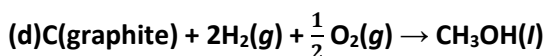
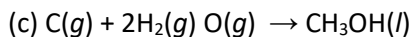
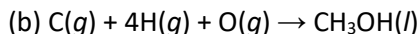
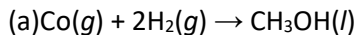
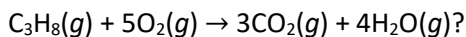


Exercise 3 (Taking it Together)

1. For which of the following equations is the enthalpy change at 25°C and 1 atm equal to ΔH_f° (CH₃OH, l) ?



2. The standard heat of combustion of propane is $-2220.1 \text{ kJ mol}^{-1}$. The standard heat of vaporizations of liquid water is 44.0 kJ mol^{-1} . What is ΔH° of



(a) -2220.1 kJ

(b) -2044.1 kJ

(c) -2396.1 kJ

(d) -2176.1 kJ

3. The gas absorbs 100 J heat and is simultaneously compressed by a constant external pressure of 1.50 atm from 8 L to 2 L in volume. Hence, ΔE will be

(a) -812 J

(b) -812 J

(c) 1011 J

(d) 914 J

4. The standard heat of combustion of solid boron is equal to

(a) $\Delta H_f^\circ (\text{B}_2\text{O}_3)$

(b) $\frac{1}{2}\Delta H_f^\circ (\text{B}_2\text{O}_3)$

(c) $2\Delta H_f^\circ (\text{B}_2\text{O}_3)$

(d) $-\frac{1}{2}\Delta H_f^\circ (\text{B}_2\text{O}_3)$

5. The standard heat of combustion of Al is $-837.8 \text{ kJ mol}^{-1}$ at 25°C. If Al reacts with O₂ at 25°C, which of the following 250 kcal of heat?

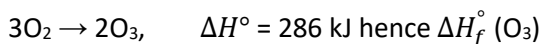
(a) The reaction of 0.624 mol of Al

(b) The formation of 0.624 mol of Al₂O₃

(c) The reaction of 0.312 mol of Al

(d) The formation of 0.150 mol of Al_2O_3

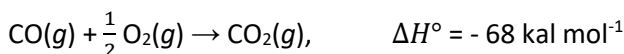
6. In the upper atmosphere O_3 is formed by



(a) 286 kJ mol⁻¹ **(b) 143 kJ mol⁻¹**

(c) 95.3 kJ mol⁻¹ (d) -286 kJ mol⁻¹

7. $\text{C}(s) + \frac{1}{2} \text{O}_2 \rightarrow \text{CO}(g), \quad \Delta H^\circ = -26 \text{ kcal mol}^{-1}$



Which is/are correct statement(s)?

(a) Heat of formation of CO_2 is -68 kcal mol⁻¹

(b) Heat of formation of $\text{C}(s)$ is -26 kcal mol⁻¹

(c) Heat of formation of $\text{CO}(g)$ is -68 kcal mol⁻¹

(d) All of the above

8. ($\Delta H - \Delta E$) for the formation of NH_3 from N_2 and H_2

(a) RT (b) $2 RT$

(c) $-RT$ (d) $-2 RT$

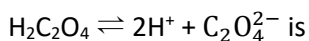
9. $\text{H}_2\text{S}(g) \rightarrow \text{HS}(g) + \text{H}(g) \quad \Delta H^\circ = x_1$



(a) $x_1 + x_2 + x_3$ (b) $x_3 + x_1 + x_2$

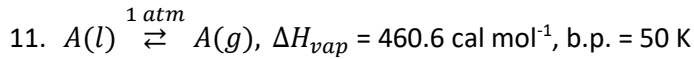
(c) $x_1 + x_2 + x_3$ (d) $x_3 + x_1 + x_2$

10. *Heat of neutralization of $\text{H}_2\text{C}_2\text{O}_4$ (oxalic acid) is -26 kcal mol⁻¹. Hence, dissociation energy of



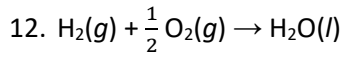
(a) 12.3 kcal mol⁻¹ **(b) 1.4 kcal mol⁻¹**

(c) -13.7 kcal mol⁻¹ (d) -1.4 kcal mol⁻¹



What is boiling point at 10 atm?

- (a) 150 K (b) 75 K
(c) **100 K** (d) None of these is correct



BE (H—H) = x_1 , BE(O=O) = x_2 , BE(O—O) = x_3 , Latent heat of vaporization of water liquid into water vapour = x_4 the ΔH_f (heat of formation of liquid water) is

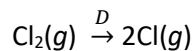
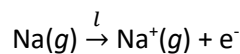
- (a) $x_1 + \frac{x_2}{2} - x_3 + x_4$ (b) $2x_3 - x_1 - \frac{x_2}{2} - x_4$
(c) $x_1 + \frac{x_2}{2} - 2x_3 - x_4$ (d) $x_3 + 2x_1 \frac{x_2}{2} + x_4$

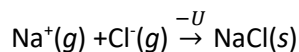
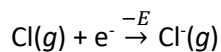
13. If ΔH of a reaction is 100 kJ mol⁻¹, then the activation energy must be

- (a) **greater than 100 kJ mol⁻¹**
(b) less than 100 kJ mol⁻¹
(c) equal to 100 kJ mol⁻¹
(d) None of the above

14. Variation of heat of reaction with temperature is given by Kirchhoff's equation which is

- (a) $\Delta H_2 = \Delta H_1 + \Delta C_p(T_2 - T_1)$
(b) $\frac{\Delta H_2 - \Delta H_1}{\Delta T} \Delta C_p$
(c) $\frac{d(\Delta H)}{dT} \Delta C_p$
(d) **all of the above**





[letters above arrow (\rightarrow) are energy parameters), ΔH_f of NaCl is

(a) $S + I + \frac{D}{2} - E - U$ (b) $S + I + \frac{D}{2} - E + U$

(c) $S + I + \frac{D}{2} - E - U$ (d) $S + I + \frac{D}{2} - E + U$

16. $\text{C}(\text{diamond}) \rightarrow \text{C}(\text{graphite})$, $\Delta S_{300\text{K}} = 10 \text{ cal K}^{-1}$

$\text{C}(\text{graphite}) + \text{O}_2 \rightarrow \text{CO}_2$. $\Delta H = x$ at 300 K, x is

(a) - 81 kcal (b) 101 kcal

(c) - 94 kcal (d) 88 kcal

17. For $\text{N}_2 + 3\text{H}_2 \rightarrow 2\text{NH}_3 + 22 \text{ kcal}$, E_a (energy of activation) is 70 kcal. Hence, E_a of

$2\text{NH}_3 \rightarrow \text{N}_2 + 3\text{H}_2$ is

(a) 92 kcal (b) 70 kcal

(c) -70 kcal (d) - 92 kcal

18. Heat of combustion of C, H_2 and C_2H_6 are $-x_1$, $-x_2$ and $-x_3$. Hence, heat of formation of C_2H_6 is

(a) $-2x_1 - 3x_2 + x_3$ (b) $-x_1 - 3x_2 + x_3$

(c) $-x_3 + 2x_1 + 3x_2$ (d) $x_1 + x_2 - 3x_3$

19. Bond energy of N-H, H-H and $\text{N}\equiv\text{N}$ bonds are q_1 , q_2 and q_3 , ΔH of

$\text{N}_2 + 3\text{H}_2 \rightarrow 2\text{NH}_3$ is

(a) $q_3 + 3q_2 - 2q_1$ (b) $2q_1 - q_3 - 2q_2$

(c) $q_3 + 3q_2 - 6q_1$ (d) $q_1 + q_2 - 2q_3$

20. $\Delta H_f(\text{H}_2\text{O}) = - 68 \text{ kcal}$, then heat of formation of OH^{-} is

(a) -68 kcal mol⁻¹ (b) -54.3 kcal mol⁻¹

(c) 54.3 kcal mol⁻¹ (d) -71.7 kcal mol⁻¹

21. Standard molar enthalpy of formation of CO_2 is equal to
- (a) zero
- (b) the standard molar enthalpy of combustion of gaseous carbon
- (c) the sum of standard molar enthalpies of CO and O_2
- (d) the standard molar enthalpy of combustion of carbon (s)**
22. The factor that does of influence the heat of reaction is
- (a) the physical state of reactants and products
- (b) the temperature
- (c) the pressure or volume
- (d) the method by which the final products are obtained**
23. The dissociation energy of CH_4 and C_2H_6 to convert them into gaseous atoms are 360 and 620 kcal mol respectively. The bond energy of C–C bond is
- (a) 260 kcal mol⁻¹ (b) 180 kcal mol⁻¹
- (c) 130 kcal mol⁻¹ **(d) 80 kcal mol⁻¹**
24. Heat of hydrogenation of ethane is x_1 and that of benzene is x_2 . Hence, resonance energy of benzene is
- (a) $x_1 - x_2$ (b) $x_1 + x_2$
- (c) $3x_1 - x_2$** (d) $x_1 - 3x_2$
25. $\text{C}_2\text{H}_6(g) + 3.5 \text{O}_2 \rightarrow 2\text{CO}_2(g) + 3\text{H}_2\text{O}(g)$

$$\Delta S_{\text{vap}}(\text{H}_2\text{O}, l) = x_1 \text{ cal K}^{-1} \text{ (b.p. } T_1)$$

$$\Delta H_{\text{f}}(\text{H}_2\text{O}, l) = x_2, \Delta H_{\text{f}}(\text{CO}_2) = x_3, \Delta H_{\text{f}}(\text{C}_2\text{H}_6) = x_4$$

Hence, ΔH of the reaction is

- (a) $2x_3 + 3x_2 - x_4$ **(b) $2x_3 + 3x_2 - x_4 + 3x_1T_1$**
- (c) $2x_3 + 3x_2 - x_4 - 3x_1T_1$ (d) $x_1T_1 + x_2 + x_3 - x_4$

26. The C—Cl bond energy can be calculated from

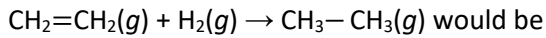
(a) ΔH_f° (CCl₄, l) only

(b) ΔH_f° (CCl₄, l) and BE (Cl₂)

(c) ΔH_f° (CCl₄, l) BE (Cl₂)

(d) ΔH_f° (CCl₄, l) BE (Cl₂), ΔH_f° (CCl₄, l) BE (Cl₂) (C. g) and ΔH_f° (CCl₄)

27. Using bond enthalpies (symbolized by ϵ) an estimated value of ΔH° for the reaction.



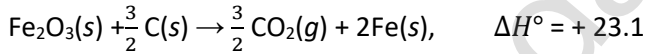
(a) $\epsilon_{\text{C}=\text{C}} + \epsilon_{\text{H}-\text{H}} - 2\epsilon_{\text{C}-\text{H}} - \epsilon_{\text{C}-\text{C}}$

(b) $\epsilon_{\text{C}=\text{C}} + \epsilon_{\text{H}-\text{H}} - 6\epsilon_{\text{C}-\text{H}} - \epsilon_{\text{C}-\text{C}}$

(c) $\epsilon_{\text{C}=\text{C}} - \epsilon_{\text{H}-\text{H}} - 4\epsilon_{\text{C}-\text{H}} - \epsilon_{\text{C}-\text{C}}$

(d) $\epsilon_{\text{C}=\text{C}} + \epsilon_{\text{H}-\text{H}} - 4\epsilon_{\text{C}-\text{H}} - \epsilon_{\text{C}-\text{C}}$

28. Given the standard enthalpies at 25°C, in kJ mol⁻¹, for the following two reactions



The ΔH° value for $4\text{Fe}(s) + 3\text{O}_2(g) \rightarrow 2\text{Fe}_2\text{O}_3(s)$ is calculated as

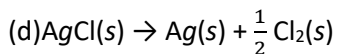
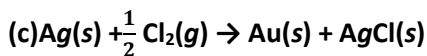
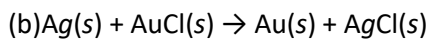
(a) $\frac{3}{2}(-393.5) - 234.1$

(b) $\frac{3}{2}(-393.5) - 234.1$

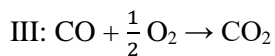
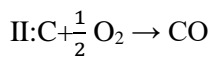
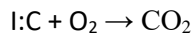
(c) $-393.5 - 234.1$

(d) $3(-393.5) - 2(234.1)$

29. The enthalpy change for which of the following process represents the enthalpy of formation of AgCl?



30. Which combination of the following equations have enthalpy changes equal to ΔH_{comb} (C)?



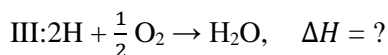
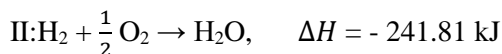
(a) I, II

(b) I, II, III

(c) I, III

(d) I

31. In the reaction,



H_2O can be formed either by I or III. Ratio of enthalpy change in III to II is

(a) 2.8

(b) 0.36

(c) 1.2

(d) 0.82

32. Specific heat of aluminium is $0.214 \text{ cal/g}^\circ\text{C}$. Heat required to raise the temperature of 40.0 g of Al from 20° to 30°C is

(a) 85.6 cal

(b) 3.2 cal

(c) 171.2 cal

(d) 342.4 cal

33. By Dulong and Petit law, molar heat capacity of the element is

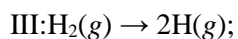
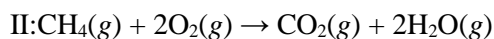
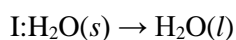
(a) $0.03 \text{ cal/mol}^\circ\text{C}$

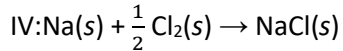
(b) $6 \text{ cal/mol}^\circ\text{C}$

(c) $0.06 \text{ cal/mol}^\circ\text{C}$

(d) $12 \text{ cal/mol}^\circ\text{C}$

34. In the following





Equations representing formation of the compound used to determine ΔH_f° are

- (a) I, III, IV (b) I, III
 (c) II, IV (d) **IV**

35. At 25°C and 1 atm, which one of the following has non-zero ΔH_f° ?

- (a) Fe (b) **O** (c) C(s) (d) Ne

36. ΔH_{comb} of CH_4 , and C_2H_6 and C_3H_8 are -210 , -368.4 and -526.3 kcal mol^{-1} . Hence, ΔH_{comb} of C_4H_{10} is approximately

- (a) **-684.0 kcal** (b) -368.4 kcal
 (c) -842.0 kcal (d) -600.0 kcal

37. The heat of formation of MgO , Al_2O_3 and SiO_2 are -602 , -1675 , -911 k mol^{-1} . Most stable oxide is,

- (a) **MgO** (b) Al_2O_3
 (c) SiO_2 (d) can't be predicted

38. Stability order of oxides given in q. 37 is

- (a) $\text{MgO} < \text{SiO}_2 < \text{Al}_2\text{O}_3$ (b) **$\text{SiO}_2 < \text{Al}_2\text{O}_3 < \text{MgO}$**
 (c) $\text{Al}_2\text{O}_3 < \text{SiO}_2 < \text{MgO}$ (d) $\text{MgO} < \text{Al}_2\text{O}_3 < \text{SiO}_2$

39. Hydration energies of Li^+ and Cl^- are -499 and -382 kJ mol^{-1} . If lattice energy of LiCl is -840 kJ mol^{-1} , heat of solution of LiCl is

- (a) $+41$ kJ mol^{-1} (b) -1222 kJ mol^{-1}
 (c) -1621 kJ mol^{-1} (d) **-41 kJ mol^{-1}**

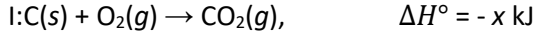
40. Heat of neutralization of NaOH with equivalent amount of acid is maximum in case of

- (a) HCl (b) HNO_3
 (c) **HF** (d) CH_3COOH

41. If enthalpies of formation for $C_2H_4(g)$, $CO_2(g)$ and $H_2O(l)$ at $25^\circ C$ and 1 atm pressure are 52 kJ/mol, - 394 kJ / mol and - 286 kJ / mol respectively, then enthalpy of combustion of $C_2H_4(g)$ will be

- (a) - 141.2 kJ/mol **(b) - 1412 kJ/mol**
 (c) - 14.2 kJ/mol (d) + 1412 kJ/mol

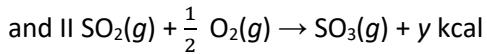
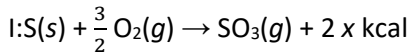
42. Given that,



The enthalpy of formation of carbon monoxide will be

- (a) $y - 2x$ (b) $2x - 2y$
(c) $\frac{y-2x}{2}$ (d) $\frac{2x-y}{2}$

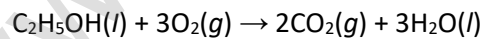
43. In the reaction,



that heat of formation of SO_2 is

- (a) $(x + y)$ (b) $(x - y)$
 (c) $(2x + y)$ **(d) $(y - 2x)$**

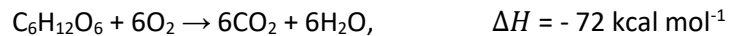
44. If ΔE is the heat of reaction for



at constant volume then ΔH (heat of reaction at constant pressure) is

- (a) $\Delta H = \Delta E + RT$ **(b) $\Delta H = \Delta E - RT$**
 (c) $\Delta H = \Delta E - 2RT$ (d) $\Delta H = \Delta E + 2RT$

45. The combustion of glucose takes place as per reaction.



The energy released by the combustion of 1.6 g of glucose is

- (a) - 0.72 kcal (b) - 0.27 kcal
(c) - 0.46 kcal **(d) - 0.64 kcal**

46. The heat of combustion of yellow phosphorus is -9.91 kJ and of red phosphorus is -8.78 kJ. The heat of a transition of yellow phosphorus to red phosphorus is

- (a) - 9.91 kJ (b) - 8078 kJ
(c) - 9.34 kJ **(d) - 1.13 kJ**

47. On burning 4.0 g of iron to ferric oxide at constant pressure, the heat evolved is 29.28 kJ. The enthalpy of formation of ferric oxide is (At. Wt. of Fe = 56)

- (a) 81.98 kJ mol⁻¹ (b) - 81.98 kJ mol⁻¹
(c) 819.8 kJ mol⁻¹ **(d) - 819.8 kJ mol⁻¹**

48. The enthalpies of combustion of carbon and carbon monoxide are -390 kJ mol⁻¹ and -278 kJ mol⁻¹ respectively. The enthalpy of formation of carbon monoxide is

- (a) - 668 kJ mol⁻¹ (b) + 668 kJ mol⁻¹
(c) 112 kJ mol⁻¹ **(d) - 112 kJ mol⁻¹**

49. 2.0 g of CH₄ on combustion produce 25 kcal. Heat of combustion of CH₄ would be

- (a) - 200 kcal** (b) - 400 kcal
(c) - 500 kcal (d) - 600 kcal

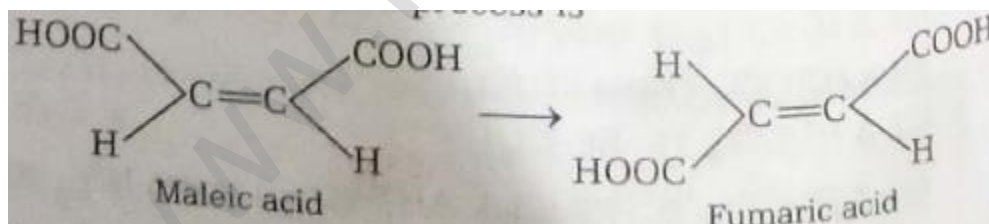
50. The heat formation of CO₂ is -95 kcal. The amount of carbon which on burning will evolve 1000 kcal is

- (a) 12.63 g (b) 17.95 g
(c) 126.3 g (d) 179.5 g

51. The enthalpies for the formation of C₂H₄(g), CO₂(g) and H₂O(l) at 25°C and 1 atm pressure are 52, -394 and -286 kJ/mol respectively. The total enthalpy of combustion of C₂H₄(g) is

- (a) + 1412 kJ/mol **(b) - 1412 kJ/mol**
(c) + 1412 kJ/mol (d) - 1412 kJ/mol

52. The heat of combustion of benzoic acid is $-2546 \text{ kJ mol}^{-1}$ at 25°C and 1 atm. The ΔE is
- (a) -1555.6 kJ (b) -2244.76 kJ
(c) -2544.76 kJ (d) -2868.66 kJ
53. The enthalpy of combustion of C_6H_6 is $-3250 \text{ kJ mol}^{-1}$. When 0.39 g of benzene is burnt in excess of oxygen in an open vessel, the amount of heat liberated is
- (a) -16.25 J **(b) -16.25 J**
 (c) -32.5 J (d) -32.5 J
54. The heat formation of $\text{C}_{12}\text{H}_{22}\text{O}_{11}(\text{s})$, $\text{CO}_2(\text{g})$ and $\text{H}_2\text{O}(\text{l})$ are -530 , -94.3 and -68.3 kcal/mol respectively. The amount of $\text{C}_{12}\text{H}_{22}\text{O}_{11}$ to supply 2700 kcal of energy is
- (a) 382.70 g (b) 832.74 g
(c) 463.9 g **(d) 682.6 g**
55. The enthalpies of formation of $\text{C}_2\text{H}_2(\text{g})$ and $\text{C}_6\text{H}_6(\text{g})$ at 298 K are 230 and 85 kJ/mol respectively. The enthalpy change for the reaction $3\text{C}_2\text{H}_2(\text{g}) \rightarrow \text{C}_6\text{H}_6(\text{g})$
- (a) 605 kJ/mol (b) 865 kJ/mol
(c) -605 kJ/mol (d) -865 kJ/mol
56. The standard enthalpies of combustion of fumaric acid and maleic acid (to four CO_2 and H_2O) are $-1336.0 \text{ kJ mol}^{-1}$ and $-1359.2 \text{ kJ mol}^{-1}$, respectively. Thus, enthalpy of the following isomerisation process is



- (a) 23.2 kJ mol^{-1}** (b) $-23.2 \text{ kJ mol}^{-1}$
 (c) $-2695.2 \text{ kJ mol}^{-1}$ (d) $+2695.2 \text{ kJ mol}^{-1}$
57. The standard molar enthalpy of formation of molecular oxygen at 298 K is zero. Thus, its value at 315 K is ($C_p^\circ(\text{O}_2)$ is 29.4 JK mol^{-1})
- (a) zero **(b) 0.5 kJ mol^{-1}**

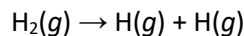
(c) -0.5 kJ mol^{-1} (d) can't be predicted

58. Which of the following substances has a non-zero ΔH_f° value at 298 K?

(a) 298 K? (b) $\text{I}_2(l)$

(c) Hg (d) $\text{O}_2(g)$

59. The standard enthalpy change for formation of atomic hydrogen (H) is



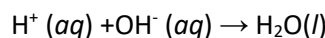
Thus, the standard enthalpy of formation of atomic hydrogen (H) is

(a) 436. kJ (b) -218.2 kJ

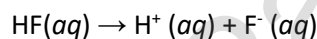
(c) **+218.2 kJ** (d) -436.4 kJ

60. Enthalpy of neutralization of HF (aq)

$\text{HF}(aq) + \text{OH}^-(aq) \rightarrow \text{F}^-(aq) + \text{H}_2\text{O}(l)$ is $-68.60 \text{ kJ mol}^{-1}$ and enthalpy change for the reaction is $-55.8 \text{ kJ mol}^{-1}$



Thus, enthalpy change (kJ mol^{-1}) for the dissociation is



(a) **-12.77** (b) $+12.77$

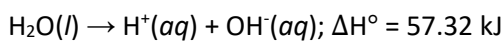
(c) -124.43 (d) $+124.43$

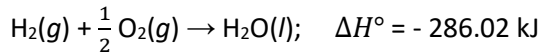
61. In a constant volume calorimeter, 3.5 g of a gas with molecular weight 28 was burnt in excess oxygen at 298.0 K. The temperature of the calorimeter was found to increase from 298.0 K to 298.45 K due to the combustion process. Given, that the heat capacity of the calorimeter is 2.5 kJ K^{-1} , the numerical value of for the enthalpy of combustion of the gas in kJ mol^{-1} is

(a) **9** (b) 6

(c) 8 (d) 4

62. On the basis of the following thermochemical data: $[\Delta G_f^\circ \text{H}^+(aq) = 0]$

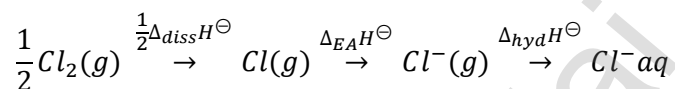




the value of the enthalpy of formation of OH^- ion at 25°C is

- (a) - 22.88 kJ
(b) -228 .88 kJ
 (c) + 228.88 kJ
 (d) -343.52 kJ

63. *Oxidising power of chlorine in aqueous solution can be determined by the parameters indicated below:



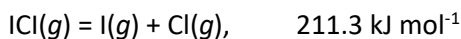
The energy involved in the conversion of $\frac{1}{2} \text{Cl}_2(\text{g})$ to $\text{Cl}^-(\text{aq})$ (using the data, $\Delta_{\text{diss}} H_{\text{Cl}_2}^\ominus = 240 \text{ kJ mol}^{-1}$, $\Delta_{\text{EA}} H_{\text{Cl}}^\ominus = -349 \text{ kJ mol}^{-1}$, $\Delta_{\text{hyd}} H_{\text{Cl}}^\ominus = -381 \text{ kJ mol}^{-1}$)

- (a) + 152 kJ mol^{-1}
(b) - 610 kJ mol^{-1}
 (c) - 850 kJ mol^{-1}
 (d) + 120 kJ mol^{-1}
64. Assuming that water vapour is an ideal gas, internal energy change (ΔU) when 1 mole water is vaporized at 1 bar pressure at 100°C , (Given, molr enthalpy of vaporization of water at 1 bar and $373 \text{ K} = 41 \text{ kJ mol}^{-1}$ and $R = 8.3 \text{ J mol}^{-1} \text{ K}^{-1}$) will be
- (a) 4.100 kJ mol^{-1} (b) 3.7904 kJ mol^{-1}
(c) 37.904 kJ mol^{-1} (d) 41.00 kJ mol^{-1}
65. The standard enthalpy of formation (ΔH_f^\ominus) at 298 K for methane, $\text{CH}_4(\text{g})$, is $-74.8 \text{ kJ mol}^{-1}$. The information required to determine the average energy of C—H bond formation would be

- (a) the dissociation energy of H_2 and enthalpy of sublimation of carbon**
 (b) latent heat of vaporization of methane
 (c) the first four ionization energies of carbon and electron gain enthalpy of hydrogen

(d) the dissociation energy of hydrogen molecule, H_2

66. The enthalpy changes for the following processes are listed below



Given that the standard states for iodine and chlorine are $I_2(s)$ and $Cl_2(g)$, the standard enthalpy of formation of $ICl(g)$ is

(a) $-14.6 \text{ kJ mol}^{-1}$

(b) $-16. \text{ kJ mol}^{-1}$

(c) $+ 16.8 \text{ kJ mol}^{-1}$

(d) $+ 244.8 \text{ kJ mol}^{-1}$

67. The standard enthalpy of formation of NH_3 is $- 46.0 \text{ kJ mol}^{-1}$. If the enthalpy of formation of H_2 from its atoms is $- 436 \text{ kJ mol}^{-1}$ and of N_2 is $- 712 \text{ kJ mol}^{-1}$, the average bond enthalpy of N—H bond in NH_3 is

(a) $- 964 \text{ kJ mol}^{-1}$

(b) $+ 352 \text{ kJ mol}^{-1}$

(c) $+ 1056 \text{ kJ mol}^{-1}$

(d) $- 1102 \text{ kJ mol}^{-1}$

68. Consider the reaction, $4NO_2(g) + O_2(g) \rightarrow 2N_2O_5(g)$ $\Delta_r H = - 111 \text{ kJ}$. If $N_2O_5(s)$ is formed instead of $N_2O_5(g)$ in above reaction, the $\Delta_r H$ value will be

(Given, ΔH of sublimation for N_2O_5 is 54 kJ mol^{-1})

(a) $- 165 \text{ kJ}$

(b) $+ 54 \text{ kJ}$

(c) $+ 219 \text{ kJ}$

(d) $- 219 \text{ kJ}$

69. The enthalpies of combustion of carbon and carbon monoxide are -393.5 and -283 kJ mol^{-1} respectively. The enthalpy of formation of carbon monoxide per mole is

- (a) 110.5 kJ (b) 675.5 kJ
(c) -676.5 kJ (d) -110.5 kJ

70. The heats of combustion of carbon monoxide at constant pressure and at constant volume at 27°C will differ from one another by

- (a) 27 cal (b) 54 cal
(c) 300 cal (d) 600 cal

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