



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).

- $\Delta H = ?$
 $\Delta T = 0.5^\circ\text{C}$
 $T = 300\text{ K}$
 $W_{\text{CH}_4} = 0.16\text{ g}$
 -890 kJ
 -885 kJ
 $+890\text{ kJ}$
 $+885\text{ kJ}$
- $q_v = \Delta U = \frac{\text{Heat Cap. of B.C.} + \text{Heat Cap. of H}_2\text{O}}{n_{\text{CH}_4}} \Delta T$ J/mole
 $\Delta U = \frac{17700 \times 0.5 \times 16}{0.16 \times 1000}$ J/mole
 $= -17700 \times 5 \text{ kJ/mole}$
 $= -885 \text{ kJ/mole}$
- $\Delta H = \Delta U + \Delta n_g RT$
 $= -885 - \frac{2 \times 25 \times 298}{3 \times 1000}$
 $= -885 - \frac{14900}{3000}$
 $= -885 - 4.96$
 $\approx -890 \text{ kJ}$
- $\text{CH}_4(\text{g}) + 2\text{O}_2(\text{g}) \rightarrow \text{CO}_2(\text{g}) + 2\text{H}_2\text{O}(\text{l})$
 $\Delta n_g = 1 - 3 = -2$
 $= -885 \text{ kJ/mole}$
- Ans. (1)

Question-



Standard enthalpy of formation is zero for

① ~~X~~ $\text{C}_{\text{diamond}}$

② ~~X~~ Br(g)

③ ☒ $\text{C}_{\text{graphite}}$

④ ~~X~~ $\text{O}_3(\text{g})$

Ans. (3)

Question-



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

1 ~~37.56 kJ mol⁻¹~~ $\Delta U = ?$ $\text{H}_2\text{O}(l) \longrightarrow \text{H}_2\text{O}(g)$

2 $-37.56\text{ kJ mol}^{-1}$ $n = \frac{18}{18} = 1$ $\Delta n_g = 1 - 0 = 1$

3 43.73 kJ mol^{-1} $\Delta H = 40.66\text{ kJ/mol}$ $T = 100^{\circ}\text{C}$
 373 K

4 $-43.76\text{ kJ mol}^{-1}$ $\Delta H = \Delta U + \Delta n_g R T$

$$\Delta U = \Delta H - \Delta n_g R T$$

$$= 40.66 - \frac{1 \times 25 \times 373}{8 \times 1000} = 40.66 - \frac{9325}{3000}$$

$$= 40.66 - 3.1 = 37.56\text{ kJ}$$

Ans. (1)

Question-

32S



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



0.5g

$$\begin{aligned} 0.5\text{g S} &\rightarrow 4.6 \text{ kJ} \\ 32\text{g S} &\rightarrow \frac{4.6 \times 32}{0.5} \times 10^3 \end{aligned}$$

= 294.4 kJ of
Heat liberated

$$\Delta H = \underline{\underline{-294.4 \text{ kJ}}}$$

Question-



The enthalpy change for the reaction $\text{H}_2\text{O}(\text{s}) \rightarrow \text{H}_2\text{O}(\ell)$ is called

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



Ans. (2)

Question-

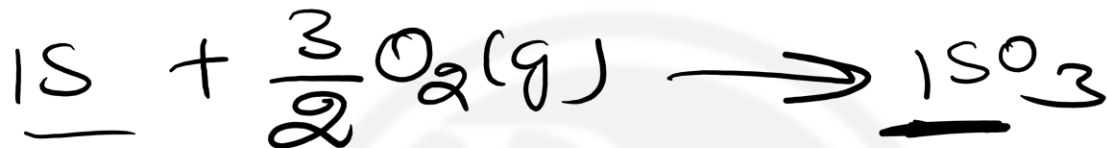


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✓

The ΔH° for the reaction, $4 \text{ S (s)} + 6 \text{ O}_2(\text{ g}) \rightarrow 4 \text{ SO}_3(\text{ g})$ 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

4 mole $\text{SO}_3 \rightarrow 1583.2 \text{ kJ}$ Heat released

1 mole $\text{SO}_3 \rightarrow \frac{1583.2}{4} = 395.8 \text{ kJ}$ 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 $\Delta H_r = \Sigma (\text{Bond dissociation enthalpy})_{\text{Reactant}} - \Sigma (\text{Bond dissociation enthalpy})_{\text{Product}}$
- ② $\Delta H_r = \Sigma (\text{Bond dissociation enthalpy})_{\text{Product}} - \Sigma (\text{Bond dissociation enthalpy})_{\text{Reactant}}$
- ③ $\Delta H_r = \Sigma (\text{Bond dissociation enthalpy})_{\text{Product}} + \Sigma (\text{Bond dissociation enthalpy})_{\text{Reactant}}$
- ④ None of these

Ans. (1)

Question-



The heat released in neutralization of HCl and NaOH is 13.7 kcal/mol, the heat released on neutralization of NaOH with CH₃COOH is 3.7 kcal/mol. The ΔH° of ionization of CH₃COOH is

1 10.2 k cal

13.7 K Cal

~~2~~ 10 k cal

$$13.7 = 3.7 + \textcircled{x}$$

3 3.7 k cal

4 9.5 k cal

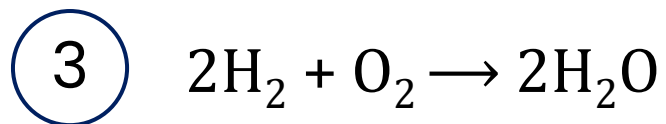
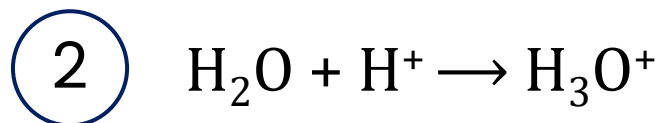
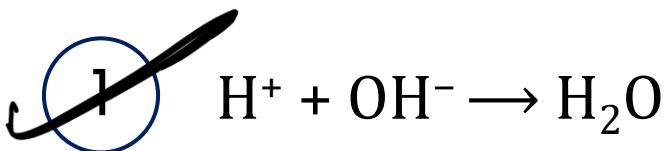
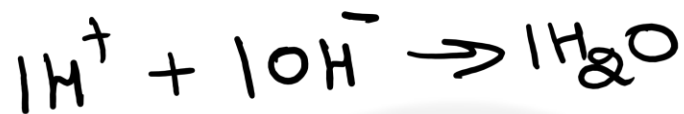
$$\begin{aligned} x &= 13.7 - 3.7 \\ &= 10 \text{ K cal} \end{aligned}$$

W.A
3.7 K Cal
Heat used in dissociation of CH₃COOH = x

Question-



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



Ans. (1)

Question-



W.A. \leftarrow CH_3COOH $\xrightarrow{\text{NaOH}}$

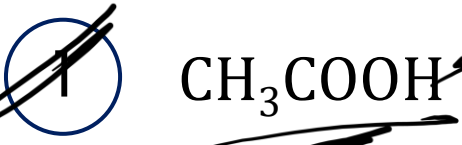
The Enthalpy of neutralization of acetic acid and sodium hydroxide is -55.4 kJ.
What is the enthalpy of ionisation of acetic acid?

- (1) -5.54 kJ S.A + S.B \rightarrow neutralisation
- (2) $+5.54$ kJ $57.3 = \cancel{\text{X}} + 55.4$
- (3) $+1.9$ kJ $\text{X} = 57.3 - 55.4$
- (4) -1.9 kJ $= 1.9$ kJ of heat used in dissociation of CH_3COOH

Question-



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



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

