DPP SOLUTION

- **Subject – Physical Chemistry**
- **Chapter –** Thermodynamics and Thermochemistry

DPP No.- 06

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Question-

0.16 g of methane was subjected to combustion at 27°C in a bomb calorimeter system. The temperature of the calorimeter system (including water) was found to rise by 0.5°C. Heat of combustion of methane at constant pressure is(Heat capacity of the calorimeter system is 17.7 kJ K^{-1}.

1. −890 kJ
2. −885 kJ
3. +890 kJ
4. +885 kJ

$w_{CH_4} = 0.16\,g \quad T = 300\,K \quad \Delta T = 0.5^\circ C \quad \Delta H = ?$

$q_V = \Delta U = \dfrac{(\text{Heat Cap. of B.C.} + \text{Heat Cap. of } H_2O)\,\Delta T}{n_{CH_4}}$ J/mole

$\Delta U = -\dfrac{17700 \times 0.5 \times 16}{0.16 \times 100}$ J/mole

$= -\dfrac{177000 \times 5}{1000}$ KJ/mole

$CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O(l) \quad \Delta n_g = 1 - 3 = -2$

$= -885$ KJ/mole

$\Delta H = \Delta U + \Delta n_g RT$

$= -885 - \dfrac{2 \times 25 \times 298}{3 \times 1000}$

$= -885 - \dfrac{14900}{3000}$

$= -885 - 4.96$

≈ -890 KJ

Ans. (1)

Question-

Standard enthalpy of formation is zero for

1. $C_{diamond}$
2. $Br(g)$
3. $C_{graphite}$
4. $O_3(g)$

Ans. (3)

Question-

18 g of water is taken to prepare the tea. Find out the internal energy of vaporization at 100°C (Δ_{vap} H for water at 373 K is 40.66 kJ mol^{-1})

1. 37.56 kJ mol^{-1}
2. −37.56 kJ mol^{-1}
3. 43.73 kJ mol^{-1}
4. −43.76 kJ mol^{-1}

$\Delta U = ?$

$H_2O(l) \longrightarrow H_2O(g)$

$n = \frac{18}{18} = 1$

$\Delta n_g = 1 - 0 = 1$

$T = 100^\circ C = 373 K$

$\Delta H = 40.66$ kJ/mol

$\Delta H = \Delta U + \Delta n_g RT$

$\Delta U = \Delta H - \Delta n_g RT$

$= 40.66 - \frac{1 \times 25 \times 373}{3 \times 1000} = 40.66 - \frac{9325}{3000}$

$= 40.66 - 3.1 = 37.56$ KJ

Ans. (1)

Question-

When 0.5 g of sulphur is burnt to SO_2, 4.6 kJ of heat is liberated. What is the enthalpy of formation of Sulphur dioxide.

1. +147.2 kJ
2. −147 kJ
3. −294.4 kJ
4. +294.4 kJ

$S + O_2 \rightarrow SO_2 \quad \Delta H = -4.6$ kJ

0.5g

$0.5g\ S \rightarrow -4.6$ kJ

$32g\ S \rightarrow \frac{-4.6 \times 32}{0.5} = -294.4$ kJ of heat liberated

$\Delta H = -294.4$ kJ

Ans. (3)

Question-

The enthalpy change for the reaction $H_2O(s) \rightarrow H_2O(\ell)$ is called

1. Enthalpy of formation
2. Enthalpy of fusion
3. Enthalpy of vaporisation
4. Enthalpy of transition

Ans. (2)

Question-

The ΔH° for the reaction, $4\ S\ (s) + 6O_2(\ g) \rightarrow 4SO_3(\ g)$ is -1583.2 kJ.–Standard enthalpy of formation of sulphur trioxide is:

1. -3166.4 kJ
2. 3166.4 kJ
3. -395.8 kJ
4. 395.8 kJ

$$1S + \frac{3}{2}O_2(g) \longrightarrow 1SO_3$$

4 mole SO_3 → 1583.2 kJ Heat released

1 mole SO_3 → $\frac{1583.2}{4} = 395.8$ kJ Heat released

$$\Delta H = -395.8 \text{ kJ}$$

Ans. (3)

Question-

Bond dissociation enthalpy is used to defining enthalpy change of a reaction as

1. $\Delta H_r = \Sigma$ (Bond dissociation enthalpy)$_{Reactant} - \Sigma$(Bond dissociation enthalpy)$_{Product}$
2. $\Delta H_r = \Sigma$ (Bond dissociation enthalpy)$_{Product} - \Sigma$(Bond dissociation enthalpy)$_{Reactant}$
3. $\Delta H_r = \Sigma$ (Bond dissociation enthalpy)$_{Product} + \Sigma$(Bond dissociation enthalpy)$_{Reactant}$
4. None of these

Ans. (1)

Question-

The heat released in neutralization of HCl and NaOH is 13.7kcal/mol, the heat released on neutralization of NaOH with CH_3COOH is 3.7 kcal/mol. The $\Delta H°$ of ionization of CH_3OOOH is

1. 10.2 k cal
2. 10 k cal
3. 3.7 k cal
4. 9.5 k cal

13.7 KCal

W.A → 3.7 KCal

Heat used in dissociation of CH_3COOH = x

$13.7 = 3.7 + x$

$x = 13.7 - 3.7$

$= 10$ Kcal

Ans. (2)

Question-

Heat of neutralization of strong acid by a strong base is equal to ΔH of

$1H^+ + 1OH^- \rightarrow 1H_2O$

1. $H^+ + OH^- \longrightarrow H_2O$
2. $H_2O + H^+ \longrightarrow H_3O^+$
3. $2H_2 + O_2 \longrightarrow 2H_2O$
4. $NH_4OH + HCl \longrightarrow NH_4Cl + H_2O$

Ans. (1)

Question-

W.A ← CH_3COOH NaOH

The Enthalpy of neutralization of acetic acid and sodium hydroxide is –55.4 kJ. What is the enthalpy of ionisation of acetic acid?

1. –5.54 kJ
2. +5.54 kJ
3. +1.9 kJ
4. –1.9 kJ

S.A + S.B → neutralisation

$57.3 = x + 55.4$

$x = 57.3 - 55.4$

$= 1.9$ KJ of heat used in dissociation of CH_3COOH

Ans. (3)

Question-

Which of the following acid has the lowest value (magnitude) of heat neutralization?

1. CH_3COOH
2. HCl
3. HBr
4. HI

most w.A. max Heat used in dissociation of w.A.

Max. w.A.

Ans. (1)

Question-

The enthalpy of neutralization of any strong acid and strong base is nearly equal to

1. +57.3 kJ/mol
2. −75.3 kJ/mol
3. +75.3 kJ/mol
4. −57.3 kJ/eq

Ans. (4)

Thank You...