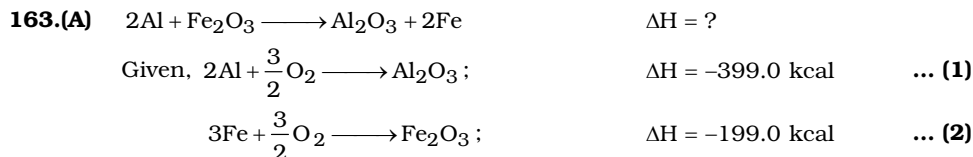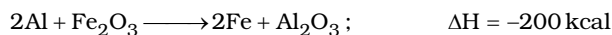| Daily Tutorial Sheet-15	Level-3

159.(B) The heat of neutralisation of strong acid and strong base is -57.3 kJ mol^{-1}

160.(A) Heat of neutralisation for strong acid and strong base is equal to -57.3 kJ mol^{-1}. $HClO_4$ and HCl both are strong acid.

161.(B) Dissociation of water is $H_2O \rightleftharpoons H^\oplus + \bar{O}H$ is reverse of the heat of neutralisation and the value of heat is equal but sign is reverse.

162.(D) Fact

163.(A) $2Al + Fe_2O_3 \longrightarrow Al_2O_3 + 2Fe$ $\qquad\qquad$ $\Delta H = ?$

Given, $2Al + \dfrac{3}{2}O_2 \longrightarrow Al_2O_3$; $\qquad\qquad$ $\Delta H = -399.0$ kcal $\qquad$ **... (1)**

$\qquad\qquad 3Fe + \dfrac{3}{2}O_2 \longrightarrow Fe_2O_3$; $\qquad\qquad$ $\Delta H = -199.0$ kcal $\qquad$ **... (2)**

Subtracting Eq. (2) from Eq. (1)

$\qquad\qquad 2Al + Fe_2O_3 \longrightarrow 2Fe + Al_2O_3$; $\qquad$ $\Delta H = -200$ kcal

Fuel mixture

Molecular weight of fuel mixture = $2 \times 27 + 2 \times 56 + 48 = 214$ g

∵ $\qquad$ 214 g mixture produces = 200 kcal heat

∴ $\qquad$ 1 g mixture produces = $\dfrac{200}{214} = 0.9346$ kcal / g

Also volume of fusion mixture = Vol. of Al + Vol. of Fe_2O_3

$\qquad\qquad \dfrac{54}{2.7} + \dfrac{160}{5.2} = 20 + 30.76 = 50.76$ mL

∴ $\qquad$ 5.76 mL mixture produces = 200 kcal

∴ $\qquad$ 1 mL mixture produces $\dfrac{200}{50.76} = 3.94$ kcal / mL

164.(A) For phosphorus trichloride, thermochemical equations are

$\qquad\qquad P(s) \longrightarrow P(g)$; $\qquad\qquad\qquad\qquad$ $\Delta H_1 = 314$ kJ

$\qquad\qquad \dfrac{3}{2}Cl_2(g) \longrightarrow 3Cl(g)$; $\qquad\qquad\qquad$ $\Delta H_2 = 363$ kJ

$\qquad\qquad P(g) + 3Cl(g) \longrightarrow PCl_3$; $\qquad\qquad\quad$ $\Delta H_3 = ?$

Also, $\quad P(s) + 3/2Cl_2(g) \longrightarrow PCl_3$; $\qquad\quad$ $\Delta H_f = -306$ kJ
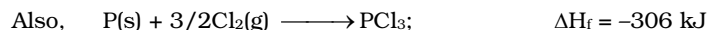
Equating the two routes leading to the formation of PCl_3

$\qquad\qquad \Delta H_f = \Delta H_1 + \Delta H_2 + \Delta H_3$
$\qquad\qquad -306 = 314 + 363 + \Delta H_3$
$\qquad\qquad \Delta H_3 = -983$ kJ

This is the amount of energy released on the formation of three P – Cl bonds. Hence,

$\qquad\qquad E_{P-Cl} = \dfrac{983}{3} = 328$ kJ $mole^{-1}$

$\qquad\qquad P(s) \longrightarrow P(g)$; $\qquad\qquad$ $\Delta H_1 = 314$ kJ

$\qquad\qquad 3/2H_2(g) \longrightarrow 3H(g)$; $\qquad$ $\Delta H_2 = 649$ kJ

$\qquad\qquad P(g) + 3H(g) \longrightarrow PH_3$; $\qquad$ $\Delta H_3 = ?$
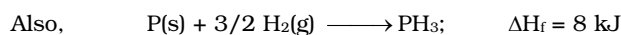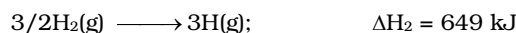
Also, $\qquad P(s) + 3/2 H_2(g) \longrightarrow PH_3$; $\qquad$ $\Delta H_f = 8$ kJ
On solving, $\Delta H_3 = -958$ kJ

$\qquad\qquad E_{P-H} = \dfrac{958}{3} = 319.33$ kJ