CHM151 Quiz 6b Spring 2019 25 Pts Name Key

SHOW ALL WORK TO RECEIVE CREDIT.

1) Which one of the following equations represents the formation reaction of $CH_3OH(l)$?

A) C(graphite) + $2H_2(g)$ + $\frac{1}{2}O_2(g)$ → $CH_3OH(l)$

B) C(diamond) + $4H(g)$ + $O(g)$ → $CH_3OH(l)$

C) $C(g)$ + $2H_2(g)$ + $\frac{1}{2}O_2(g)$ → $CH_3OH(l)$

D) C(graphite) + $4H(g)$ + $O(g)$ → $CH_3OH(l)$

E) $C(g)$ + $4H(g)$ + $O(g)$ → $CH_3OH(l)$

2) Calculate the $\Delta H°_{rxn}$ for the decomposition of calcium carbonate to calcium oxide and carbon dioxide.

$\Delta H°_f[CaCO_3(s)] = -1206.9$ kJ/mol; $\Delta H°_f[CaO(s)] = -635.1$ kJ/mol;

$\Delta H°_f[CO_2(g)] = -393.5$ kJ/mol

$CaCO_3(s) \rightarrow CaO(s) + CO_2(g)$

$\Delta H°_{rxn} = \sum n\Delta H_{products} - \sum n\Delta H_{reactants}$

$(-635.1 + (-393.5)) - (-1206.9)$ kJ

$\Delta H°_{rxn} = 178.3$ kJ

3) Ethylene glycol, used as a coolant in automotive engines, has a specific heat capacity of 2.42 J/(g·K). Calculate q when 3.65 kg of ethylene glycol is cooled from 132°C to 85°C.

$3.65 \cancel{\text{kg}} \left| \frac{2.42 \text{ J}}{\cancel{\text{g}} \cdot \text{K}} \right| (132 - 85) \cancel{^\circ\text{C}} = 415$ kJ

$\Delta °C = \Delta K$

— more on back —

Key

4) Use Hess's Law to calculate the enthalpy change for the reaction

Goal: $WO_3(s) + 3H_2(g) \rightarrow W(s) + 3H_2O(g)$

from the following data:

① $2W(s) + 3O_2(g) \rightarrow 2WO_3(s)$ $\Delta H = -1685.4$ kJ

② $2H_2(g) + O_2(g) \rightarrow 2H_2O(g)$ $\Delta H = -477.84$ kJ

① ÷ 2 + reverse $WO_3(s) \rightarrow W(s) + \frac{3}{2}O_2$ $+842.7$

② × $\frac{3}{2}$ $3H_2(g) + \frac{3}{2}O_2(g) \rightarrow 3H_2O(g)$ -716.76

$WO_3(s) + 3H_2(g) \rightarrow W(s) + 3H_2O(g)$ 125.9 kJ

5) Sand is converted to pure silicon in a three step process. The third step is

$SiCl_4(g) + 2Mg(s) \rightarrow 2MgCl_2(s) + Si(s)$ $\Delta H = -625.6$ kJ

What is the enthalpy change when 25.0 mol of silicon tetrachloride is converted to elemental silicon

$$25.0 \text{ mol } SiCl_4 \left| \frac{1 \text{ mol Si}}{1 \text{ mol } SiCl_4} \right| \frac{-625.6 \text{ kJ}}{\text{mol Si}} = -1.56 \times 10^4 \text{ kJ}$$

-15640 kJ