Daily Tutorial Sheet-4	Level-1

46.(D) $\Delta H \neq \Delta E$ for $CO(g) + \frac{1}{2}O_2(g) \longrightarrow CO_2(g)$ because $\Delta n_g \neq 0$

47.(A) The amount of heat evolved or absorbed in the formation of one mole of product from its elements.

So, the correct answer is $C + O_2 \text{ (1 atm)} \longrightarrow CO_2 \text{ (1 atm)}$.

48.(D) The formation of one mole of HCl can be represented as,

$$\frac{1}{2}(H-H) + \frac{1}{2}(Cl-Cl) \longrightarrow H-Cl; \quad \Delta H = -90 \text{ kJ}$$

Hence, for the reaction,

Heat evolved = heat evolved in bond formation – heat required for bond breaking

$\therefore \quad 90 \text{ KJ} = [H-Cl \text{ bond energy}] - \left(\frac{1}{2} \times 430 + \frac{1}{2} \times 240\right)$

$\therefore \quad (H-Cl \text{ bond energy}) = 90 + (215 + 120) = 425 \text{ kJ mol}^{-1}$

49.(D) Formation of XY is known as : $\frac{1}{2}X_2 + \frac{1}{2}Y_2 \longrightarrow XY$

$\Delta H = (BE)_{X-X} + (BE)_{Y-Y} - 2(BE)_{X-Y}$

If (BE) of $X-Y = a$

Then (BE) of $(X-X) = a$

And (BE) of $(Y-Y) = \frac{a}{2}$

$\therefore \quad \Delta H_f (X-Y) = -200 \text{ kJ} \quad \therefore \quad -400 (\text{for } 2 \text{ mol XY}) = a + \frac{a}{2} - 2a$

$\Rightarrow \quad -400 = -\frac{a}{2} \quad \Rightarrow \quad a = +800 \text{ kJ}$

The bond dissociation energy of $X_2 = 800 \text{ kJ mol}^{-1}$.

50.(B) $CH_3-\underset{\displaystyle}{\overset{\displaystyle CH_3 \atop |}{C}H}-CH_3(g) + \frac{13}{2}O_2(g) \longrightarrow 4CO_2(g) + 5H_2O(g)$

$\Delta H = \Delta E + \Delta nRT$

Δn = mole of (gaseous products–gaseous reactants) = +ve

Thus, $\Delta H > \Delta E$

51.(A) Enthalpy of formation of H_2SO_4 can be represented by the following equation:

$$H_2 + S + 2O_2 \longrightarrow H_2SO_4$$

Given, $S + O_2 \longrightarrow SO_2, \quad \Delta H = -298.2 \text{ kJ}$

$SO_2 + \frac{1}{2}O_2 \longrightarrow SO_3, \quad \Delta H = -98.7 \text{ kJ}$

$SO_3 + H_2O \longrightarrow H_2SO_4, \quad \Delta H = -130.2 \text{ kJ}$

$H_2 + \frac{1}{2}O_2 \longrightarrow H_2O, \quad \Delta H = -287.3 \text{ kJ}$

On adding all the four equations, we get the equation (i),

Hence, $\Delta H_f = (-298.2) + (-98.7) + (-130.2) + (-287.3) = -814.4 \text{ kJ}$

52.(B) According to question,

$$2Al + \frac{3}{2}O_2 \longrightarrow Al_2O_3; \qquad \Delta H = -1596 \text{ kJ} \quad \textbf{...(i)}$$

$$2Cr + \frac{3}{2}O_2 \longrightarrow Cr_2O_3; \qquad \Delta H = -1134 \text{ kJ} \quad \textbf{...(ii)}$$

Reversing Equation (ii) and adding both reactions, we get :

$$2Al + Cr_2O_3 \longrightarrow 2Cr + Al_2O_3; \qquad \Delta H = -462 \text{ kJ}$$

53.(C) CH_4 has four C – H bonds. So, 4 × 416 kJ is required to break CH_4 into C and 4H.

54.(C) We know, $\Delta H = \Delta U + \Delta nRT$

Δn = [total number of moles of gaseous products] – [Total number of moles of gaseous reactants]

For this reaction $A(s) + 3B(g) \longrightarrow 4C(g) + D(l)$ $\quad \Delta n = \left[4 - 3\right] = 1$

$\Delta H = \Delta U + RT$

55.(D) We know that, $\Delta H = \Delta E + \Delta n_g RT$

For reaction, $N_2O_4 \longrightarrow 2NO_2$

$\Delta n_g = 2 - 1 = 1$

$\therefore \quad \Delta H = \Delta E + RT \quad$ or $\quad \Delta H > \Delta E$

56.(B) $\Delta H = \Delta E + p\Delta V = \Delta E + n_g RT$

$PCl_5(g) \longrightarrow PCl_3(g) + Cl_2(g)$

$\Delta n_g = n_{(p)_g} - n_{(r)_g} = 2 - 1 = 1$

$\therefore \quad \Delta H = \Delta E + 1 \times RT \quad \therefore \quad \Delta H > \Delta E$

57.(B) The structure of N_2H_4 is as follows

Hence, in the reaction,

$N_2H_4(g) \longrightarrow 2N(g) + 4H(g);$

$\Delta H = (N-N \text{ bond energy}) + (N-H \text{ bond energy} \times 4)$

$\therefore \quad N-N \text{ bond energy} = 1724 - 1564 = 160 \text{ kJ/mol}$

58.(C) The amount of heat either evolved or absorbed when one gram mole of a substance is formed form its constituent elements, is known as the standard heat of formation (ΔH_f°).

For standard state temperature is 25°C or 298 K and pressure of gaseous substance is one atmosphere.

59.(A) Heat of decomposition of water is $H_2O(g) \longrightarrow H_2(g) + \frac{1}{2}O_2(g) \qquad \Delta H = \frac{+573.2}{2} = 286.6 \text{ kJ/mol}$

60.(D) Bond energy O – H bond = 109 kcal/mol

$\therefore$ Energy absorbed in the dissociation of 1 mol of water (H_2O) = 2 × 109 = 218 kcal

$\therefore$ Energy released in the formation of 1 mole of water = 218 kcal.