Enthalpy Change

-2006 III(1)

Use equations 1-3 provided below to find the heat Q(kJ) of the thermochemical equation (A).

Thermochemical equation (A): $2H_2(g) + O_2(g) = 2NH_3(g) + Q\ kJ$

1: $2H_2(g) + O_2(g) = 2H_2O(l) + 572\ kJ$

2: $4NH_3(g) + 3O_2(g) = 2N_2(g) + 6H_2O(g) + 1268\ kJ$

3: $H_2O(l) = H_2O(g) - 44\ kJ$

-2012 II

II Give the appropriate values for (a) and (b) in the sentences below.

1 mol of graphite is completely oxidized to carbon dioxide while evolving 394 kJ of heat, and 1 mol of carbon monoxide is completely oxidized to carbon dioxide while evolving 283 kJ of heat. At 0 °C, under 1 atm, (a) L of oxygen is required to oxidize 1 mol of graphite to carbon monoxide with the heat evolution of (b) kJ.

-2013 II

II Give the appropriate values for (a) and (b) in the sentences below.

Complete oxidation of 1 mol of methane requires (a) L of oxygen at 0 °C, under 1 atm. The heat of formation of methane is calculated to be (b) kJ mol^{-1} using following values; bonding energy of a hydrogen molecule : 432 kJ mol^{-1}, bonding energy of a C-H bond in methane : 414 kJ mol^{-1}, sublimation energy of carbon (graphite) : 717 kJ mol^{-1}.

-2017 IV(2)

(2) A crystalline silicon adopts a diamond-type structure. The number of Si atom covalently bonded to one Si atom in the crystalline silicon is (c) . The energy required for breaking the bonds in crystalline silicon to convert the crystal into Si atoms is 439 kJ mol^{-1}, and the bond energies for Si–H and H–H bonds are 318 and 436 kJ mol^{-1}, respectively. Hence, the heat of formation for SiH_4 (g) is evaluated to be (d) kJ mol^{-1}.

-2018 IV(1)(a)

(1) Heat of 11.6 kJ was released when 11.2 g of KOH was completely dissolved in water. The heat of solution is (a) kJ mol^{-1}. Water was more added to adjust 2.0 L of KOH solution.

-2019 IV(1)

(1) The dissociation energies of H_2 and O_2 are 436 kJ mol^{-1} and 498 kJ mol^{-1}, respectively, and the bond energy of O–H bond is 463 kJ mol^{-1}. The heat of vaporization for water (liquid) is 44.0 kJ mol^{-1}. Therefore, the heat of formation for water (liquid) is (a) kJ mol^{-1}. Furthermore, hydrogen reacts with oxygen to form gaseous hydrogen peroxide as follows:

$$H_2 + O_2 \rightarrow H_2O_2$$

In the above reaction, 142 kJ mol^{-1} is released as heat. Hence, the bond energy of O–O bond in the hydrogen peroxide molecule is (b) kJ mol^{-1}.