PHYSICAL CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

DPP No. 49

Total Marks : 29

Max. Time : 31 min.

Topic : Thermodynamics & Thermochemistry

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.7	(3 marks, 3 min.)	[21, 21]
Subjective Questions ('–1' negative marking) Q.8 to Q.9	(4 marks, 5 min.)	[8, 10]

1. The species which by definition has zero standard molar enthalpy of formation at 298 K is :

(A) CO_2 (g) (B) H_2O (ℓ) (C) O_2 (g) (D) P_4 (red)

2. Consider the following processes

(i) 1/2 H_2 (g) + aq. $\longrightarrow$ H^+ (aq.) (ii) 2O(g) $\longrightarrow$ O_2(g)

(iii) NH_4^+ (g) + Cl^- (g) $\longrightarrow$ NH_4Cl(s) (iv) P_4 (black) + 5O_2(g) $\longrightarrow$ P_4O_{10}(s)

Which of the above does not represent $\Delta H_{formation}$ of the product :

(A) I,IV (B) II, IV (C) I, II, III (D) II , III, IV

3. The difference between heat of reaction at constant pressure and constant volume for the reaction given below at 27ºC in kJ is : (Take R = 8.3 J/K/mole) 2 C_6H_6 (ℓ) + 15 O_2 (g) $\longrightarrow$ 12 CO_2 (g) + 6H_2O (ℓ)

(A) –7.47 (B) + 3.72 (C) – 3.72 (D) + 7.47

4. For the two reactions given below :

H_2(g) + ½O_2(g) $\longrightarrow$ H_2O (ℓ) + x_1 kJ mol^{-1}

H_2(g) + ½O_2(g) $\longrightarrow$ H_2O (g) + x_2 kJ mol^{-1}

Compare the magnitude of x_1 and x_2 : (x_1 and x_2 are the heat released in above two process.)

(A) $x_1 > x_2$ (B) $x_1 < x_2$ (C) $x_1 = x_2$ (D) $x_2 = 2x_1$

5. The combustion of 0.2 mol of liquid carbon disulphide CS_2 to give CO_2(g) and SO_2(g) releases 215 kJ of heat. What is ΔH_f^o for $CS_{2(l)}$ in kJ mol^{-1} :

ΔH_f^o	kJ mol^{-1}
$CO_{2(g)}$	–393.5
$SO_{2(g)}$	–296.8

(A) 772.1 (B) 87.9 (C) –385 (D) – 475

6. Consider the following changes

Na^+(g) $\longrightarrow$ Na^+(aq) ΔH_1 .... (1) Na(s) $\longrightarrow$ Na(g) ΔH_2 .... (2)

Cl^-(g) $\longrightarrow$ Cl^-(aq) ΔH_3 .... (3) Cl_2(g) $\longrightarrow$ 2Cl(g) ΔH_4 .... (4)

Na^+(g) + Cl(g) $\longrightarrow$ NaCl (s)+ e^- ΔH_5 .... (5) NaCl(s) $\longrightarrow$ Na^+(aq) + Cl^- (aq) ΔH_6 .... (6)

Hydration enthalpy of NaCl can be defined by sum of the following :

(A) $\Delta H_1 + \Delta H_4$ (B) $\Delta H_1 + \Delta H_5$ (C) $\Delta H_1 + \Delta H_3$ (D) ΔH_6 only

7. Given that $S_{(s)}$ + 3/2 $O_{2(g)}$ $\longrightarrow$ $SO_{3(g)}$ + 2x Kcal ; $SO_{2(g)}$ + 1/2 $O_{2(g)}$ $\longrightarrow$ $SO_{3(g)}$ + y Kcal

What would be the enthalpy of formation of SO_2 :

(A) – 2x + y (B) 2x + y (C) x + y (D) 2x/y

8. From the follwing data :

(i) $C_{(graphite)}$ + O_2 (g) $\longrightarrow$ CO_2 (g) ; ΔH_1 = – 94.1 KCal

(ii) $C_{(diamond)}$ $\longrightarrow$ $C_{(graphite)}$; ΔH_2 = – 0.5 KCal

Calculate ΔH for burning of diamond to CO_2 .

9. The standard enthalpies of formation at 298 K for CCl_4 (g) , H_2O (g) , CO_2 (g) and HCl (g) are – 25.5 , – 57.8 , – 94.1 & – 22.1 K Cal/mole respectively . Calculate ΔH^o_{298} for the reaction :

CCl_4 (g) + 2 H_2O (g) $\longrightarrow$ CO_2 (g) + 4 HCl (g).

Answer Key

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1.	(C)	2.	(D)	3.	(A)	4.	(A)	5.	(B)
6.	(C)	7.	(A)	8.	- 94.6 KCal	9.	- 41.4 KCal		

Hints & Solutions

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1. Standard molar enthalpy of formation (ΔH^o_f) of element in their stable state of agregation is zero.
$\therefore \quad \Delta H^o_f (O_2, g) = 0$

4. Some of the heat is used to vaporise the $H_2O(\ell)$
$\therefore \quad x_1 > x_2$

5. $CS_2(\ell) + 3O_2(g) \longrightarrow CO_2(g) + 2SO_2(g)$; $\quad \Delta H^o_{rxn.} = 5 \times -215 = -1075$ kJ
$\Delta H^o_{rxn.} = \Delta H^o_f (CO_2) + 2 \times \Delta H^o_f (SO_2) - \Delta H^o_f (CS_2)$
$\Delta H^o_{rxn.} = (-393.5 - 2 \times 296.8) - (-1075)$
$\Delta H^o_{rxn.} = 87.9$

6. Refer Class notes.

8. Eq (i) + Eq (ii)
$C_{diamond} + O_2(s) \longrightarrow CO_2(g)$
$\Delta H = \Delta H_1 + \Delta H_2$