ENERGY STOICHIOMETRY WORKSHEET

1. How much heat will be released when 6.44 g of sulfur reacts with excess O_2?

$$2\ S + 3\ O_2 \rightarrow 2\ SO_3;\ \Delta H° = -791.4\ kJ$$

2. Find the enthalpy change when 1.99 g of Na_2O_2 reacts with excess water.

$$2\ Na_2O_2\ (s) + 2\ H_2O\ (l) \rightarrow 4\ NaOH\ (aq.) + O_2\ (g);\ \Delta H° = -215\ kJ$$

3. Find the enthalpy change when 200 mL of 4 M ammonia reacts with excess hydrogen bromide.

$$NH_3\ (aq) + HBr\ (aq) \rightarrow NH_4Br\ (aq);\ \Delta H° = -188\ kJ$$

4. Compute the enthalpy change when decomposing 0.772 g cobalt (II) carbonate into cobalt (II) oxide and carbon dioxide.

$$CoCO_3\ (s) \rightarrow CoO\ (s) + CO_2\ (g);\ \Delta H° = +81.6\ kJ$$

5. What mass of propane, C_3H_8, must be burned to produce 76,000 kJ of energy?

$$C_3H_8 + 5\ O_2 \rightarrow 3\ CO_2 + 4\ H_2O;\ \Delta H° = -2200\ kJ$$

6. Compute the enthalpy change for producing 17.1 L of NO_2 at 1.5 atm and 30 °C.

$$2\ NO\ (g) + O_2\ (g) \rightarrow 2\ NO_2\ (g)\ ;\ \Delta H° = -114\ kJ$$

Name : _____

Date : _____

ENERGY STOICHIOMETRY WORKSHEET

Answers

1. How much heat will be released when 6.44 g of sulfur reacts with excess O_2?

$$2\ S + 3\ O_2 \rightarrow 2\ SO_3;\ \Delta H° = -791.4\ kJ$$

6.44 g S x (1 mol S/32 g S) x (-791.4 kJ/ 2 mol S) = -79.6 kJ

2. Find the enthalpy change when 1.99 g of Na_2O_2 reacts with excess water.

$$2\ Na_2O_2\ (s) + 2\ H_2O\ (l) \rightarrow 4\ NaOH\ (aq.) + O_2\ (g);\ \Delta H° = -215\ kJ$$

1.99 g Na_2O_2 x (1 mol Na_2O_2/77.978 g Na_2O_2) x (-215 kJ/2 mol Na_2O_2) = -2.743 kJ

3. Find the enthalpy change when 200 mL of 4 M ammonia reacts with excess hydrogen bromide.

$$NH_3\ (aq) + HBr\ (aq) \rightarrow NH_4Br\ (aq);\ \Delta H° = -188\ kJ$$

0.200 L NH_3 x (4 mol NH_3/1 L NH_3) x (-188 kJ/1 mol NH_3) = -150.4 kJ

4. Compute the enthalpy change when decomposing 0.772 g cobalt (II) carbonate into cobalt (II) oxide and carbon dioxide.

$$CoCO_3\ (s) \rightarrow CoO\ (s) + CO_2\ (g);\ \Delta H° = +81.6\ kJ$$

0.772 g $CoCO_3$ x (1 mol $CoCO_3$/118.941 g $CoCO_3$) x (+81.6 kJ/ 1 mol $CoCO_3$) = +0.5296 kJ

5. What mass of propane, C_3H_8, must be burned to produce 76,000 kJ of energy?

$$C_3H_8 + 5\ O_2 \rightarrow 3\ CO_2 + 4\ H_2O;\ \Delta H° = -2200\ kJ$$

-76,000 kJ x (1 mol C_3H_8/-2200 kJ) x (44 g C_3H_8/1 mol C_3H_8) = 1520 g C_3H_8

6. Compute the enthalpy change for producing 17.1 L of NO_2 at 1.5 atm and 30 °C.

$$2\ NO\ (g) + O_2\ (g) \rightarrow 2\ NO_2\ (g)\ ;\ \Delta H° = -114\ kJ$$

Number of moles of NO_2: n = PV/RT = (1.5 atm x 17.1 L)/(0.082 L-atm x (273 + 30 K)) = 1.03 mol NO_2

1.03 mol NO_2 x (-114 kJ/2 mol NO_2) = -58.76 kJ

Name : _____

Date : _____