Heat Stoichiometry

Name: ________________

Part 1: Decide whether each of the following is an endothermic or exothermic reaction.

1) $2\ S + 3\ O_2 \text{-->} 2\ SO_3 + 791\ kJ$ ____________________

2) $H_2 + Br_2 \text{-->} 2\ HBr \quad \Delta H = +78.3\ kJ$ ____________________

3) $2\ PCl_5 + 886\ kJ \text{--->} 2\ P + 5\ Cl_2$ ____________________

4) $C_2H_5OH + 3\ O_2 \text{--->} 2\ CO_2 + 3\ H_2O \quad \Delta H = -1367\ kJ$ ____________________

Part 2: Show set up and all work (including units) to receive full credit.

1) The chemical reaction in respiration burns glucose to provide energy for movement and body warmth. $C_6H_{12}O_6\ (s) + 6\ O_2\ (g) \text{-------->} 6\ CO_2\ (g) + 6\ H_2O(l) + 2870\ kJ$

a) If the average person burns 110. grams of glucose each day, how much heat energy from glucose is transferred to the person through respiration each day?

b) When suffering from a fever, your body temperature rises from 37^oC to 40^oC, burning 787 kJ of energy in the process. Assume that your body burns only glucose to raise your temperature, how many grams of oxygen will need to mix with the glucose?

2a) A mountain climber wants to melt snow for drinking water using his propane burner. How much energy is needed to melt 500. grams of snow (Heat needed to melt snow = 40.6 kJ/mol)?

a) Using the heat needed to melt snow, determine how much energy needs to be produced to melt all the snow.

b) If butane, C_4H_{10}, is used to melt the snow, based on the reaction:

$$2\ C_4H_{10}\ (g) + 13\ O_2\ (g) \text{-->} 8\ CO_2\ (g) + 10\ H_2O\ (g) \quad \Delta H = -5755\ kJ$$

Calculate how many grams of butane will need to be burned to produce the energy in (a).

Answers: 1a) 1750 kJ 2b) 22.7 g butane

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Part 1: Decide whether each of the following is an endothermic or exothermic reaction.

1) $6\ C + 3\ H_2 \text{-->} C_6H_6$ $\Delta H = +49$ kJ ____________________

2) $3\ Fe + 2\ O_2 \text{-->} Fe_3O_4$ $\Delta H = -1120$ kJ ____________________

3) $2\ NO \text{--->} N_2 + O_2 + 180$ kJ ____________________

4) $6\ CO_2 + 6\ H_2O + 2800$ kJ $\text{-->} C_6H_{12}O_6 + 6\ O_2$ ____________________

Part 2: Show set up and all work (including units) to receive full credit.

1) If 3.00 g of CO_2 is decomposed according to the reaction CO_2 (g) + 393.5 kJ --> C (s) + O_2 (g), how much energy is needed to do this?

2) How many grams of ammonia (NH_3) can be made using 522 kJ of energy based off the reaction:
4 NO (g) + 6 H_2O (g) --> 4 NH_3 (g) + O_2 (g) $\Delta H = +1170$ kJ

3) Which of the following combustion reactions releases more heat energy? You have to calculate the heat released by both reactions to determine which gives off the most heat.

a) burning 214 g of hydrogen   2 H_2 (g) + O_2 (g) -------> 2 H_2O (g) $\Delta H = -572$ kJ

b) burning 214 g of isoctane 2 C_8H_{18} (l) + 25 O_2 (g) ------> 16 CO_2 (g) + 18 H_2O (l) $\Delta H = -10990$ kJ

Answers: 1) 26.8 kJ   2) 30.3 g ammonia