

**Topic : Thermodynamics & Thermochemistry**
**Type of Questions**

Single choice Objective ('-1' negative marking) Q.1 to Q.5

(3 marks, 3 min.)

M.M., Min.

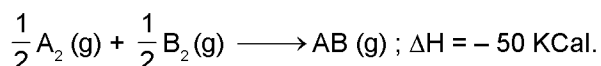
[15, 15]

Subjective Questions ('-1' negative marking) Q.6 to Q.9

(4 marks, 5 min.)

[16, 20]

1. For the reaction,


 If the bond energies of  $A_2$ ,  $B_2$  and 'AB' are respectively  $x$ ,  $\frac{x}{2}$  and  $x$  KCal, the value of  $x$  is :

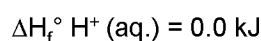
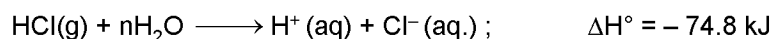
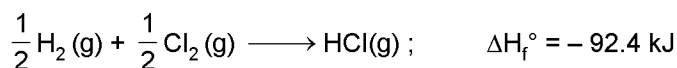
- (A) 50 (B) 100 (C) 200 (D) 400

2. The enthalpy of neutralization of 40 g of NaOH by 60 g of  $CH_3COOH$  will be :

- (A) 57.1 kJ equiv
- <sup>-1</sup>
- (B) less than 57.1 kJ equiv
- <sup>-1</sup>
- 
- (C) more than 57.1 kJ equiv
- <sup>-1</sup>
- (D) 13.7 kJ equiv
- <sup>-1</sup>

3. The heat evolved in neutralizing a solution containing 1mole of HCN with a strong alkali is 3 KCal. The enthalpy of dissociation of HCN is :

- (A) 10.2 KCal (B) 13.7 KCal (C) 10.7 KCal (D) 16.7 KCal

4.  $\Delta H_f^\circ$  for the chloride ion (aq) from the following data will be :

- (A) 167.2 kJ (B) - 167.2 kJ (C) 334.4 kJ (D) - 334.4 kJ

5. The polymerisation of ethylene to linear polyethylene is represented by the reaction :

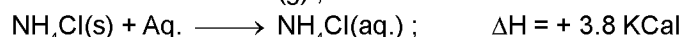
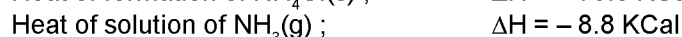
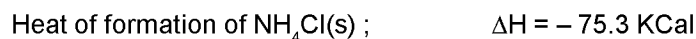
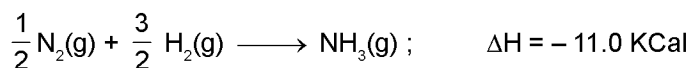
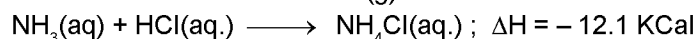
 $n CH_2 = CH_2 \longrightarrow (CH_2 - CH_2)_n$  where  $n$  has a large integral value. Given that the average enthalpies of bond dissociation for  $C = C$  &  $C - C$  at 298 K are +590 & +331 KJ mol<sup>-1</sup> respectively. Then the enthalpy of polymerisation per mole of ethylene at 298 K will be :

- (A) 72 kJ/mol (B) - 72 kJ/mol (C) 36 kJ/mol (D) - 36 kJ/mol

6. Assuming that 50% of the heat is useful, how many kg of water at 15°C can be heated to 95°C by burning 280 litre of methane at STP ? The heat of combustion of methane is 240 KCal/mol.

7. One litre sample of a mixture of  $CH_4$  and  $O_2$  measured at 27°C and 760 torr, was allowed to react at constant pressure in a calorimeter. The complete combustion of  $CH_4$  to  $CO_2$  and water caused a temperature rise in calorimeter of 0.667 K. Calculate mole % of  $CH_4$  in original mixture. ( $R = 1/12L \text{ atm/K/mole}$ )8. The specific heats of iodine vapour and solid are 0.031 Calg<sup>-1</sup>°C<sup>-1</sup> and 0.055 Calg<sup>-1</sup>°C<sup>-1</sup> respectively. If heat of sublimation of iodine is 24 Cal/g at 200°C, what is its value at 250°C ?

9. Calculate the heat of formation of HCl (g) from :



# Answer Key

## DPP No. # 50

1. (C)      2. (B)      3. (C)      4. (B)      5. (B)  
6. 8.33 kg.      7. 10%.      8. 22.8 Cal/g.      9. -22.1 KCal

# Hints & Solutions

## DPP No. # 50

2. Since it is neutralisation of a weak acid with strong base.  
3. enthalpy of dissociation =  $(13.7 - 3)$  KCal = 10.7 KCal

6.  $n_{\text{CH}_4} = \frac{280}{22.4}$

$$\therefore \Delta H_{\text{obtained}} = \frac{240 \times 280}{22.4} \text{ KCal}$$

$$\therefore m = \frac{240 \times 280}{22.4 \times 2 \times 1 \times 180} \text{ kg} = 8.33 \text{ kg.}$$

7. Heat generated =  $C_T \Delta T = 1260 \times 0.667$  cal.

$$\therefore n_{\text{CH}_4} = \frac{1260 \times 0.667}{210 \times 10^3}$$

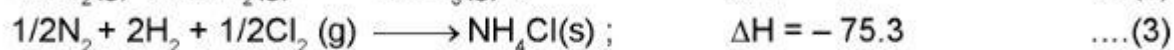
$$n_{\text{total}} = \frac{PV}{RT} = 4 \times 10^{-2}$$

$$\therefore \text{mol\%} = \frac{4 \times 10^{-3}}{4 \times 10^{-2}} \times 100\% = 10\% \text{ Ans.}$$

8.  $\Delta H_2 - 24 = -0.024 \times (523 - 473)$  Cal/g.  
 $\therefore \Delta H_2 = 22.8$  Cal/g.



9. **Target eq**  $1/2 \text{H}_2(\text{g}) + 1/2 \text{Cl}_2(\text{g}) \longrightarrow \text{HCl}(\text{g})$

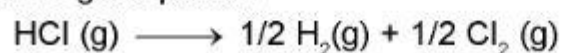


$$\Delta\text{H} = \text{eq (6)} - \text{eq (3)} + \text{eq (2)} + \text{eq (4)} + \text{eq (5)}$$

$$= -12.1 - 3.8 - (-75.3) - 11 - 8.8 - 17.5$$

$$= +22.1$$

from this we get equation



$$\therefore \Delta\text{H of target eq} = -\Delta\text{H} = -22.1 \text{ Kcal Ans.}$$

