$$

8. A chemical reaction takes place inside a calorimeter which contains 75.0 grams of water. The temperature of the water rises from 21.0 °C to 23.0 °C. Calculate the heat given off by the reaction. Is the rxn endothermic or exothermic?

$2^\circ C$

$$heat = -(75\ g)(4.184\ J/g^\circ C)(23-21\ ^\circ C) = -628\ J \quad EXO$$

9. A chemical reaction takes place inside a calorimeter which contains 50.0 grams of water. The temperature of the water drops from 23.0 °C to 19.0 °C. Calculate the heat given off by the reaction. Is the rxn endothermic or exothermic?

4°

$$heat = -(50\ g)(4.184\ \tfrac{J}{g^\circ C})(19-23\ ^\circ C) = +837\ J \quad Endo$$

10. A 10.0 gram piece of metal is heated to 100.°C. It is placed in a calorimeter containing 75.0 grams of water at 25.0 °C. The final temperature of the metal and water is 27.0 °C. What is the specific heat of the metal?

73° 2°

$$(10\ g)\,c\,(27-100\ ^\circ C) = -(75\ g)(4.184\ J/g^\circ C)(27-25)$$

$$c = .860\ J/g^\circ C$$

11. A 36.0 g sample of metal with a temperature of 100.0 °C is placed in a calorimeter holding 80.0 g of water at 20.0 °C. The temperature of the metal and water is 25.0 °C. What is the specific heat of the metal?

-75° 5°

$$(36\ g)(c)(25-100\ ^\circ C) = -(80\ g)(4.184\ J/g^\circ C)(25-20\ ^\circ C)$$

$$c = .620\ J/g^\circ C$$