CHEMISTRY 11 AP – ENERGY CHANGES IN CHEMICAL REACTIONS WORKSHEET

1) Indicate whether each of the following changes is endothermic or exothermic.

   (a) Barbecuing a steak

   (b) Freezing a tray full of water to make ice

   (c) Neutralizing an acid spill with baking soda

   (d) Making a grilled cheese sandwich

   (e) Condensing water on a mirror

2) Rewrite the following reactions including the energy term. **(4 marks)**

   (a) $2\ NO_{(g)} + O_{2\ (g)} \rightarrow 2\ NO_{2\ (g)}$ $\Delta H = +112$ kJ

   (b) $C_{(s)} + O_{2\ (g)} \rightarrow CO_{2\ (g)}$ $\Delta H = -394$ kJ

   (c) $CaO_{(s)} + 3\ C_{(s)} \rightarrow CaC_{2\ (s)} + CO_{(g)}$ $\Delta H = +464.8$ kJ

   (d) $CaO_{(s)} + H_2O_{(l)} \rightarrow Ca(OH)_{2\ (aq)}$ $\Delta H = -65.2$ kJ

3) Determine the ΔH for the following reactions and state whether the reaction is endothermic or exothermic. **(4 marks)**

   (a) $CH_{4\ (g)} + 2\ O_{2\ (g)} \rightarrow CO_{2\ (g)} + 2\ H_2O_{(l)} + 890.3$ kJ

   (b) $2\ Na_2O_{2\ (s)} + 2\ H_2O_{(l)} + 287.0$ kJ $\rightarrow 4\ NaOH_{(aq)} + O_{2\ (g)}$

   (c) $2\ H_{2\ (g)} + O_{2\ (g)} \rightarrow 2\ H_2O_{(l)} + 572$ kJ

   (d) 28 kJ $+ H_{2\ (g)} + I_{2\ (g)} \rightarrow 2\ HI_{(g)}$

4) When carbon monoxide and nitrogen dioxide react, 234 kJ is released. Which of the following correctly represent this reaction? **(2 marks)**

I	$CO(g) + NO_2(g) \rightarrow CO_2(g) + NO(g) + 234\,kJ$
II	$CO(g) + NO_2(g) + 234\,kJ \rightarrow CO_2(g) + NO(g)$
III	$CO(g) + NO_2(g) \rightarrow CO_2(g) + NO(g) \quad \Delta H = +234\,kJ$
IV	$CO(g) + NO_2(g) \rightarrow CO_2(g) + NO(g) \quad \Delta H = -234\,kJ$

5) Given the following ΔH values, write a balanced thermochemical equation and an equation using ΔH notation with the smallest possible whole number coefficients for each of the following changes:

(a) $\Delta H_{\text{combustion}}$ of $C_2H_{6\,(g)} = -1428.5$ kJ/mol

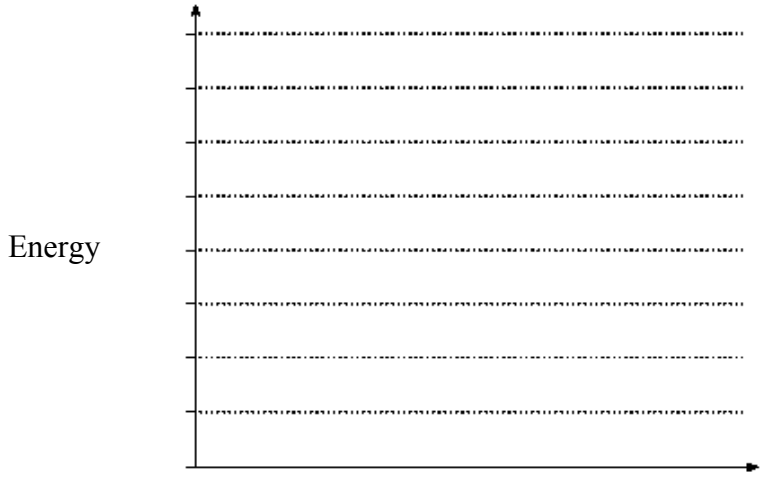
(b) $\Delta H_{\text{decomposition}}$ of $NH_{3\,(g)} = +46.1$ kJ/mol

(c) $\Delta H_{\text{formation}}$ of $HBr_{(g)} = -36.1$ kJ/mol

6) Consider the following reaction:

$$CaO_{(s)} + H_2O_{(l)} \rightarrow Ca(OH)_{2\,(aq)} \qquad \Delta H = -60.0 \text{ kJ}$$

Draw the energy diagram for the above reaction. **(2 marks)**



7) Consider the following reaction:

$$N_2O_{4\,(g)} + 50.0 \text{ kJ} \rightarrow 2\,NO_{2\,(g)}$$

Draw the energy diagram for the above reaction. **(2 marks)**