DAILY PRACTICE PROBLEM OF PHYSICAL CHEMISTRY FOR NEET

BY

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THERMOCHEMISTRY

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DPP- 1

1. If the heat of formation of NO_2 is 'x' [$\frac{1}{2} N_2(g) + O_2(g) \rightarrow NO_{2(g)}$] the heat of reaction $N_{2(g)} + O_{2(g)} \rightarrow 2NO_{2(g)}$ is y and the heat of reaction $2NO_{(g)} + O_{2(g)} \rightarrow 2NO_{2(g)}$ is z, then

(1) $2x + z = y$ (2) $2y + z = x$ (3) $2x - z = y$ (4) $2z + x = y$

Ans. **(3)**

2. $S\,(\text{rhombic}) + O_2(g) \rightarrow SO_2(g)$; $\Delta H = -297.5$ kJ

$S\,(\text{monoclinic}) + O_2(g) \rightarrow SO_2(g)$; $\Delta H = -300$ kJ

The above data can predict that

(1) Rhombic sulphur is yellow in colour.
(2) Monoclinic sulphur has metallic lustre
(3) Monoclinic sulphur is more stable
(4) $\Delta H_{(\text{Transition})}$ of S (R) to S (M) is endothermic process.

Ans. **(4)**

3. If $S + O_2 \rightarrow SO_2$; $\Delta H = -298.2$ kJ

$SO_2 + 1/2\ O_2 \rightarrow SO_3$; $\Delta H = -98.7$ kJ

$SO_3 + H_2O \rightarrow H_2SO_4$; $\Delta H = -130.2$ kJ

$H_2 + 1/2\ O_2 \rightarrow H_2O$; $\Delta H = -287.3$ kJ

then the enthalpy of formation of H_2SO_4 at 298 K is

(1) –814.4 kJ (2) –650.3 kJ (3) –320.5 kJ (4) –433.5 kJ

Ans. **(1)**

4. When 1 g of anhydrous oxalic acid is burnt at 25°C, the amount of heat liberated is 2.835 kJ. ΔH combustion is (oxalic acid : $C_2H_2O_4$)

(1) –255.15 kJ (2) –445.65 kJ (3) –295.24 kJ (4) –155.16 kJ

Ans. **(1)**

5. Which one of the following is not applicable for a thermochemical equation :

(1) It tells about physical state of reactants and products
(2) It tells whether the reaction is spontaneous
(3) It tells whether the reaction is exothermic or endothermic
(4) It tells about the allotropic form (if any) of the reactants

Ans. **(2)**

6. The enthalpy changes of formation of the gaseous oxide of nitrogen (N_2O and NO) are positive because of :

(1) The high bond energy of the nitrogen molecule (2) The high electron affinity of oxygen atoms
(3) The high electron affinity of nitrogen atoms (4) The tendency of oxygen to form O^{2-}

Ans. **(1)**

7. Heat of formation, ΔH_f° of an explosive compound like NCl_3 is –

(1) Positive (2) Negative (3) Zero (4) Positive or negative

Ans. **(1)**

8. Enthalpy of a compound is equal to its :- (When it is formed from constituent particles)

(1) Heat of combustion (2) Heat of formation (3) Heat of reaction (4) Heat of solution

Ans. **(2)**

9. The enthalpy of formation of ammonia is –46.0 KJ mol^{-1}. The enthalpy change for the reaction $2NH_3(g) \rightarrow N_2(g) + 3H_2(g)$ is :

(1) 46.0 KJ mol^{-1} (2) 92.0 KJ mol^{-1} (3) – 23.0 KJ mol^{-1} (4) – 92.0 KJ mol^{-1}

Ans. **(2)**

10. Standard enthalpy of formation is zero for .

(1) $C_{diamond}$ (2) $Br_{(g)}$ (3) $C_{graphite}$ (4) $O_{3(g)}$

Ans. **(3)**

11. Given standard enthalpy of formation of CO (–110 KJ mol^{-1}) and CO_2(–394 KJ mol^{-1}). The heat of combustion when one mole of graphite burns is

(1) – 110 KJ (2) – 284 KJ (3) – 394 KJ (4) – 504 KJ

Ans. **(3)**

12. The heat evolved during the combustion of 112 litre of water gas at STP (mixture of equal volume of H_2 and CO) is : Given

$H_2(g) + ½\ O_2(g) = H_2O(g)$; $\Delta H = –241.8$ KJ

$CO(g) + ½\ O_2(g) = CO_2(g)$; $\Delta H = – 283$ KJ

(1) 241.8 KJ (2) 283 KJ (3) 1312 KJ (4) 1586 KJ

Ans. **(3)**

13. Heat of formation of CO_2 is - 94.0 K. cal. What would be the quantity of heat liberated, when 3 g of graphite is burnt in excess of oxygen:-

(1) 23.5 K cals (2) 2.35 K cals (3) 94.0 K cals (4) 31.3 K cals

Ans. **(1)**

14. Given $C(s) + O_2(g) \longrightarrow CO_2(g) + 94.2$ Kcal

$H_2(g) + ½\ O_2(g) \longrightarrow H_2O(\ell) + 68.3$ Kcal

$CH_4(g) + 2O_2(g) \longrightarrow CO_2(g) + 2H_2O(\ell) + 210.8$ Kcal

The heat of formation of methane in Kcal will be

(1) –45.9 (2) –47.8 (3) –20.0 (4) –47.3

Ans. **(3)**

15. If, $H_2(g) + Cl_2(g) \longrightarrow 2HCl(g)$; $\Delta H^0 = –44$ Kcal

$2Na(s) + 2HCl(g) \longrightarrow 2NaCl(s) + H_2(g)$;

$\Delta H = – 152$ Kcal

Then, $Na(s) + 0.5\ Cl_2(g) \longrightarrow NaCl(s)$; $\Delta H^0 = ?$

(1) 108 Kcal (2) 196 Kcal (3) – 98 Kcal (4) 54 Kcal

Ans. **(3)**

16. Given that :

$Zn + ½\ O_2 \rightarrow ZnO + 84000$ cal 1

$Hg + ½\ O_2 \rightarrow HgO + 21700$ cal 2

The heat of reaction (ΔH) for,

$Zn + HgO \rightarrow ZnO + Hg$ is :-

(1) 105700 cal (2) 62300 cal (3) –105700 cal (4) – 62300 cal

Ans. **(4)**

17. The heat of reaction for

$A + \frac{1}{2} O_2 \rightarrow AO$ is - 50 K cal and

$AO + \frac{1}{2} O_2 \rightarrow AO_2$ is 100 Kcal. The heat of reaction for $A + O_2 \rightarrow AO_2$ is:-

(1) - 50 K cal. (2) + 50 K cal. (3) 100 K cal. (4) 150 K cal.

Ans. **(2)**

18. Using the following thermochemical data:

$C(S) + O_2(g) \rightarrow CO_2(g)$, $\Delta H = -94.0$ Kcal

$H_2(g) + 1/2O_2(g) \rightarrow H_2O(\ell)$, $\Delta H = -68.0$ Kcal

$CH_3COOH(\ell) + 2O_2(g) \rightarrow 2CO_2(g) + 2H_2O(\ell)$, $\Delta H = -210.0$ Kcal

The heat of formation of acetic acid is:-

(1) 116.0 Kcal (2) - 116.0 Kcal (3) - 114.0 Kcal (4) + 114.0 K cal

Ans. **(3)**

DPP - 2

1. Consider the following reaction :

$C\ (graphite) + O_2\ (g) \rightarrow CO_2(g)\ ;\quad \Delta H = -x_1$ cal

$C\ (diamond) + O_2\ (g) \rightarrow CO_2(g)\ ;\quad \Delta H = -x_2$ cal

What is the heat of transition of graphite into diamond ?

(1) $x_1 + x_2$ (2) $x_2 - x_1$ (3) $x_1 - x_2$ (4) x_1x_2

Ans. **(2)**

2. The heat of combustion of yellow P and red P are –9.91 kJK and –8.78 kJ respectively. The heat of transition of yellow to red phosphorus is

(1) –18.69 kJ (2) +1.13 kJ (3) +18.69 kJ (4) –1.13 kJ

Ans. **(4)**

3. ΔH_f, $C_2H_4 = 12.5$ kcal

Heat of atomisation of C = 171 kcal

Bond energy of H_2 = 104.3 kcal

Bond energy of C – H = 99.3 kcal

What is C = C bond energy ?

(1) 140.9 kcal (2) 49 kcal (3) 40 kcal (4) 76 kcal

Ans. **(1)**

4. $H_2(g) + \frac{1}{2}O_2\ (g) \longrightarrow H_2O\ (\ell)$

$H_2O_{(l)} \rightarrow H_2O_{(g)}\ ;\ \Delta H = x_4$

Given,

$E_{H-H} = x_1$

$E_{O=O} = x_2$

$E_{O-H} = x_3$

ΔH_F of H_2O vapour is

(1) $x_1 + \frac{x_2}{2} - x_3 + x_4$ (2) $2x_3 - x_1 - \frac{x_2}{2} - x_4$ (3) $x_1 + \frac{x_2}{2} - 2x_3 - x_4$ (4) $x_1 + \frac{x_2}{2} - 2x_3 + x_4$

Ans. **(4)**

5. $H(g) + O(g) \rightarrow O - H(g)\ ;$ ΔH for this reaction is

(1) Heat of formation of O – H (2) Bond energy of O – H

(3) Heat of combustion of H_2 (4) Zero at all temperatures

Ans. **(2)**

6. Energy required to dissociate 4 g of gaseous H_2 into free gaseous atoms is 872 kJ at 25°C. The bond energy of H–H bond will be

(1) 8.72 kJ (2) 4.36 kJ (3) 436 kJ (4) 43.6 kJ

Ans. **(3)**

7. The enthalpy of reaction,

$2HC \equiv CH + 5O_2 \rightarrow 4CO_2 + 2H_2O$

If the bond energies of C–H, C≡C, O=O, C=O and O–H bonds are p, q, r, s, t respectively.

(1) [8s + 4t] – [4p + q + 5r] (2) [4p + 2q + 5r] – [8s + 4t]

(3) [4p + 2q + 5r + 8s + 4t] (4) [2p + q + 5r] – [8s + 4t]

Ans. **(2)**

8. Using bond energy data, calculate heat of formation of isoprene

$$5C(s) + 4H_2(g) \longrightarrow H_2C=\underset{\displaystyle CH_3}{\overset{\displaystyle |}{C}}-CH=CH_2$$

Given C–H, H–H, C–C, C = C and C(s) → C(g) respectively as 98.8 kcal, 104 kcal, 83 kcal, 147 kcal, 171 kcal

(1) –21 kcal (2) 21 kcal (3) 40 kcal (4) 50 kcal

Ans. **(2)**

9. Entropy of vaporisation of water at 100°C, if molar heat of vaporisation is 9710 cal mol^{-1} will be

(1) 20 cal mol^{-1} K^{-1} (2) 26.0 cal mol^{-1} K^{-1} (3) 24 cal mol^{-1} K^{-1} (4) 28.0 cal mol^{-1} K^{-1}

Ans. **(2)**

10. If ΔH_f^o of $ICl_{(g)}$, $Cl_{(g)}$, and $I_{(g)}$ is 17.57, 121.34 and 106.96 J mol^{-1} respectively. Then bond dissociation energy of ICl bond is -

(1) 35.15 J mol^{-1} (2) 106.69 J mol^{-1} (3) 210.73 J mol^{-1} (4) 420.9 J mol^{-1}

Ans. **(3)**

11. The enthalpy of vapourisation of liquid water using the data:

$H_2(g) + 1/2\,O_2(g) \rightarrow H_2O(\ell);\ \Delta H = -285.77 KJmol^{-1}$

$H_2(g) + 1/2\,O_2(g) \rightarrow H_2O(g);\ \Delta H = -241.84 KJmol^{-1}$

(1) + 43.93 KJ mol^{-1} (2) - 43.93 KJ mol^{-1} (3) + 527.61 KJ mol^{-1} (4) - 527.61 KJ mol^{-1}

Ans. **(1)**

DPP - 3

1. In the reactions

$HCl + NaOH \rightarrow NaCl + H_2O + x\ cal$

$H_2SO_4 + 2NaOH \rightarrow Na_2SO_4 + 2H_2O + y\ cal$

(1) $x = y$ (2) $x = 2y$ (3) $x = \frac{y}{2}$ (4) $x = \sqrt{y}$

Ans. **(3)**

2. The difference between ΔH and ΔE for the reaction $2C_6H_6(l) + 15O_2(g) \rightarrow 12CO_2(g) + 6H_2O(l)$ at 25°C in kJ is

(1) –7.43 kJ (2) +3.72 kJ (3) –3.72 kJ (4) +7.43 kJ

Ans. **(1)**

3. The heat of neutralization of LiOH and HCl at 25°C is 34.868 kJ mol^{-1}. The heat of ionisation of LiOH will be

(1) 44.674 kJ (2) 22.232 kJ (3) 32.684 kJ (4) 96.464 kJ

Ans. **(2)**

4. Which compound will absorb the maximum amount of heat when dissolved in the same amount of water ? (Integral heats of solution at 25°C in kcal/mol of each solute are given in brackets)

(1) HCl ($\Delta H = -17.74$) (2) HNO_3 ($\Delta H = -7.85$)

(3) NH_4NO_3 ($\Delta H = +16.08$) (4) NaCl ($\Delta H = +1.02$)

Ans. **(3)**

5. $HA + OH^- \rightarrow H_2O + A^- + q_1 kJ$

$H^+ + OH^- \rightarrow H_2O + q_2\ kJ$

The enthalpy of ionisation of HA is

(1) $(q_1 + q_2)$ (2) $(q_1 - q_2)$ (3) $(q_2 - q_1)$ (4) $-(q_1 + q_2)$

Ans. **(3)**

6. For strong acid strong base neutralisation energy for 1 mole H_2O formation is –57.1 kJ. If 0.25 mole of strong monoprotic acid is reacted with 0.5 mole of strong base then enthalpy of neutralisation of

(1) $-(0.25 \times 57.1)$ (2) 0.5×57.1 (3) 57.1 (4) $-(0.5 \times 57.1)$

Ans. **(1)**

7. The heat of combustion of solid benzoic acid at constant volume is –321.3 kJ at 27°C. The heat of combustion at constant pressure is

(1) $-321.3 - 300R$ (2) $-321.30 + 300R$ (3) $-321.3 - 150R$ (4) $-321.3 + 900R$

Ans. **(3)**

8. The standard entropies of N_2 (g), H_2 (g) and NH_3 (g) are 191.5, 130.5, 192.6 $JK^{-1}\ mol^{-1}$. The value of $\Delta S°$ of formation of ammonia is

(1) –98.9 $JK^{-1}\ mol^{-1}$ (2) Zero (3) + 129.4 $JK^{-1}\ mol^{-1}$ (4) –29.4 $JK^{-1}\ mol^{-1}$

Ans. **(1)**

9. Given $S^o_{C_2H_6} = 225\ J\ mol^{-1}\ K^{-1}$

$S^o_{C_2H_4} = 220\ J\ mol^{-1}\ K^{-1}$, $S^o_{H_2} = 130\ J\ mol^{-1}\ K^{-1}$

Then $\Delta S°$ for the process

$C_2H_4 + H_2 \rightarrow C_2H_6$ is

(1) +25 J (2) –125 J (3) 135 J (4) 315 J

Ans. **(2)**

10. For the melting of NaCl heat required is 7.26 kcal mol^{-1} and ΔS increases by 6.73 cal mol^{-1} k^{-1}. The melting point of the salt is

(1) 805.75°C (2) 500 K (3) 1.77 K (4) 1.77°C

Ans. **(1)**

11. The ΔS for the reaction

$2H_2(g) + O_2(g) \rightarrow 2H_2O(l)$ at 300 K when

$S^o_{H_2}(g) = 126.6$, $S^o_{O_2}(g) = 201.20$, $S^o_{H_2O}(l) = 68.0$ $JK^{-1}mol^{-1}$ respectively is

(1) –318.4 $JK^{-1}mol^{-1}$ (2) 318.4 $JK^{-1}mol^{-1}$ (3) 31.84 $JK^{-1}mol^{-1}$ (4) 3.184 $JK^{-1}mol^{-1}$

Ans. **(1)**

12. Which of the following is correct ?

	ΔH	ΔS	**Nature of reaction**
(1)	(–)	(+)	Spontaneous only at high temperature
(2)	(+)	(–)	Nonspontaneous regardless of temperature
(3)	(+)	(+)	Spontaneous only at low temperature
(4)	(–)	(–)	Spontaneous at all temperatures

Ans. **(2)**

13. A particular reaction at 27°C for which $\Delta H > 0$ and $\Delta S > 0$ is found to be non-spontaneous. The reaction may proceed spontaneously if

(1) The temperature is decreased (2) The temperature is increased

(3) The temperature is kept constant (4) It is carried in open vessel at 27°C

Ans. **(2)**

14. It is impossible for a reaction to take place if

(1) ΔH is +ve and ΔS is +ve (2) ΔH is –ve and ΔS is +ve

(3) ΔH is +ve and ΔS is –ve (4) ΔH is –ve and ΔS is –ve

Ans. **(3)**

15. The sole criterion for the spontaneity of a process is

(1) Tendency to acquire minimum energy

(2) Tendency to acquire maximum randomness

(3) Tendency to acquire minimum energy and maximum randomness

(4) Tendency to acquire maximum stability

Ans. **(4)**

16. If water is formed from H^+ ions and OH^- the heat of formation of water is :

(1) – 13.7 Kcal (2) 13.7 KCal (3) –63.4 Kcal (4) More data required

Ans. **(1)**

17. The heat of solution of anhydrous $CuSO_4$ and $CuSO_4.5H_2O$ are – 15.89 and 2.80 Kcal mol^{-1} respectively. What will be the heat of hydration of anhydrous $CuSO_4$?

(1) –18.69 KCal (2) 18.69 Kcal (3) –28.96 Kcal (4) 28.96 Kcal

Ans. **(1)**