SCH4UR – F2018B – Period 2

Chapter 5 – Energy and Enthalpy Quiz

For full marks, please provide complete solutions with all units and sig
Good luck! ☺

$c_{water} = 4.184 J/g°C$ $d_{water} = 1.0 g/mL$

1. Identify the following as either an open, closed or isolated system: (1 mark K)

   a) Soda in an unopened soft drink can — (closed), heat can escape but the can is sealed

   b) An aquarium — open because of the aquarium has an open top, for like dolphins to jump, water and water vapour can escape as well as the heat

2. Use the following equation to answer the questions that follow:

$$C_2H_5OH(l) + 3O_2(g) \rightarrow 2CO_2(g) + 3H_2O(g) \quad \Delta H = -1235 \text{ kJ}$$

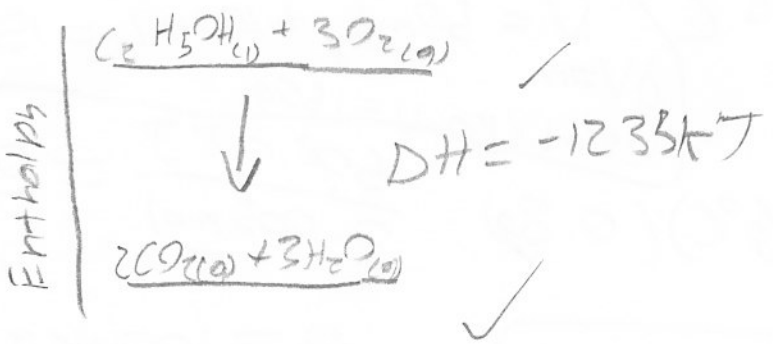
   a) Is the reaction endothermic or exothermic? (1 mark K)

   exothermic, negative ΔH, and can tell us in Q # 2d

   b) Rewrite the thermochemical equation, including the enthalpy of reaction as either a reactant or a product. (1 mark C)

   $C_2H_5OH_{(l)} + 3O_{2(g)} \rightarrow 2CO_{2(g)} + 3H_2O_{(g)} + 1235 kJ$

   c) Draw a labelled enthalpy diagram to represent the reaction. (2 marks C)



   d) How much energy is released when 7.36g of C_2H_5OH reacts? (3 marks = 2 marks T, 1 mark C)

$$7.36 g \; C_2H_5OH \;/\; [2(12.01) + 6(1.01) + 1(16.00) \; g/mol] = 0.15972 \text{ mol of } C_2H_5OH$$

$$\frac{-1235 kJ}{1 mol} = \frac{Q kJ}{0.15972 mol}$$

$Q kJ/mol = -197.25 kJ/mol$

$Q = -197.2560 kJ = -197 kJ$

So 197 kJ of energy is released when 7.36 g of C_2H_5OH is reacted

ethanol

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3. Calculate the enthalpy for the following reaction, given the equations shown below. Remember to show all work to receive full marks. (4 marks T)

only 3 sig dos

$4NH_3(g) + 5O_2(g) \rightarrow 4NO(g) + 6H_2O(g)$ $\Delta H = ?$

a (1) $N_2(g) + O_2(g) \rightarrow 2NO(g)$ $\Delta H = -180.5$ kJ

b (2) $N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$ $\Delta H = -91.8$ kJ

c (3) $2H_2(g) + O_2(g) \rightarrow 2H_2O(g)$ $\Delta H = -483.6$ kJ

$\Delta H = -2(b) + 2a + 3c$

$\Delta H = +2(-91.8) + 2(-180.5) + 3(-483.6)$

$= -1628.2$ kJ

$4NH_{3(g)} \rightarrow 2N_{2(g)} + 6H_{2(g)}$

$4NH_{3(g)} + 2N_{2(g)} + 2O_{2(g)} \rightarrow 4NO_{(g)} + 2N_{2(g)} + 6H_{2(g)}$

$4NH_{3(g)} + 2O_{2(g)} + 3O_{2(g)} + 6H_{2(g)} \rightarrow 4NO_{(g)} + 6H_2O_{(g)} + 6H_{2(g)}$

$4NH_{3(g)} + 5O_{2(g)} \rightarrow 4NO_{(g)} + 6H_2O_{(g)}$

sig fig

So The enthalpy of the reaction is -1630 kJ

3 sig dos

4. In a coffee cup calorimeter, 50.0mL of 0.100mol/L $AgNO_3$(aq) and 100.0mL of 0.050 mol/L HCl(aq) are mixed. The two solutions were initially at 22.60°C and the final temperature is 23.40°C. Calculate the enthalpy change for this reaction in kJ/mol. (5 marks = 4 marks T, 1 mark C)

$\Delta T = 23.4 - 22.6 = 0.8°C$

$Q = mc\Delta T$

$Q = (150\,g)(4.184\,J/g°C)(0.8g)$

$= 502.08\,J$

$V = 50mL + 100mL = 150mL$

$\delta V = m$

$(1g/mL)(150mL) = 150g$

$\frac{502.08\,J}{0.005\,mol} = \frac{Q}{1}$

$Q = 100416\,J$

$= 100.416\,kJ$

reaction is exothermic $= -100$ kJ

So The enthalpy change of the reaction is -100 kJ

sig fig

mols of $AgNO_3$

$\frac{n\,mol}{50mL} = \frac{2\,1mol}{1000mL}$

$n = 0.005mol$

mols of HCl

$\frac{n\,mol}{100mL} = \frac{0.050\,mol}{1000mL}$

$n = 0.005mol$