Exercise - I (Conceptual Questions) Build Up Your Understanding

INTRODUCTION

1. Thermodynamics is concerned with :-
(1) Total energy of a system
(2) Energy changes in a system
(3) Rate of a chemical change
(4) Mass changes in nuclear reactions
CTD001

2. A well stoppered thermos flask contains some ice cubes. This is an example of :–
(1) Closed system
(2) Open system
(3) Isolated system
(4) Non-thermodynamic system
CTD002

3. Identify the intensive quantities from the following -
(1) Enthalpy and temperature
(2) Volume and temperature
(3) Enthalpy and volume
(4) Temperature and refractive index
CTD003

4. Which of the following is an extensive property
(1) Mass (2) Enthalpy
(3) Energy (4) All of these
CTD004

5. For an adiabatic process which of the following relations is correct
(1) $\Delta E = 0$ (2) $P\Delta V = 0$
(3) $q = 0$ (4) $q = + W$
CTD005

6. In which of the following process work is independent of path :
(1) Isothermal (2) Isochoric
(3) Adiabatic (4) Isobaric
CTD006

7. When a gas is compressed adiabatically and reversibly, the final temperature is-
(1) Higher than the initial temperature
(2) Lower than the initial temperature
(3) The same as initial temperature
(4) Dependent upon the rate of compression
CTD007

8. Which one is dependent on initial and final state?
(1) Heat supplied at constant pressure
(2) Heat supplied at constant volume
(3) Enthalpy
(4) All of the above
CTD008

9. Out of boiling point (I), entropy (II), pH (III) and emf of a cell (IV), intensive properties are :
(1) I, III, IV (2) I, II
(3) I, II, III (4) All of these
CTD009

10. The work done by a weightless piston in causing an expansion ΔV (at constant temperature), when the opposing pressure P is variable, is given by :
(1) $W = -\int PdV$ (2) $W = 0$
(3) $W = -P\Delta V$ (4) None
CTD010

11. The work done by 100 calorie of heat in isothermal expansion of ideal gas is :-
(1) 418.4 J (2) 4.184 J
(3) 41.84 J (4) None
CTD011

12. Temperature and volume are not :-
(1) Extensive properties
(2) Intensive properties
(3) Intensive and extensive properties respectively
(4) Extensive and intensive properties respectively
CTD012

13. $q = -w$ is not true for :-
(1) Isothermal process
(2) Adiabatic process
(3) Cyclic process
(4) 1 and 3 both
CTD013

14. The temperature of an ideal gas increase in an -
(1) Adiabatic compression
(2) Adiabatic expansion
(3) Isothermal expansion
(4) Isothermal compression

CTD014

15. Which statement is true for reversible process :–
(1) It takes place in single step
(2) Driving force is much greater than opposing force
(3) Work obtained is minimum
(4) None

CTD015

FIRST LAW OF THERMODYNAMICS ($\Delta E = q + W$)

16. Both q & w are_ _ _ _ _ function :-
(1) State (2) State, Path
(3) Path, State (4) Path

CTD016

17. If work done by the system is 300 joule when 100 cal. heat is supplied to it. The change in internal energy during the process is :-
(1) – 200 Joule (2) 400 Joule
(3) 720 Joule (4) 120 Joule

CTD017

18 A system has internal energy equal to E_1, 450 J of heat is taken out of it and 600 J of work is done on it. The final energy of the system will be -
(1) $(E_1 + 150)$ (2) $(E_1 + 1050)$
(3) $(E_1 - 150)$ (4) None of these

CTD018

19. The work done by a system is 8J when 40J heat is supplied to it. The change in internal energy of the system during the process :
(1) 32 J (2) 40 J (3) 48 J (4) –32 J

CTD019

ENTHALPY [$\Delta H=\Delta E + P\Delta V/\Delta H= \Delta E + \Delta n_g RT$]

20. Internal energy change during a reversible isothermal expansion of an ideal gas is :-
(1) Always negative
(2) Always positive
(3) Zero
(4) May be positive or negative

CTD020

21. Under which of the following conditions is the relation, $\Delta H = \Delta E + P\Delta V$ valid for a system :–
(1) Constant pressure
(2) Constant temperature
(3) Constant temperature and pressure
(4) Constant temperature, pressure and composition

CTD021

22. The difference between heats of reaction at constant pressure and constant volume for the reaction
$2C_6H_6(l) + 15O_2(g) \longrightarrow 12CO_2(g) + 6H_2O(l)$ at 25^0C in KJ is
(1) + 7.43 (2) +3.72
(3) – 7.43 (4) – 3.72

CTD022

23. For a gaseous reaction,
$A(g) + 3B(g) \longrightarrow 3C(g) + 3D(g)$
Δ E is 17 kCal at 27^0C assuming
R = 2 Cal K^{-1} mol^{-1}, the value of ΔH for the above reaction is:
(1) 15.8 Kcal (2) 18.2 Kcal
(3) 20.0 Kcal (4) 16.4 Kcal

CTD023

24. Which of the following statements is correct for the reaction ;
$2SO_2(g) + O_2(g) \longrightarrow 2SO_3(g)$ at constant temperature and pressure
(1) $\Delta H = \Delta E$ (2) $\Delta H < \Delta E$
(3) $\Delta H > \Delta E$ (4) None of the above

CTD024

25. For the reaction
$Ag_2O(s) \longrightarrow 2Ag(s) + ½\ O_2(g)$, which one of the following is true :
(1) $\Delta H = \Delta E$ (2) $\Delta H = ½\ \Delta E$
(3) $\Delta H < \Delta E$ (4) $\Delta H > \Delta E$

CTD025

26. A mixture of 2 moles of carbon monoxide and one mole of oxygen in a closed vessel is ignited to get carbon dioxide. If ΔH is the enthalpy change and ΔE is the change in internal energy, then :–
(1) $\Delta H > \Delta E$ (2) $\Delta H < \Delta E$
(3) $\Delta H = \Delta E$ (4) Not definite

CTD026

27. For the gaseous reaction involving the complete combustion of isobutane -
(1) $\Delta H = \Delta E$ (2) $\Delta H > \Delta E$
(3) $\Delta H = \Delta E = 0$ (4) $\Delta H < \Delta E$
CTD027

28. For the reversible isothermal expansion of one mole of an ideal gas at 300 K, from a volume of 10 dm^3 to 20 dm^3, ΔH is -
(1) 1.73 kJ (2) –1.73 kJ
(3) 3.46 kJ (4) Zero
CTD028

29. For $CaCO_3(s) \rightarrow CaO(s) + CO_2(g)$ at 977°C, ΔH = 174 KJ/mol ; then ΔE is :-
(1) 160 kJ (2) 163.6 kJ
(3) 186.4 kJ (4) 180 kJ
CTD029

30. Heat of reaction for,
$CO(g) + ½ \quad O_2(g) \rightarrow CO_2(g)$ at constant V is –67.71 kcal at 17°C. The heat of reaction at constant P at 17°C is :-
(1) –68.0 kCal (2) + 68.0 kCal
(3) – 67.42 kCal (4) None
CTD030

31. The enthalpy of vaporisation of water at 100^0C is 40.63 kJ mol^{-1}. The value ΔE for this process would be:-
(1) 37.53 kJ mol^{-1} (2) 39.08 kJ mol^{-1}
(3) 42.19 kJ mol^{-1} (4) 43.73 kJ mol^{-1}
CTD031

32. For the system $S(s) + O_2(g) \rightarrow SO_2(g)$:–
(1) $\Delta H = \Delta E$ (2) $\Delta H > \Delta E$
(3) $\Delta E > \Delta H$ (4) $\Delta H = 0$
CTD032

33. For the reaction $CO(g) + \frac{1}{2} O_2(g) \rightarrow CO_2(g)$
Which one of these statement is correct at constant T and P ?
(1) $\Delta H = \Delta E$
(2) $\Delta H < \Delta E$
(3) $\Delta H > \Delta E$
(4) ΔH is Independent of physical state of reactants
CTD033

34. Which is true for the combustion of sucrose ($C_{12}H_{22}O_{11}$) at 25°C :-
(1) $\Delta H > \Delta E$ (2) $\Delta H < \Delta E$
(3) $\Delta H = \Delta E$ (4) None
CTD034

35. For which change $\Delta H \neq \Delta E$:-
(1) $H_2(g) + I_2(g) \rightarrow 2HI(g)$
(2) $HCl(\ell) + NaOH(\ell) \rightarrow NaCl(s) + H_2O(\ell)$
(3) $C(s) + O_2(g) \rightarrow CO_2(g)$
(4) $N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$
CTD035

36. The heat of combustion of ethanol determined in a bomb calorimeter is – 670.48 kCal $mole^{-1}$ at 27°C. What is ΔH at 27°C for the reaction :–
(1) – 335.24 kCal (2) – 671.08 kCal
(3) – 670.48 kCal (4) + 670.48 kCal
CTD036

37. The difference in ΔH and ΔE for the combustion of methane at 25°C would be :–
(1) Zero (2) 2 × 298 × – 2 Cal
(3) 2 × 298 × – 3 Cal (4) 2 × 25 × – 3 Cal
CTD037

38. For which of the following reactions ΔH is less than ΔE :–
(1) $C_{12}H_{22}O_{11}(s) + 12O_2(g) \rightarrow 12CO_2(g) + 11H_2O(\ell)$
(2) $2SO_2(g) + O_2(g) \rightarrow 2SO_3(g)$
(3) $N_2O_4(g) \rightarrow 2NO_2(g)$
(4) $N_2(g) + O_2(g) \rightarrow 2NO(g)$
CTD038

39. For a reaction $2X(s) + 2Y(s) \rightarrow 2C(\ell) + D(g)$
The q_p at 27°C is – 28 kCal mol^{-1}.
The q_V is _____ kCal mol^{-1} :–
(1) – 27.4 (2) + 27.4 (3) – 28.6 (4) 28.6
CTD039

WORK DONE IN DIFFERENT PROCESS

40. The work (in ergs) for a reversible expansion of one mole of an ideal gas from a volume of 10 litres to 20 litres at 25^0C is :
(1) $-2.303 \times 8.314 \times 10^7 \times 298 \log 2$
(2) $-2.303 \times 0.0821 \times 298 \log 2$
(3) $-2.303 \times 0.0821 \times 298 \log 0.5$
(4) $-2.303 \times 2 \times 298 \log 2$
CTD040

41. Two moles of an ideal gas expand spontaneously into vacuum. The work is :–
(1) Zero (2) 2 J (3) 4 J (4) 8 J
CTD041

42. One mole of a gas occupying $3dm^3$ expands against a constant external pressure of 1 atm to a volume of 13 L. Find work is :–
(1) – 10 atm dm^3 (2) – 20 atm dm^3
(3) – 39 atm dm^3 (4) – 48 atm dm^3
CTD042

ENTROPY/SECOND LAW OF THERMODYNAMICS

43. For which reaction from the following, ΔS will be maximum ?
(1) $Ca(s) + ½\ O_2(g) \longrightarrow CaO(s)$
(2) $CaCO_3(s) \longrightarrow CaO(s) + CO_2(g)$
(3) $C(s) + O_2(g) \longrightarrow CO_2(g)$
(4) $N_2(g) + O_2(g) \longrightarrow 2NO(g)$
CTD043

44. An adiabatic reversible process is one in which :-
(1) Temperature of the system does not change
(2) The system is not closed to heat transfer
(3) There is no entropy change
(4) None of these
CTD044

45. Entropy means
(1) Disorderness (2) Randomness
(3) Orderness (4) Both 1 & 2
CTD045

46. ΔS for the reaction;
$MgCO_3(s) \longrightarrow MgO(s) + CO_2(g)$ will be :
(1) 0 (2) –ve
(3) +ve (4) ∞
CTD046

47. Change in entropy is negative for
(1) $Br_2(\ell) \longrightarrow Br_2(g)$
(2) $C(s) + H_2O(g) \longrightarrow CO(g) + H_2(g)$
(3) $N_2(g, 10\ atm) \longrightarrow N_2(g, 1\ atm)$
(4) Fe(at 400 K) $\longrightarrow$ Fe(at 300 K)
CTD047

48. In which reaction ΔS is positive :-
(1) $H_2O(\ell) \rightarrow H_2O(s)$
(2) $3O_2(g) \rightarrow 2O_3(g)$
(3) $H_2O(\ell) \rightarrow H_2O(g)$
(4) $N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$
CTD048

49. When the egg is hard boiled, there is-
(1) Increase in disorder
(2) Decrease in disorder
(3) No change in disorder
(4) ΔG is negative
CTD049

50. If S^0 for H_2, Cl_2 and HCl are 0.13, 0.22 and 0.19 kJ K^{-1} mol^{-1} respectively. The total change in standard entropy for the reaction
$H_2 + Cl_2 \longrightarrow 2HCl$ is :
(1) 30 JK^{-1} mol^{-1} (2) 40 JK^{-1} mol^{-1}
(3) 60 JK^{-1} mol^{-1} (4) 20 JK^{-1} mol^{-1}
CTD050

51. Which has the least entropy :
(1) Graphite (2) Diamond
(3) $N_2(g)$ (4) $N_2O(g)$
CTD051

52. When two gases are mixed the entropy :–
(1) Remains constant (2) Decreases
(3) Increases (4) Becomes zero
CTD052

53. The enthalpy of vaporisation of per mole of ethanol (B.pt. = 79.5^0C and $\Delta S = 109.8\ JK^{-1}\ mol^{-1}$) is :–
(1) 27.35 kJ mol^{-1} (2) 32.19 kJ mol^{-1}
(3) 38.70 kJ mol^{-1} (4) 42.37 kJ mol^{-1}
CTD053

54. If 900J/g of heat is exchanged at boiling point of water, then what is increase in entropy?
(1) 43.4 $JK^{-1}mole^{-1}$ (2) 87.2 $JK^{-1}mole^{-1}$
(3) 900 $JK^{-1}mole^{-1}$ (4) Zero
CTD054

55. 5 mole of an ideal gas expand reversibly from a volume of 8 dm^3 to $80dm^3$ at a temperature of 27^0C. The change in entropy is :–
(1) 41.57 JK^{-1} (2) – 95.73 JK^{-1}
(3) 95.73 JK^{-1} (4) – 41.57 JK^{-1}
CTD055

56. In a spontaneous irreversible process the total entropy of the system and surroundings
(1) Remains constant (2) Increases
(3) Decreases (4) Zero
CTD056

57. The total entropy change for a system & its surroundings increases if the process is :
(1) Reversible (2) Spontaneous
(3) Exothermic (4) Endothermic
CTD057

58. Calculate the entropy of $Br_2(g)$ in the reaction $H_2(g) + Br_2(g) \rightarrow 2HBr(g)$, $\Delta S° = 20.1\ JK^{-1}$ given, entropy of H_2 and HBr is 130.6 and 198.5 J $mol^{-1}\ K^{-1}$:-
(1) 246.3 JK^{-1} (2) 123.15 JK^{-1}
(3) 24.63 JK^{-1} (4) 20 kJK^{-1}
CTD058

59. In which of the following case entropy decreases–
(1) Solid changing to liquid
(2) Expansion of a gas
(3) Crystals dissolve
(4) Polymerisation
CTD059

60. Which of the following quantity is not zero for element in standard state :–
(1) Enthalpy of formation
(2) Entropy
(3) Free energy of formation
(4) All of these
CTD060

61. Entropy of an adiabatic reversible process is:-
(1) Positive (2) Zero
(3) Negative (4) Constant
CTD061

GIBBS FREE ENERGY

62. A gas is allowed to expand under reversible adiabatic conditions then :-
(1) $\Delta U = 0$ (2) $\Delta T = 0$
(3) $\Delta S = 0$ (4) None of these
CTD062

63. For a reaction at 25^0C enthalpy change (ΔH) and entropy change (ΔS) are $-11.7 \times 10^3\ Jmol^{-1}$ and $-105\ J\ mol^{-1}\ K^{-1}$ respectively. The reaction is :
(1) Spontaneous
(2) Non spontaneous
(3) At equilibrium
(4) Can't say anything
CTD063

64. If $\Delta H > 0$ and $\Delta S > 0$, the reaction proceeds spontaneously when :-
(1) $\Delta H > 0$ (2) $\Delta H < T\Delta S$
(3) $\Delta H = T\Delta S$ (4) None
CTD064

65. The temperature at which the reaction
$Ag_2O(s) \longrightarrow 2Ag(s) + ½\ O_2(g)$
is at equilibrium is .....;
Given $\Delta H = 30.5\ kJ\ mol^{-1}$
and $\Delta S = 0.066\ kJK^{-1}\ mol^{-1}$:
(1) 462.12 K (2) 362.12 K
(3) 262.12 K (4) 562.12 K
CTD065

66. Which of the following is true for the reaction $H_2O(\ell) \rightleftharpoons H_2O(g)$ at 100^0C and 1 atmosphere
(1) $\Delta S = 0$ (2) $\Delta H = 0$
(3) $\Delta H = \Delta E$ (4) $\Delta H = T\Delta S$
CTD066

67. For the reaction $A(s) \longrightarrow B(s) + C(g)$ the value of $\Delta H = 30.56\ kJ\ mol^{-1}$ and $\Delta S = 66\ JK^{-1}\ mol^{-1}$. The temperature at which the free energy change for the reaction will be zero is :–
(1) 373 K (2) 413 K (3) 463 K (4) 493 K
CTD067

68. For hypothetical reversible reaction
$½\ A_2(g) + ⅗\ B_2(g) \longrightarrow AB_3(g)$; $\Delta H = -20$ kJ if standard entropies of A_2, B_2 and AB_3 are 60, 40 and 50 JK^{-1} $mole^{-1}$ respectively. The above reaction will be in equilibrium at :–
(1) 400 K (2) 500 K (3) 250 K (4) 200 K
CTD068

69. For the precipitation of AgCl by Ag^+ ions and HCl
(1) $\Delta H = 0$ (2) $\Delta G = 0$
(3) $\Delta G = -ve$ (4) $\Delta H = \Delta G$
CTD069

70. What is the sign of ΔG for the process of ice melting at 1 atm, 283 K is ?
(1) $\Delta G > 0$ (2) $\Delta G = 0$
(3) $\Delta G < 0$ (4) None of these
CTD070

71. A reaction A + B $\longrightarrow$ C + D + q is found to have a positive entropy change, the reaction will be -
(1) Possible at high temperature
(2) Possible only at low temperature
(3) Not possible at any temperature
(4) Possible at any temperature
CTD071

72. Equilibrium constant of a reaction is related to :
(1) Standard free energy change ΔG^0
(2) Free energy change ΔG
(3) Entropy change
(4) None
CTD072

73. The Vant Hoff equation is :
(1) $\Delta G° = RT \log_e K_P$ (2) $-\Delta G° = RT \log_e K_P$
(3) $\Delta G° = RT^2 \ell n K_P$ (4) None
CTD073

74. If $\Delta G^0 > 0$ for a reaction then :
(1) $K_P > 1$
(2) $K_P < 1$
(3) The products predominate in the equilibrium mixture
(4) None
CTD074

75. If the equilibrium constant for a reaction is 10, then the value of ΔG^0 will be
(R = 8JK^{-1} mol^{-1}, T = 300 K)
(1) + 5.527 kJ mol^{-1} (2) – 5.527 kJ mol^{-1}
(3) +55.27 kJ mol^{-1} (4) – 55.27 kJ mol^{-1}
CTD075

76. The process of evaporation of a liquid is accompanied by :
(1) Increase in enthalpy
(2) Decrease in free energy
(3) Increase in entropy
(4) All
CTD076

77. For the process, $CO_2(s) \longrightarrow CO_2(g)$:
(1) Both ΔH and ΔS are +ve
(2) ΔH is negative and ΔS is +ve
(3) ΔH is +ve and ΔS is –ve
(4) Both ΔH and ΔS are –ve
CTD077

78. Which of the following provide exceptions to third law of thermodynamics
(1) CO (2) ice
(3) CO_2 (4) All the above
CTD078

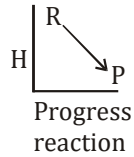
79. The Gibbs free energy change of a reaction at 27°C is –26 kCal and its entropy change is – 60 Cal K^{-1}. ΔH for the reaction is :–
(1) – 44 kCal (2) – 18 kCal
(3) 34 kCal (4) – 24 kCal
CTD079

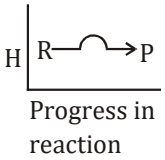
80. Which of the following reaction is expected never to be spontaneous :–
(1) $2O_3(g) \rightarrow 3O_2(g)$
ΔH = – Ve, ΔS = +Ve
(2) $Mg(s) + H_2(g) \rightarrow MgH_2$
ΔH = – Ve, ΔS = – Ve
(3) $Br_2(I) \rightarrow Br_2(g)$
ΔH = + Ve, ΔS = + Ve
(4) $2Ag(s) + 3N_2(g) \rightarrow 2AgN_3$
ΔH = +Ve, ΔS=– Ve
CTD080

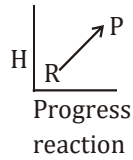
THERMOCHEMICAL REACTION

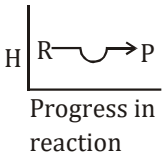
81. The formation of water from $H_2(g)$ and $O_2(g)$ is an exothermic process because :
(1) The chemical energy of $H_2(g)$ and $O_2(g)$ is more than that of water
(2) The chemical energy of $H_2(g)$ and $O_2(g)$ is less than that of water
(3) The temperature of $H_2(g)$ and $O_2(g)$ is higher than that of water
(4) The temperature of $H_2(g)$ and $O_2(g)$ is lower than that of water
CTD081

82. Which plot represents for an exothermic reaction:

(1) 

(2) 

(3) 

(4) 

CTD082

83. 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

CTD083

84. The correct thermochemical equation is :
(1) $C + O_2 \longrightarrow CO_2$; $\Delta H = -94$ kCal
(2) $C + O_2 \longrightarrow CO_2$; $\Delta H = +94.0$ kCal
(3) $C(s) + O_2(g) \longrightarrow CO_2(g)$; $\Delta H = -94$ kCal
(4) $C(s) + O_2(g) \longrightarrow CO_2(g)$; $\Delta H = +94$ kCal

CTD084

85. 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-}

CTD085

86. ΔH for transition of carbon from diamond form to graphite form is – 453.5 Cal. This suggests that :
(1) Graphite is chemically different from diamond
(2) Graphite is as stable as diamond
(3) Graphite is more stable than diamond
(4) Diamond is more stable than graphite

CTD086

87. Which of the following values of heat of formation indicates that the product is least stable
(1) – 94 kCal (2) – 231.6 kCal
(3) + 21.4 kCal (4) + 64.8 kCal

CTD087

88. Heat of formation, ΔH_f° of an explosive compound like NCl_3 is –
(1) Positive
(2) Negative
(3) Zero
(4) Positive or negative

CTD088

89. According to the following reaction
$C(s) + 1/2\ O_2(g) \rightarrow CO(g)$, $\Delta H = -26.4$ kCal
(1) CO is an endothermic compound
(2) CO is an exothermic compound
(3) The reaction is endothermic
(4) None of the above

CTD089

90. Which of the following represents an exothermic reaction:-
(1) $N_2(g) + O_2(g) \rightarrow 2NO(g)$, $\Delta H = 180.5$ kJ
(2) $H_2O(g) + C(s) \rightarrow CO(g) + H_2(g)$, $\Delta E = 131.2$ kJ
(3) $2HgO(s) + 180.4\ KJ \rightarrow 2Hg(\ell) + O_2(g)$
(4) $2Zn(s) + O_2(g) \rightarrow 2ZnO(s)$, $\Delta E = -693.8$ kJ

CTD090

91. Consider the reaction $3O_2 \rightarrow 2O_3$; $\Delta H = +$ Ve, from the reaction, we can say that :–
(1) Ozone is more stable then oxygen
(2) Ozone is less stable then oxygen and ozone decomposes forming oxygen readily
(3) Oxygen is less stable than ozone and oxygen decomposes forming ozone readily
(4) None of the above

CTD091

92. From the reaction P(White) $\rightarrow$ P(Red) ; $\Delta H = -18.4$ kJ, it follows that :-
(1) Red P is readily formed from white P
(2) White P is readily formed from red P
(3) White P can not be converted to red P
(4) White P can be converted into red P and red P is more stable

CTD092

FACTORS AFFECTING HEAT OF REACTION

93. In Kirchoff's equation which factor affects the heat of reaction :
(1) Pressure (2) Temperature
(3) Volume (4) Atomicity
CTD093

94. The enthalpy of a reaction at 273 K is –3.57 kJ. what will be the enthalpy of reaction at 373 K if ΔC_p = zero :–
(1) – 3.57 kJ (2) Zero
(3) $-3.57 \times \frac{373}{273}$ kJ (4) – 375 kJ
CTD094

95. For the reactions,
(i) $H_2(g) + Cl_2(g) \longrightarrow 2HCl(g) + x$ kJ
(ii) $H_2(g) + Cl_2(g) \longrightarrow 2HCl(\ell) + y$ kJ
Which one of the following statement is correct :
(1) x > y (2) x < y
(3) x = y (4) More data required
CTD095

HEAT OF FORMATION

96. Since the enthalpy of formation of the elements in their standard states is taken to be zero. The heat of formation (ΔH_f) of compounds :
(1) Is always negative
(2) Is always positive
(3) Is zero
(4) May be positive or negative
CTD096

97. Reaction $H_2(g) + I_2(g) \longrightarrow 2HI$; ΔH = 12.40 kCal. According to this, heat of formation of HI will be –
(1) 12.40 kCal (2) – 12.40 kCal
(3) – 6.20 kCal (4) 6.20 kCal
CTD097

98. Which of the following equations respresents standard heat of formation of CH_4 ?
(1) $C_{(diamond)} + 2H_{2\,(g)} \longrightarrow CH_{4(g)}$
(2) $C_{(graphite)} + 2H_{2\,(g)} \longrightarrow CH_{4(g)}$
(3) $C_{(diamond)} + 4H_{(g)} \longrightarrow CH_{4(g)}$
(4) $C_{(graphite)} + 4H_{(g)} \longrightarrow CH_{4(g)}$
CTD099

99. 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}
CTD100

100. Given enthalpy of formation of $CO_2(g)$ and CaO(s) are – 94.0 kJ and – 152 kJ respectively and the enthalpy of the reaction :
$CaCO_3(s) \longrightarrow CaO(s) + CO_2(g)$ is 42 kJ. The enthalpy of formation of $CaCO_3(s)$ is
(1) – 42 KJ (2) – 202 KJ
(3) +202 KJ (4) – 288KJ
CTD101

101. Given that standard enthalpy of formation of CH_4, C_2H_4 and C_3H_8 are –17.9, 12.5, –24.8 kCal mol^{-1}. The ΔH for $CH_4 + C_2H_4 \rightarrow C_3H_8$ is :
(1) – 55.2 kCal (2) – 30.2 kCal
(3) 55.2 kCal (4) – 19.4 kCal
CTD102

102. The standard molar heat of formation of ethane, CO_2 and water are respectively –21.1, –94.1 and – 68.3 kCal. The standard molar heat of combustion of ethane will be
(1) –372 kCal (2) –162 kCal
(3) – 240 kCal (4) –183.5 kCal
CTD103

103. The ΔH_f° for $CO_{2(g)}$, $CO_{(g)}$ and $H_2O_{(g)}$ are –393.5, –110.5 and –241.8 kJ mol^{-1} respectively the standard enthalpy change (in kJ) for the reaction
$CO_{2(g)} + H_{2\,(g)} \rightarrow CO_{(g)} + H_2O_{(g)}$ is -
(1) 524.1 (2) 41.2
(3) –262.5 (4) –41.2
CTD104

104. The enthalpies of combustion of carbon and carbon monoxide are –393.5 kJ and –283 kJ, respectively the enthalpy of formation of carbon monoxide is :
(1) –676.5 kJ (2) –110.5 kJ
(3) 110.5 kJ (4) 676.5 kJ
CTD105

105. The standard heat of formation of $CS_2(\ell)$ will be; given that the standard heat of combustion of carbon (s), sulphur(s) and $CS_2(\ell)$ are –393.3, –293.72 and –1108.76 kJ mol^{-1} respectively is
(1) –128.02 kJ $mole^{-1}$ (2) +12.802 kJ mol^{-1}
(3) +128.02 kJ mol^{-1} (4) –12.802 kJ mol^{-1}
CTD106

106. The heat of combustion of $CH_{4(g)}$, $C_{(s)}$ and $H_{2(g)}$ at 25 °C are –212.4 K Cal, –94.0 K Cal and –68.4 K Cal respectively, the heat of formation of CH_4 will be -
(1) +54.4 K Cal (2) –18.4 K Cal
(3) –375.2 K Cal (4) +212.8 K Cal
CTD107

107. Standard enthalpy of formation is zero for.
(1) $C_{diamond}$ (2) $Br_{(g)}$
(3) $C_{graphite}$ (4) $O_{3(g)}$
CTD108

108. The standard heats of formation of $NO_2(g)$ and $N_2O_4(g)$ are 8.0 and 2.0 kCal mol^{-1} respectively the heat of dimerization of NO_2 in kCal is
(1) 10.0 (2) –6.0 (3) –12.0 (4) –14.0
CTD109

109. M is a metal that forms an oxide M_2O

$$\frac{1}{2}M_2O \rightarrow M + \frac{1}{4}O_2 \quad \Delta H = 120 \text{ kCal}$$

When a sample of metal M reacts with one mole of oxygen what will be the ΔH in that case
(1) 240 kCal (2) – 240 kCal
(3) 480 kCal (4) – 480 kCal
CTD110

HEAT OF COMBUSTION

110. According to equation,
$C_6H_6(\ell) + 15/2\ O_2(g) \rightarrow 6CO_2(g) + 3H_2O(\ell)$; ΔH = – 3264.4 kJ mol^{-1} the energy evolved when 7.8 g benzene is burnt in air will be -
(1) 163.22 kJ (2) 32.64 kJ
(3) 3.264 kJ (4) 326.4 kJ
CTD111

111. Heat of combustion of CH_4,C_2H_6, C_2H_4 and C_2H_2 gases are –212.8, –373.0, –337.0 and –310.5 kCal respectively at the same temperature. The best fuel among these gases is :
(1) CH_4 (2) C_2H_6 (3) C_2H_4 (4) C_2H_2
CTD112

112. 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
CTD113

113. The enthalpy of formation for $C_2H_4(g)$, $CO_2(g)$ and $H_2O(\ell)$ at 25^0C and 1 atm. pressure are 52, – 394 and – 286 kJ $mole^{-1}$ respectively. The enthalpy of combustion of C_2H_4 will be:-
(1) + 1412 kJ $mole^{-1}$ (2) –1412 kJ $mole^{-1}$
(3) + 142.2 kJ $mole^{-1}$ (4) –141.2 kJ $mole^{-1}$
CTD114

114. The combustion of one mole of benzene takes place at 298 K and 1 atm. After combustion, $CO_2(g)$ and $H_2O(l)$ are produced and 3267.0 kJ of heat is liberated. Calculate the standard enthalpy of formation, $\Delta_f H^\circ$ of benzene.
Standard enthalpies of formation of $CO_2(g)$ and $H_2O(l)$ are –393.5 kJ mol^{-1} and –285.83 kJ mol^{-1} respectively.
(1) 48.51 kJ mol^{-1} (2) –48.51 kJ mol^{-1}
(3) –97.02 kJ mol^{-1} (4) 97.02 kJ mol^{-1}
CTD115

115. 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
$H_2(g) + ½\ O_2(g) \rightarrow H_2O(g)$; ΔH = –241.8 kJ
$CO(g) + ½\ O_2(g) \rightarrow CO_2(g)$; ΔH = –283 kJ
(1) 241.8 kJ (2) 283 kJ
(3) 1312 kJ (4) 1586 kJ
CTD116

116. A person requires 2870 kCal of energy to lead normal daily life. If heat of combustion of cane sugar is –1349 $kCalmol^{-1}$, then his daily consumption of sugar is :
(1) 728 g (2) 0.728 g
(3) 342 g (4) 0.342 g
CTD117

117. The following are the heats of reactions -
(i) ΔH_f^o of $H_2O_{(\ell)}$ = –68.3 kCal mol^{-1}
(ii) $\Delta H_{comb.}^o$ of C_2H_2 = –337.2 kCal mol^{-1}
(iii) $\Delta H_{comb.}^o$ of C_2H_4 = –363.7 kCal mol^{-1}
Then heat change for the reaction
$C_2H_2 + H_2 \rightarrow C_2H_4$ is -
(1) –716.1 kCal (2) + 337.2 kCal
(3) –41.8 kCal (4) –579.5 kCal

CTD118

118. The heat of combustion of a substance is :-
(1) Always positive
(2) Always negative
(3) Numerically equal to the heat of formation
(4) 1 and 3 both

CTD119

119. The value of ΔH for the combustion of C(s) is –94.4 kCal. The heat of formation of $CO_2(g)$ is :-
(1) –49.5 kCal
(2) –94.4 kCal
(3) –188.0 kCal
(4) More data required

CTD120

120. In the combustion of 0.4 g. of CH_4, 0.25 kCal. of heat is liberated. The heat of combustion of CH_4 is
(1) – 20 kCal (2) – 10 kCal
(3) – 2.5 kCal (4) – 5 kCal

CTD121

121. If $C_6H_{12}O_6(s) + 9O_2(g) \rightarrow 6CO_2(g) + 6H_2O(g)$; ΔH = – 680 kCal The weight of $CO_2(g)$ produced when 170 kCal of heat is evolved in the combustion of glucose is:-
(1) 265 g (2) 66 g (3) 11 g (4) 64 g

CTD122

122. Which of the following equations corresponds to the enthalpy of combustion at 298 K :-
(1) $C_2H_6(g) + 7/2\ O_2(g) \rightarrow 2CO_2(g) + 3H_2O(g)$
(2) $2C_2H_6(g) + 7\ O_2(g) \rightarrow 4CO_2(g) + 6H_2O(g)$
(3) $C_2H_6(g) + 7/2\ O_2(g) \rightarrow 2CO_2(g) + 3H_2O(\ell)$
(4) $2C_2H_6(g) + 7O_2(g) \rightarrow 4CO_2(g) + 6H_2O(\ell)$

CTD123

123. Heat of formation of CO_2 is – 94.0 kCal. What would be the quantity of heat liberated, when 3 g of graphite is burnt in excess of oxygen:-
(1) 23.5 kCal (2) 2.35 kCal
(3) 94.0 kCal (4) 31.3 kCal

CTD124

HEAT OF NEUTRALIZATION

124. The amount of heat liberated when one mole of NH_4OH reacts with one mole of HCl is
(1) 13.7 kCal
(2) More than 13.7 kCal
(3) Less than 13.7 kCal
(4) Cannot be predicted

CTD125

125. If $H^+ + OH^- = H_2O$ + 13.7 kCal, then heat of complete neutralisation of one gram mole of H_2SO_4 with strong base will be :
(1) –13.7 kcal (2) –27.4 kcal
(3) –6.85 kcal (4) –3.425 kCal

CTD126

126. Heat of neutralisation of a strong dibasic acid in dilute solution by NaOH is nearly :
(1) – 27.4 kCal eq^{-1} (2) – 13.7 kCal eq^{-1}
(3) 13.7 kCal eq^{-1} (4) – 13.7 kCal mol^{-1}

CTD127

127. The temperature of a 5 ml of strong acid increases by 5^{0}C when 5 ml of a strong base is added to it. If 10 ml of each are mixed temperature should increase by :
(1) 5^0 C (2) 10^{0}C
(3) 15^{0}C (4) Cannot be known

CTD128

128. The heat of neutralization of HCl by NaOH is –55.9 kJ mol^{-1}. If the heat of neutralization of HCN by NaOH is – 12.1 kJ mol^{-1}. The energy of dissociation of HCN is
(1) –43.8 kJ (2) 43.8 kJ
(3) 68 kJ (4) – 68 kJ

CTD129

129. If water is formed from H^+ ions and OH^- the heat exchange during the reaction :
(1) – 13.7 kCal (2) 13.7 kCal
(3) –63.4 kCal (4) More data required

CTD130

130. The change in the enthalpy of
$NaOH + HCl \longrightarrow NaCl + H_2O$ is called :
(1) Heat of neutralisation
(2) Heat of reaction
(3) Heat of hydration
(4) Heat of solution

CTD131

HEAT OF HYDROGENATION

131. The heat of combustion of C_2H_4, C_2H_6 and H_2 are –1409.5 kJ, –1558.3 kJ and –285.6 kJ. The heat of hydrogenation of ethene is -
(1) –136.8 kJ (2) –13.68 kJ
(3) 273.6 kJ (4) 1.368 kJ

CTD132

132. The enthalpy of combustion of cyclohexane, cyclohexene and H_2 are respectively –3920, –3800 and –241 kJ mol^{-1}. The heat of hydrogenation of cyclohexene is:-
(1) –121 kJ mol^{-1} (2) 121 kJ mol^{-1}
(3) –242 kJ mol^{-1} (4) 242 kJ mol^{-1}

CTD133

BOND ENERGY/RESONANCE ENERGY

133. Bond energy of a molecule :
(1) Is always negative
(2) Is always positive
(3) Either positive or negative
(4) Depends upon the physical state of the system

CTD134

134. Among the following for which reaction heat of reaction represents bond energy of HCl
(1) $HCl(g) \longrightarrow H^+(g) + Cl^-(g)$
(2) $HCl(g) \longrightarrow \frac{1}{2} H_2(g) + \frac{1}{2} Cl_2(g)$
(3) $2HCl(g) \longrightarrow H_2(g) + Cl_2(g)$
(4) $HCl(g) \longrightarrow H(g) + Cl(g)$

CTD135

135. The bond energies of F_2, Cl_2, Br_2 and I_2 are 155.4, 243.6, 193.2 and 151.2 kJ mol^{-1} respectively. The strongest bond is :
(1) F – F (2) Cl – Cl
(3) Br – Br (4) I – I

CTD136

136. Energy required to dissociate 4g of gaseous hydrogen into free gaseous atoms is 208 kCal at 25^0C. The bond energy of H—H bond will be :
(1) 1.04 kCal (2) 10.4 kCal
(3) 104 kCal (4) 1040 kCal

CTD137

137. Heat evolved in the reaction
$H_2 + Cl_2 \longrightarrow 2HCl$ is 182 kJ. Bond energies of H–H and Cl–Cl are 430 and 242 kJ mol^{-1} respectively. The H–Cl bond energy is :
(1) 245 kJ mol^{-1} (2) 427 kJ mol^{-1}
(3) 336 kJ mol^{-1} (4) 154 kJ mol^{-1}

CTD138

138. The enthalpy change for the reaction
$H_2(g) + C_2H_4(g) \rightarrow C_2H_6(g)$ is ..... The bond energies are in kCal mol^{-1}
H – H = 103, C – H = 99, C – C = 80 & C = C =145
(1) –10 kCal mol^{-1} (2) +10 kCal mol^{-1}
(3) – 30 kCal mol^{-1} (4) +30 kCal mol^{-1}

CTD139

139. Bond dissociation enthalpies of $H_2(g)$ and $N_2(g)$ are 436.0 kJ mol^{-1} and 941.8 kJ mol^{-1} respectively and enthalpy of formation of $NH_3(g)$ is –46 kJ mol^{-1}. What is enthalpy of atomization of $NH_3(g)$?
(1) 390.3 kJ mol^{-1} (2) 1170.9 kJ mol^{-1}
(3) 590 kJ mol^{-1} (4) 720 kJ mol^{-1}

CTD140

140. From the reactions :
$C(s) + 2H_2(g) \rightarrow CH_4(g)$ $\Delta H = -X$ kcal
$C(g) + 4H(g) \rightarrow CH_4(g)$, $\Delta H = -X_1$ kcal
$CH_4(g) \rightarrow CH_3(g) + H(g)$ $\Delta H = +Y$ kcal
Bond energy of C–H bond is –
(1) $\frac{X}{4}$ kCal mol^{-1} (2) Y kCal mol^{-1}
(3) $\frac{X_1}{4}$ kCal mol^{-1} (4) X_1 kCal mol^{-1}

CTD141

141. The enthalpy changes at 298 K in successive breaking of O–H bonds of water are

$H_2O \longrightarrow H(g) + OH(g)$; $\Delta H = 498$ kJ mol^{-1}

$OH(g) \longrightarrow H(g) + O(g)$; $\Delta H = 428$ kJmol^{-1}

the bond enthalpy of O–H bond is

(1) 498 kJ mol^{-1}

(2) 428 kJ mol^{-1}

(3) 70 kJ mol^{-1}

(4) 463 kJ mol^{-1}

CTD142

142. If ΔH_f° 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}

CTD143

143. Heat of dissociation of benzene to elements is 5535 kJ mol^{-1}. The bond enthalpies of C–C, C=C and C–H are 347.3, 615.0 and 416.2 kJ respectively. Magnitude of resonance energy of benzene is

(1) 1.51 kJ (2) 15.1 kJ

(3) 151 kJ (4) 1511 kJ

CTD144

SOME OTHER HEAT OF REACTIONS

144. The enthalpy change for the reaction

$2C(\text{graphite}) + 3H_2(g) \longrightarrow C_2H_6(g)$ is called

(1) Enthalpy of formation

(2) Enthalpy of combustion

(3) Enthalpy of hydrogenation

(4) Enthalpy of vaporisation

CTD145

145. $Cl_2(g) \longrightarrow 2Cl(g)$, In this process value of ΔH will be -

(1) Positive

(2) Negative

(3) Zero

(4) Nothing can be predicted

CTD146

146. The magnitude of heat of solution ..... on addition of solvent to solution

(1) Decreases

(2) Increases

(3) Remains constant

(4) Increases or decreases

CTD147

147. If $H_2(g) \longrightarrow 2H(g)$; $\Delta H = 104$ kCal, than heat of atomisation of hydrogen is :

(1) 52 kCal (2) 104 kCal

(3) 208 kCal (4) None of these

CTD148

148. $S_{(\text{rhombic})} + O_{2(g)} \longrightarrow SO_{2(g)}$; $\Delta H = -297.5$ kJ

$S_{(\text{monoclinic})} + O_{2\,(g)} \longrightarrow SO_2$; $\Delta H = -300$ kJ

The data can predict that –

(1) Rhombic sulphur is yellow in colour

(2) Monoclinic sulphur has metallic lusture.

(3) Monoclinic sulphur is more stable

(4) ΔH transition of S_R to S_M is endothermic

CTD149

149. The heat of combustion of yellow phosphorous and red phosphorous are – 9.91 kJ and –8.78 kJ respectively. The heat of transition of yellow phosphorous to red phosphorous is

(1) –18.69 kJ (2) +1.13 kJ

(3) +18.69 kJ (4) –1.13 kJ

CTD150

150. $2CO_{(g)} + O_{2(g)} \longrightarrow 2CO_{2(g)} + X$ kJ

In the above equation X kJ refers to :

(1) Heat of formation of CO_2

(2) Heat of vapourisation

(3) Heat of reaction

(4) Heat of sublimation

CTD151

151. ΔH for the reaction, $I_{(g)} + I_{(g)} \rightarrow I_2(g)$ will be:-

(1) Zero (2) – ve (3) + ve (4) ∞

CTD152

152. Given that :

$A(s) \xrightarrow{T K} A(\ell)$; $\Delta H = x$,

$A(\ell) \xrightarrow{T K} A(g)$; $\Delta H = y$

Calculate enthalpy of sublimation at 'T'K :-

(1) x + y (2) x – y

(3) x or y (4) –(x + y)

CTD153

HESS LAW

153. The enthalpy change of a reaction does not depend on
(1) State of reactants and products
(2) Nature of reactants and products
(3) Different intermediate reactions
(4) Initial and final enthalpy change of reaction

CTD154

154. From the thermochemical reactions,
$C(graphite) + \frac{1}{2} O_2 \longrightarrow CO$; $\Delta H = -110.5$ kJ
$CO + \frac{1}{2} O_2 \longrightarrow CO_2$; $\Delta H = -283.2$ kJ
the heat of reaction of
$C(graphite) + O_2 \longrightarrow CO_2$ is :
(1) 393.7 kJ (2) – 393.7 kJ
(3) – 172.7 kJ (4) + 172.7 kJ

CTD155

155. If $H_2 + \frac{1}{2} O_2 \longrightarrow H_2O$; $\Delta H = -68.39$ kCal
$K + H_2O + water \longrightarrow KOH(aq) + \frac{1}{2} H_2$; $\Delta H = -48.0$ kCal
$KOH + water \longrightarrow KOH(aq)$ $\Delta H = -14.0$ kCal
the heat of formation of KOH is -
(1) – 68.39 + 48 – 14.0
(2) – 68.39 – 48.0 +14.0
(3) +68.39 – 48.0 + 14.0
(4) + 68.39 + 48.0 – 14.0

CTD156

156. Given $C(s) + O_2(g) \longrightarrow CO_2(g) + 94.2$ kCal
$H_2(g) + \frac{1}{2} O_2(g) \longrightarrow H_2O(\ell) + 68.3$ 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

CTD157

157. If, $H_2(g) + Cl_2(g) \longrightarrow 2HCl(g)$;
$\Delta H^0 = -44$ kCal
$2Na(s) + 2HCl(g) \longrightarrow 2NaCl(s) + H_2(g)$;
$\Delta H^0 = -152$ 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

CTD158

158. (i) $S(s) + 3/2\ O_2(g) \rightarrow SO_3(g) + 2x$ kCal
(ii) $SO_2(g) + \frac{1}{2} O_2(g) \rightarrow SO_3(g) + y$ kCal
Calculate the heat of formation of SO_2 :
(1) (2x + y) (2) –(2x – y)
(3) x + y (4) 2x / y

CTD159

159. If $S + O_2 \longrightarrow SO_2$; $\Delta H = -298.2$ kJ
$SO_2 + \frac{1}{2} O_2 \longrightarrow SO_3$; $\Delta H = -98.7$ kJ
$SO_3 + H_2O \longrightarrow H_2SO_4$; $\Delta H = -130.2$ kJ
$H_2 + \frac{1}{2} O_2 \longrightarrow H_2O$; $\Delta H = -287.3$ 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

CTD160

160. Given that :
$Zn + \frac{1}{2} O_2 \rightarrow ZnO + 84000$ Cal
$Hg + \frac{1}{2} O_2 \rightarrow HgO + 21700$ Cal
The heat of reaction (ΔH) for,
$Zn + HgO \rightarrow ZnO + Hg$ is :-
(1) 105700 Cal (2) 62300 Cal
(3) –105700 Cal (4) – 62300 Cal

CTD161

161. Given that -
$2C(s) + 2O_2(g) \rightarrow 2CO_2(g)$ $\Delta H = -787$ kJ
$H_2(g) + \frac{1}{2} O_2(g) \rightarrow H_2O(\ell)$ $\Delta H = -286$ kJ
$C_2H_2(g) + \frac{5}{2} O_2(g) \rightarrow 2CO_2(g) + H_2O(\ell)$
$\Delta H = -1310$ kJ Heat of formation of acetylene is :-
(1) + 1802 kJ (2) – 1802 kJ
(3) – 800 kJ (4) + 237 kJ

CTD162

162. The heat of reaction for

$A + \frac{1}{2}O_2 \rightarrow AO$ is –50 kCal 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 kCal (2) + 50 kCal

(3) 100 kCal (4) 150 kCal

CTD163

163. $C(s) + O_2(g) \rightarrow CO_2(g) + 94.0$ kCal

$CO(g) + \frac{1}{2}O_2(g) \rightarrow CO_2(g)$, $\Delta H = -67.7$ kCal

from the above reactions find how much heat (kCal mole^{-1}) would be produced in the following reaction : $C(s) + \frac{1}{2}O_2(g) \rightarrow CO(g)$

(1) 20.6 (2) 26.3

(3) 44.2 (4) 161.6

CTD164

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

$H_2(g) + \frac{1}{2}O_2(g) \rightarrow H_2O(\ell)$; $\Delta H = -285.77$ kJ mol^{-1}

$H_2(g) + \frac{1}{2}O_2(g) \rightarrow H_2O(g)$; $\Delta H = -241.84$ kJ mol^{-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}

CTD165

165. $H_2(g) + \frac{1}{2}O_2(g) \rightarrow H_2O(\ell)$;

$\Delta H_{298K} = -68.32$kCal. Heat of vapourisation of water at 1 atm and 25^{0}C is 10.52 kCal. The standard heat of formation (in kCal) of 1 mole of water vapour at 25^{0}C is

(1) 10.52 (2) –78.84 (3) +57.80 (4) –57.80

CTD166

166. 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

CTD167

167. Which of the following expressions is true:-

(1) $H_f^0(CO,g) = \frac{1}{2}\Delta H_f^0(CO_2,g)$

(2) $\Delta H_f^0(CO,g)$

$= \Delta H_f^0(C,\text{graphite}) + \frac{1}{2}\Delta H_f^0(O_2,g)$

(3) $\Delta H_f^0(CO,g) = \Delta H_f^0(CO_2,g) - \frac{1}{2}\Delta H_f^0(O_2,g)$

(4) $\Delta H_f^0(CO,g)$

$= \Delta H_{comb}^0(C,\text{graphite}) - \Delta H_{comb}^0(CO,g)$

CTD168

EXERCISE-I (Conceptual Questions) ANSWER KEY

Question	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Answer	2	3	4	4	3	3	1	4	1	1	1	4	2	1	4
Question	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Answer	4	4	1	1	3	1	3	2	2	4	2	2	4	2	1
Question	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
Answer	1	1	2	3	4	2	2	2	3	1	1	1	2	3	4
Question	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
Answer	3	4	3	1	1	2	3	3	1	3	2	2	1	4	2
Question	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
Answer	4	3	2	2	1	4	3	2	3	3	4	1	2	2	2
Question	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90
Answer	4	1	4	1	4	1	1	2	3	1	3	4	1	2	4
Question	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105
Answer	2	4	2	1	2	4	4	2	2	4	4	1	2	2	3
Question	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120
Answer	2	3	4	4	4	1	3	2	1	3	1	3	2	2	2
Question	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135
Answer	2	3	1	3	2	2	1	2	1	1	1	1	2	4	2
Question	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150
Answer	3	2	3	2	3	4	3	3	1	1	3	2	4	4	3
Question	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165
Answer	2	1	3	2	2	3	3	2	1	4	4	2	2	1	4
Question	166	167													
Answer	1	4													

Exercise - II (Previous Year Questions) AIPMT/NEET

AIPMT 2014

1. For the reaction : $X_2O_4(\ell) \longrightarrow 2XO_2(g)$

$\Delta U = 2.1$ kCal, $\Delta S = 20$ cal K^{-1} at 300 K

Hence ΔG is :-

(1) 2.7 kCal (2) – 2.7 kCal

(3) 9.3 kCal (4) – 9.3 kCal

CTD182

AIPMT 2015

2. Which of the following statements is **correct** for a reversible process in a state of equilibrium ?

(1) $\Delta G = 2.30\ RT \log K$

(2) $\Delta G^\circ = -2.30\ RT \log K$

(3) $\Delta G^\circ = 2.30\ RT \log K$

(4) $\Delta G = -2.30\ RT \log K$

CTD183

Re-AIPMT 2015

3. The heat of combustion of carbon to CO_2 is -393.5 kJ mol^{-1}. The heat exchange in the formation of 35.2 g of CO_2 from carbon and oxygen gas is:

(1) –630 kJ (2) –3.15 kJ

(3) –315 kJ (4) +315 kJ

CTD184

NEET-I 2016

4. The correct thermodynamic conditions for the spontaneous reaction at all temperatures is

(1) $\Delta H > 0$ and $\Delta S > 0$

(2) $\Delta H > 0$ and $\Delta S < 0$

(3) $\Delta H < 0$ and $\Delta S > 0$

(4) $\Delta H < 0$ and $\Delta S < 0$

CTD185

NEET-II 2016

5. For a sample of perfect gas when its pressure is changed isothermally from p_i to p_f, the entropy change is given by

(1) $\Delta S = nRT \ln \left(\frac{p_f}{p_i}\right)$ (2) $\Delta S = RT \ln \left(\frac{p_i}{p_f}\right)$

(3) $\Delta S = nR \ln \left(\frac{p_f}{p_i}\right)$ (4) $\Delta S = nR \ln \left(\frac{p_i}{p_f}\right)$

CTD186

NEET(UG) 2017

6. For a given reaction, $\Delta H = 35.5$ kJ mol^{-1} and $\Delta S = 83.6$ $JK^{-1}mol^{-1}$. The reaction is spontaneous at : (Assume that ΔH and ΔS do not vary with temperature)

(1) T > 425 K (2) All temperatures

(3) T > 298 K (4) T < 425 K

CTD187

7. A gas is allowed to expand in a well insulated container against a constant external pressure of 2.5 atm from an initial volume of 2.50 L to a final volume of 4.50 L. The change in internal energy ΔU of the gas in joules will be:-

(1) –500 J (2) –505 J

(3) +505 J (4) 1136.25 J

CTD188

NEET (UG) 2018

8. The bond dissociation energies of X_2, Y_2 and XY are in the ratio of 1 : 0.5 : 1. ΔH for the formation of XY is –200 kJ mol^{-1}. The bond dissociation energy of X_2 will be

(1) 200 kJ mol^{-1}

(2) 100 kJ mol^{-1}

(3) 800 kJ mol^{-1}

(4) 400 kJ mol^{-1}

CTD189

NEET(UG) 2019

9. Under isothermal condition, a gas at 300 K expands from 0.1L to 0.25L against a constant external pressure of 2 bar. The work done by the gas is :- [Given that 1L bar = 100 J]

(1) –30 J (2) 5kJ

(3) 25 J (4) 30 J

CTD190

NEET(UG) 2019 (Odisha)

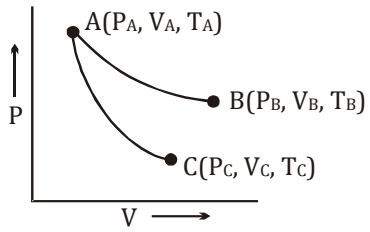
10. An ideal gas expands isothermally from 10^{-3} m^3 to 10^{-2} m^3 at 300 K against a constant pressure of 10^5 Nm^{-2}. The work, in the process is :-

(1) +270 kJ (2) –900 J

(3) +900 kJ (4) –900 kJ

CTD191

11. Reversible expansion of an ideal gas under isothermal and adiabatic conditions are as shown in the figure.



AB → Isothermal expansion
AC → Adiabatic expansion
Which of the following options is **not** correct ?
(1) $\Delta S_{isothermal} > \Delta S_{adiabatic}$
(2) $T_A = T_B$
(3) $W_{isothermal} > W_{adiabatic}$
(4) $T_c > T_A$

CTD192

NEET (UG) 2020

12. The correct option for free expansion of an ideal gas under adiabatic condition is :
(1) $q > 0, \Delta T > 0$ and $w > 0$
(2) $q = 0, \Delta T = 0$ and $w = 0$
(3) $q = 0, \Delta T < 0$ and $w > 0$
(4) $q < 0, \Delta T = 0$ and $w = 0$

CTD193

13. Hydrolysis of sucrose is given by the following reaction.
Sucrose + $H_2O \rightleftharpoons$ Glucose + Fructose
If the equilibrium constant (K_c) is 2×10^{13} at 300K, the value of $\Delta_r G^1$ at the same temperature will be:
(1) $-8.314\ J\ mol^{-1}\ K^{-1} \times 300\ K \times \ln(4 \times 10^{13})$
(2) $-8.314\ J\ mol^{-1}\ K^{-1} \times 300\ K \times \ln(2 \times 10^{13})$
(3) $8.314\ J\ mol^{-1}\ K^{-1} \times 300\ K \times \ln(2 \times 10^{13})$
(4) $8.314\ J\ mol^{-1}\ K^{-1} \times 300\ K \times \ln(3 \times 10^{13})$

CTD194

14. For the reaction $2Cl(g) \rightarrow Cl_2(g)$, the **correct** option is:
(1) $\Delta_r H < 0$ and $\Delta_r S < 0$
(2) $\Delta_r H > 0$ and $\Delta_r S > 0$
(3) $\Delta_r H > 0$ and $\Delta_r S < 0$
(4) $\Delta_r H < 0$ and $\Delta_r S > 0$

CTD195

NEET (UG) 2020 (Covid-19)

15. If for a certain reaction $\Delta_r H$ is 30 kJ mol^{-1} at 450 K, the value of $\Delta_r S$ (in $JK^{-1}\ mol^{-1}$) for which the same reaction will be spontaneous at the same temperature is
(1) 70 (2) –33 (3) 33 (4) –70

CTD196

16. At standard conditions, if the change in the enthalpy for the following reaction is –109 kJ mol^{-1} $H_{2(g)} + Br_{2(g)} \rightarrow 2HBr_{(g)}$
Given that bond energy of H_2 and Br_2 is 435 kJ mol^{-1} and 192 kJ mol^{-1}, respectively, what is the bond energy (in kJ mol^{-1}) of HBr?
(1) 368 (2) 736 (3) 518 (4) 259

CTD197

NEET (UG) 2021

17. Which one among the following is the correct option for right relationship between C_P and C_V for one mole of ideal gas ?
(1) $C_P + C_V = R$ (2) $C_P - C_V = R$
(3) $C_P = RC_V$ (4) $C_V = RC_P$

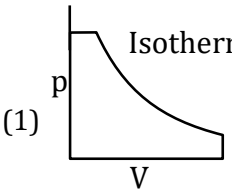
CTD198

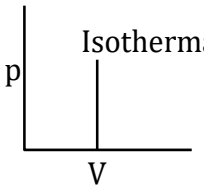
18. For irreversible expansion of an ideal gas under isothermal condition, the correct option is :
(1) $\Delta U = 0, \Delta S_{total} = 0$ (2) $\Delta U \neq 0, \Delta S_{total} \neq 0$
(3) $\Delta U = 0, \Delta S_{total} \neq 0$ (4) $\Delta U \neq 0, \Delta S_{total} = 0$

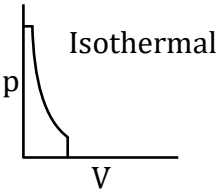
CTD199

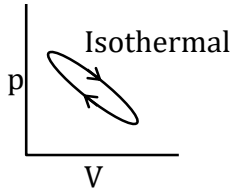
NEET (UG) 2022

19. Which of the following p-V curve represents maximum work done ?

(1) 

(2) 

(3) 

(4) 

CTD200

20. One mole of an ideal gas at 300 K is expanded isothermally from 1 L to 10 L volume. ΔU for this process is (Use R = 8.314 J K^{-1} mol^{-1})
(1) 1260 J (2) 2520 J
(3) 5040 J (4) 0 J

CTD201

NEET (UG) 2023

21. The equilibrium concentrations of the species in the reaction A + B $\rightleftharpoons$ C + D are 2, 3, 10 and 6 mol L^{-1}, respectively at 300 K. ΔG^0 for the reaction is
(R = 2 cal/mol K)
(1) –137.26 cal (2) –1381.80 cal
(3) –13.73 cal (4) 1372.60 cal

CTD224

22. Which amongst the following options is the **correct** relation between change in enthalpy and change in internal energy?
(1) $\Delta H = \Delta U + \Delta n_g RT$ (2) $\Delta H - \Delta U = -\Delta nRT$
(3) $\Delta H + \Delta U = \Delta nR$ (4) $\Delta H = \Delta U - \Delta n_g RT$

CTD225

NEET (UG) 2024

23. Match List I with List II.

List-I (Process)	List-II (Conditions)
A. Isothermal process	I. No heat exchange
B. Isochoric process	II. Carried out at constant temperature
C. Isobaric process	III. Carried out at constant volume
D. Adiabatic process	IV. Carried out at constant pressure

Choose the correct answer from the options given below :
(1) A-IV, B-III, C-II, D-I (2) A-IV, B-II, C-III, D-I
(3) A-I, B-II, C-III, D-IV (4) A-II, B-III, C-IV, D-I

CTD268

24. In which of the following processes entropy increases ?
A. A liquid evaporates to vapour
B. Temperature of a crystalline solid lowered from 130 K to 0K.
C. $2NaHCO_{3(s)} \rightarrow Na_2CO_{3(s)} + CO_{2(g)} + H_2O_{(g)}$
D. $Cl_{2(g)} \rightarrow 2\,Cl_{(g)}$
Choose the correct answer from the options given below :
(1) A and C (2) A, B and D
(3) A, C and D (4) C and D

CTD269

25. The work done during reversible isothermal expansion of one mole of hydrogen gas at 25°C from pressure of 20 atmosphere to 10 atmosphere is :
(Given R = 2.0 cal K^{-1} mol^{-1})
(1) 0 calorie (2) –413.14 calories
(3) 413.14 calories (4) 100 calories

CTD270

NEET (UG) 2024 (Re-examination)

26. Choose the correct statement for the work done in the expansion and heat absorbed or released when 5 litres of an ideal gas at 10 atmospheric pressure isothermally expands into vacuum until volume is 15 litres :
(1) Both the heat and work done will be greater than zero
(2) Heat absorbed will be less than zero and work done will be positive.
(3) Work done will be zero and heat will also be zero
(4) Work done will be greater than zero and heat will remain zero.

CTD271

27. For an endothermic reaction :
A. q_p is negative. B. $\Delta_r H$ is positive.
C. $\Delta_r H$ is negative. D. q_p is positive.
Choose the **correct** answer from the options given below :
(1) B and D (2) C and D
(3) A and B (4) A and C

CTD272

28. For the following reaction at 300 K
$A_2(g) + 3B_2(g) \rightarrow 2AB_3(g)$
the enthalpy change is + 15 kJ,
then the internal energy change is :
(1) 19988.4 J (2) 200 J
(3) 1999 J (4) 1.9988 kJ

CTD273

EXERCISE-II (Previous Year Questions) ANSWER KEY

Question	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Answer	2	2	3	3	4	1	2	3	4	2	4	2	2	1	1
Question	16	17	18	19	20	21	22	23	24	25	26	27	28		
Answer	1	2	3	1	4	2	1	4	3	2	3	1	1		

Exercise – III (Analytical Questions) Master Your Understanding

1. Given below are two statements :
Statement I : A process is said to be reversible, if a change is brought out in such a way that the process could, at any moment, be reversed by an infinitesimal change.
Statement II : A reversible process proceeds by a series of equilibrium states such that system and surroundings are near equilibrium with each other.
In the light of the above statements, choose the most appropriate answer from the options given below :
(1) Both statement I and statement II are incorrect.
(2) Statement I is correct but statement II is incorrect
(3) Statement I is incorrect but statement II is correct.
(4) Both statement I and statement II are correct.
CTD202

2. **Statement I :** Combustion of all organic compounds is an exothermic reaction.
Statement II : The enthalpy of formation of all elements in their stable and standard states is zero.
(1) Both statement I and statement II are incorrect.
(2) Statement I is correct but statement II is incorrect
(3) Statement I is incorrect but statement II is correct.
(4) Both statement I and statement II are correct.
CTD203

3. Given below are two statements:
Statement I : $C_{p,m} - C_{v,m} = R$ is applicable for all gases.
Statement II : $C_{p,m} - C_{v,m} = R$ is applicable for ideal gas only.
In the light of the above statements, choose the most appropriate answer from the options given below :
(1) Both statement I and statement II are incorrect.
(2) Statement I is correct but statement II is incorrect.
(3) Statement I is incorrect but statement II is correct.
(4) Both statement I and statement II are correct.
CTD204

4. Which of the following is correct -
(1) ΔU is calculated at constant volume and pressure
(2) ΔH is calculated at constant volume only
(3) ΔS is calculated at constant volume only
(4) ΔG calculated at constant temperature and pressure is used to decide spontaneity.
CTD206

5. Which of the following is not correct –
(1) $(\Delta G)_{T,P}$ is zero at equilibrium
(2) $(\Delta G)_{T,P} > 0$ for a spontaneous reaction
(3) $(\Delta G)_{T,P} < 0$ for a spontaneous reaction
(4) $(\Delta G)_{T,P} > 0$ for a nonspontaneous reaction
CTD207

6. Match List – I with List- II.

List – I		List - II	
(a)	Entropy of vapourisation	(i)	ΔS = negative
(b)	ΔU in reversible adiabatic expansion of an ideal gas	(ii)	Decreases
(c)	Crystalline solid state	(iii)	Lowest entropy
(d)	A liquid freezes	(iv)	$\frac{\Delta H_{vap}}{T_b}$

(1) (a) – (iv), (b) – (ii), (c) – (iii), (d) – (i)
(2) (a) – (iii), (b) – (ii), (c) – (iv), (d) – (i)
(3) (a) – (iv), (b) – (i), (c) – (iii), (d) – (ii)
(4) (a) – (iv), (b) – (iii), (c) – (ii), (d) – (i)
CTD208

7. Predict in which of the following entropy increases.
(a) A liquid crystallizes into a solid
(b) Temperature of a crystalline solid is raised from 0 K to 115 K
(c) $2NaHCO_3(s) \rightarrow Na_2CO_3(s) + CO_2(g) + H_2O(g)$
(d) $H_2(g) \rightarrow 2H(g)$
The correct one is –
(1) a, b (2) b, c, d
(3) a, b, c (4) a, b, c and d
CTD209

8. In a given process for an ideal gas w = 0 and q < 0 for gas.
The correct one is :
(1) Temperature will decrease.
(2) Volume will increase.
(3) Pressure remains constant
(4) Temperature will increase

CTD210

9. Given below are two statements: one is labelled as **Assertion (A)** and the other is labelled as **Reason (R)**.
Assertion (A): ΔH_f° for $H_2(g)$, and $Cl_2(g)$ is zero.
Reason (R): ΔH_f° for every element in its stable and standard state is zero.
In the light of the above statements, choose the most appropriate answer from the options given below:
(1) Both **(A)** and **(R)** are correct but **(R)** is not the correct explanation of **(A).**
(2) **(A)** is correct but **(R)** is not correct.
(3) **(A)** is not correct but **(R)** is correct.
(4) Both **(A)** and **(R)** are correct and **(R)** is the correct explanation of **(A).**

CTD211

10. Given below are two statements:
Statement I : All natural processes are spontaneous.
Statement II : All natural processes are irreversible.
(1) Both statement I and statement II are incorrect.
(2) Statement I is correct but statement II is incorrect
(3) Statement I is incorrect but statement II is correct.
(4) Both statement I and statement II are correct.

CTD212

11. Which of the following pairs for a chemical reaction is certain to result in a spontaneous reaction.
(1) Exothermic and decreasing disorderness.
(2) Exothermic and increasing disorderness.
(3) Endothermic and increasing disorderness.
(4) Endothermic and decreasing disorderness.

CTD214

12. Given below are two statements:
Statement I : In an isolated system there is no exchange of energy but exchange of matter is possible between system and the surroundings.
Statement II : The presence of reactants in a thermous flask is an example of an isolated system.
In the light of the above statements, choose the **most appropriate** answer from the options given below :
(1) Both statement I and statement II are incorrect.
(2) Statement I is correct but statement II is incorrect
(3) Statement I is incorrect but statement II is correct.
(4) Both statement I and statement II are correct.

CTD215

13. Given below are two statements:
Statement I : Natural processes are irreversible and spontaneous in nature.
Statement II : Decrease in enthalpy is a contributory factor for spontaneity.
In the light of the above statements, choose the **most appropriate** answer from the options given below :
(1) Both statement I and statement II are incorrect.
(2) Statement I is correct but statement II is incorrect
(3) Statement I is incorrect but statement II is correct.
(4) Both statement I and statement II are correct.

CTD216

14. Given below are two statements:

Statement I : If both ΔH° and ΔS° are positive then reaction will be spontaneous at high temperature.

Statement II : All process with positive entropy change are spontaneous.

In the light of the above statements, choose the most appropriate answer from the options given below :

(1) Both statement I and statement II are incorrect.

(2) Statement I is correct but statement II is incorrect

(3) Statement I is incorrect but statement II is correct.

(4) Both statements I and statements II are correct.

CTD218

15. Match List – I with List – II.

List – I		List - II	
(a)	$p_{ext.} = 0$	(i)	Adiabatic change
(b)	$q = p_{ext.}(v_f - v_i)$	(ii)	free expansion of an ideal gas
(c)	$q = 2.303\ nRT \log\left(\frac{v_f}{v_i}\right)$	(iii)	isothermal irreversible change
(d)	$\Delta U = W$	(iv)	isothermal reversible change

Choose the correct answer from the options given below:

(1) (a) – (ii), (b) – (iv), (c) – (iii), (d) – (i)

(2) (a) – (ii), (b) – (iii), (c) – (iv), (d) – (i)

(3) (a) – (iii), (b) – (iv), (c) – (i), (d) – (ii)

(4) (a) – (i), (b) – (ii), (c) – (iii), (d) – (iv)

CTD220

16. Match List – I with List – II.

List – I		List - II	
(a)	$H_2O(s) \xrightarrow[1atm]{0^\circ C} H_2O(l)$	(i)	ΔG = –ve, ΔS = +ve
(b)	$H_2O(s) \xrightarrow[1atm]{10^\circ C} H_2O(l)$	(ii)	ΔG = +ve, ΔS = +ve
(c)	$H_2O(s) \xrightarrow[1atm]{-10^\circ C} H_2O(l)$	(iii)	ΔG = 0, ΔS = +ve
(d)	On addition of HCl in Ag^+ solution	(iv)	ΔG = –ve, ΔS = –ve

Choose the correct answer from the options given below:

(1) (a) – (i), (b) – (ii), (c) – (iii), (d) – (iv)

(2) (a) – (ii), (b) – (i), (c) – (iv), (d) – (iii)

(3) (a) – (iii), (b) – (i), (c) – (ii), (d) – (iv)

(4) (a) – (i), (b) – (iii), (c) – (ii), (d) – (iv)

CTD221

EXERCISE-III (Analytical Questions) ANSWER KEY

Question	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Answer	4	4	3	4	2	1	2	1	4	4	2	3	4	2	2
Question	16														
Answer	3														