THERMOCHEMISTRY

1. The standard heat of formation $\left(\Delta_f H^0_{298}\right)$ of ethane in (kJ/mol), if the heat of combustion of ethane, hydrogen and graphite are –1560, –393.5 and –286 kJ/mol, respectively is _____

2. If enthalpy of atomisation for $Br_{2(l)}$ is x kJ/mol and bond enthalpy for Br_2 is y kJ/mol, the relation between them :

(1) is x = y (2) is x < y

(3) does not exist (4) is x > y

3. Lattice enthalpy and enthalpy of solution of NaCl are 788 kJ mol^{-1} and 4 kJ mol^{-1}, respectively. The hydration enthalpy of NaCl is :

(1) –780 kJ mol^{-1} (2) –784 kJ mol^{-1}

(3) 780 kJ mol^{-1} (4) 784 kJ mol^{-1}

4. The heat of combustion of ethanol into carbon dioxide and water is –327 kcal at constant pressure. The heat evolved (in cal) at constant volume and 27°C (if all gases behave ideally) is (R = 2 cal mol^{-1} K^{-1})

SOLUTION

1. NTA Ans. (–192.50 or –85.00)

Sol. $2C(\text{graphite}) + 3H_2(g) \longrightarrow C_2H_6(g)$

$\Delta_f H\,(C_2H_6) = 2\Delta H_{comb}\,(C_{graphite}) + 3\,\Delta H_{comb}(H_2) - \Delta H_{comb}\,(C_2H_6)$

$= -(286\times 2) - (393.5\times 3) - (-1560)$

$= -572 - 1180.5 + 1560 = -192.5$ kJ/mole

2. NTA Ans. (4)

Sol. Enthalpy of atomisation of $Br_2(l)$

$$Br_2(l) \xrightarrow{\Delta H_{vap}} Br_2(g) \xrightarrow{\Delta H_{BE}} 2Br(g)$$

$$\Delta H_{atom.}$$

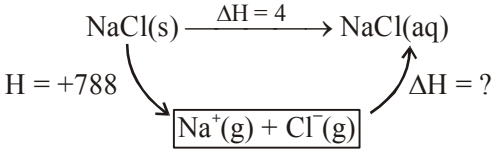
$\Delta H_{atom} = \Delta H_{vap} + \Delta H_{BE}$

$x = \Delta H_{vap} + y$

So, $x > y$

3. Official Ans. by NTA (2)

Sol.



$4 = 788 + \Delta H$

$\Delta H = -784$ kJ

4. Official Ans. by NTA (–326400.00)
Official Ans. by ALLEN (326400.00)

Sol. $C_2H_5OH_{(\ell)} + 3O_{2(g)} \longrightarrow 2CO_{2(g)} + 3H_2O_{(\ell)}$

$\Delta n_g = 2 - 3 = -1$

$\Delta_c H = \Delta_c U + (\Delta n_g)\,RT$

$\Delta_c H = \Delta_c U - RT$

$\Delta_c U = \Delta_c H + RT$

$= -327 \times 10^3 + 2 \times 300$

$= -326400$ cal.

$\therefore$ Heat evolved

$= 326400$ cal.