

PHYSICAL CHEMISTRY

ENTHUSIAST | LEADER | ACHIEVER



EXERCISE

Chemical Thermodynamics & Energetics

ENGLISH MEDIUM

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

TH0001

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

TH0002

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

TH0003

4. Which of the following is an extensive property

- (1) Mass
- (2) Enthalpy
- (3) Energy
- (4) All of these

TH0004

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) $q = +W$

TH0005

6. In which of the following process work is independent of path :

- (1) Isothermal
- (2) Isochoric
- (3) Adiabatic
- (4) Isobaric

TH0006

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

TH0007

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

TH0008

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

TH0009

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) $W = - \int P dV$
- (2) $W = 0$
- (3) $W = - P\Delta V$
- (4) None

TH0010

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

TH0011

12. Temperature and volume are not :-

- (1) Extensive properties
- (2) Intensive properties
- (3) Intensive and extensive properties respectively
- (4) Extensive and intensive properties respectively

TH0012

13. $q = -w$ is not true for :-

- (1) Isothermal process
- (2) Adiabatic process
- (3) Cyclic process
- (4) 1 and 3 both

TH0013

14. The temperature of an ideal gas increase in an -

- (1) Adiabatic compression
- (2) Adiabatic expansion
- (3) Isothermal expansion
- (4) Isothermal compression

TH0014

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

TH0016

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

16. Both q & w are _____ function :-

- (1) State (2) State, Path
(3) Path, State (4) Path

TH0017

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

TH0018

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

TH0019

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

TH0020

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

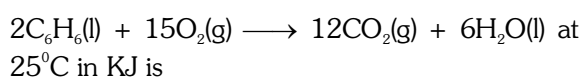
TH0022

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

TH0023

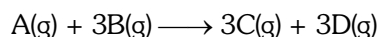
22. The difference between heats of reaction at constant pressure and constant volume for the reaction



- (1) + 7.43 (2) +3.72
(3) - 7.43 (4) - 3.72

TH0024

23. For a gaseous reaction,



ΔE is 17 kCal at $27^\circ C$ assuming $R = 2 \text{ Cal K}^{-1} \text{ mol}^{-1}$, 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

TH0025

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

TH0026

25. For the reaction $Ag_2O(s) \longrightarrow 2Ag(s) + \frac{1}{2}O_2(g)$, which one of the following is true :

- (1) $\Delta H = \Delta E$ (2) $\Delta H = \frac{1}{2}\Delta E$
(3) $\Delta H < \Delta E$ (4) $\Delta H > \Delta E$

TH0027

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

TH0028

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) $\Delta H < \Delta E$

TH0029

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

TH0030

29. For $CaCO_3(s) \rightarrow CaO(s) + CO_2(g)$ at $977^\circ C$, $\Delta H = 174 \text{ KJ/mol}$; then ΔE is :-

- (1) 160 kJ (2) 163.6 kJ
(3) 186.4 kJ (4) 180 kJ

TH0031

30. Heat of reaction for , $CO(g) + \frac{1}{2}O_2(g) \rightarrow CO_2(g)$ at constant V is -67.71 K cal at $17^\circ C$. The heat of reaction at constant P at $17^\circ C$ is :-

- (1) -68.0 kCal (2) + 68.0 kCal
(3) - 67.42 kCal (4) None

TH0032

- 31.** The enthalpy of vaporisation of water at 100°C 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

TH0034

- 32.** For the system $S(s) + O_2(g) \rightarrow SO_2(g)$:-

- (1) ΔH = ΔE (2) ΔH > ΔE
(3) ΔE > ΔH (4) ΔH = 0

TH0035

- 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) ΔH = ΔE
(2) ΔH < ΔE
(3) ΔH > ΔE
(4) ΔH is Independent of physical state of reactants

TH0036

- 34.** Which is true for the combustion of sucrose (C₁₂H₂₂O₁₁) at 25°C :-

- (1) ΔH > ΔE (2) ΔH < ΔE
(3) ΔH = ΔE (4) None

TH0037

- 35.** For which change ΔH ≠ ΔE :-

- (1) $H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$
(2) $HCl(l) + NaOH(l) \rightarrow NaCl(s) + H_2O(l)$
(3) $C(s) + O_2(g) \rightarrow CO_2(g)$
(4) $N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$

TH0038

- 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

TH0039

- 37.** The difference in ΔH and ΔE for the combustion of methane at 25°C would be :-

- (1) Zero (2) $2 \times 298 \times -2$ Cal
(3) $2 \times 298 \times -3$ Cal (4) $2 \times 25 \times -3$ Cal

TH0040

- 38.** For which of the following reactions ΔH is less than ΔE :-

- (1) $C_6H_{12}O_6(s) + 6O_2(g) \rightarrow 6CO_2(g) + 6H_2O(l)$
(2) $2SO_2(g) + O_2(g) \rightarrow 2SO_3(g)$
(3) $N_2O_4(g) \rightarrow 2NO_2(g)$
(4) $N_2(g) + O_2(g) \rightarrow 2NO(g)$

TH0041

- 39.** For a reaction $2X(s) + 2Y(s) \rightarrow 2C(l) + D(g)$

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

TH0042

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°C 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) $-2.303 \times 2 \times 298 \log 2$

TH0043

- 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

TH0045

- 42.** One mole of a gas occupying 3dm³ expands against a constant external pressure of 1 atm to a volume of 13 L. Find work is :-

- (1) - 10 atm dm³ (2) - 20 atm dm³
(3) - 39 atm dm³ (4) - 48 atm dm³

TH0046

ENTROPY/SECOND LAW OF THERMODYNAMICS

- 43.** For which reaction from the following, ΔS will be maximum ?

- (1) $Ca(s) + \frac{1}{2}O_2(g) \rightarrow CaO(s)$
(2) $CaCO_3(s) \rightarrow CaO(s) + CO_2(g)$
(3) $C(s) + O_2(g) \rightarrow CO_2(g)$
(4) $N_2(g) + O_2(g) \rightarrow 2NO(g)$

TD0047

- 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

TD0048

- 45.** Entropy means
(1) Disorderness (2) Randomness
(3) Ordermess (4) both 1 & 2
TD0049
- 46.** ΔS for the reaction;
 $\text{MgCO}_3(\text{s}) \longrightarrow \text{MgO}(\text{s}) + \text{CO}_2(\text{g})$ will be :
(1) 0 (2) -ve (3) +ve (4) ∞
TD0050
- 47.** Change in entropy is negative for
(1) $\text{Br}_2(\ell) \longrightarrow \text{Br}_2(\text{g})$
(2) $\text{C}(\text{s}) + \text{H}_2\text{O}(\text{g}) \longrightarrow \text{CO}(\text{g}) + \text{H}_2(\text{g})$
(3) $\text{N}_2(\text{g}, 10 \text{ atm}) \longrightarrow \text{N}_2(\text{g}, 1 \text{ atm})$
(4) $\text{Fe}(\text{at } 400 \text{ K}) \longrightarrow \text{Fe}(\text{at } 300 \text{ K})$
TD0051
- 48.** In which reaction ΔS is positive :-
(1) $\text{H}_2\text{O}(\ell) \rightarrow \text{H}_2\text{O}(\text{s})$
(2) $3\text{O}_2(\text{g}) \rightarrow 2\text{O}_3(\text{g})$
(3) $\text{H}_2\text{O}(\ell) \rightarrow \text{H}_2\text{O}(\text{g})$
(4) $\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \rightarrow 2\text{NH}_3(\text{g})$
TD0052
- 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
TD0053
- 50.** If S° for H_2 , Cl_2 and HCl are 0.13, 0.22 and 0.19 $\text{kJ K}^{-1} \text{mol}^{-1}$ respectively. The total change in standard entropy for the reaction
 $\text{H}_2 + \text{Cl}_2 \longrightarrow 2\text{HCl}$ is :
(1) 30 $\text{JK}^{-1} \text{mol}^{-1}$ (2) 40 $\text{JK}^{-1} \text{mol}^{-1}$
(3) 60 $\text{JK}^{-1} \text{mol}^{-1}$ (4) 20 $\text{JK}^{-1} \text{mol}^{-1}$
TD0054
- 51.** Which has the least entropy :
(1) Graphite (2) Diamond
(3) $\text{N}_2(\text{g})$ (4) $\text{N}_2\text{O}(\text{g})$
TD0055
- 52.** When two gases are mixed the entropy :-
(1) Remains constant (2) Decreases
(3) Increases (4) Becomes zero
TD0056
- 53.** The enthalpy of vaporisation of per mole of ethanol (B.pt. = 79.5°C and $\Delta S = 109.8 \text{ JK}^{-1} \text{mol}^{-1}$) 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}
TD0058
- 54.** If 900J/g of heat is exchanged at boiling point of water, then what is increase in entropy?
(1) 43.4 $\text{JK}^{-1} \text{mole}^{-1}$ (2) 87.2 $\text{JK}^{-1} \text{mole}^{-1}$
(3) 900 $\text{JK}^{-1} \text{mole}^{-1}$ (4) Zero
TD0059
- 55.** 5 mole of an ideal gas expand reversibly from a volume of 8 dm^3 to 80 dm^3 at a temperature of 27°C . 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}
TD0060
- 56.** In a spontaneous irreversible process the total entropy of the system and surroundings
(1) Remains constant (2) Increases
(3) Decreases (4) Zero
TD0061
- 57.** The total entropy change for a system & its surroundings increases if the process is :
(1) Reversible (2) Spontaneous
(3) Exothermic (4) Endothermic
TD0062
- 58.** Calculate the entropy of $\text{Br}_2(\text{g})$ in the reaction
 $\text{H}_2(\text{g}) + \text{Br}_2(\text{g}) \rightarrow 2\text{HBr}(\text{g})$, $\Delta S^\circ = 20.1 \text{ JK}^{-1}$ given, entropy of H_2 and HBr is 130.6 and 198.5 $\text{J mol}^{-1} \text{K}^{-1}$:-
(1) 246.3 JK^{-1} (2) 123.15 JK^{-1}
(3) 24.63 JK^{-1} (4) 20 kJK^{-1}
TD0063
- 59.** In which of the following case entropy decreases-
(1) Solid changing to liquid
(2) Expansion of a gas
(3) Crystals dissolve
(4) Polymerisation
TD0065
- 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
TD0066
- 61.** Entropy of an adiabatic reversible process is:-
(1) Positive (2) Zero
(3) Negative (4) Constant
TD0067

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

TD0068

- 63.** For a reaction at 25°C enthalpy change (ΔH) and entropy change (ΔS) are $-11.7 \times 10^3 \text{ J mol}^{-1}$ and $-105 \text{ J mol}^{-1} \text{ K}^{-1}$ respectively. The reaction is :

(1) Spontaneous (2) Non spontaneous
 (3) At equilibrium (4) Can't say anything

TD0069

- 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

TD0071

- 65.** The temperature at which the reaction $\text{Ag}_2\text{O(s)} \longrightarrow 2\text{Ag(s)} + \frac{1}{2} \text{O}_2\text{(g)}$ is at equilibrium is

Given $\Delta H = 30.5 \text{ kJ mol}^{-1}$
 and $\Delta S = 0.066 \text{ kJ K}^{-1} \text{ mol}^{-1}$:

(1) 462.12 K (2) 362.12 K
 (3) 262.12 K (4) 562.12 K

TD0072

- 66.** Which of the following is true for the reaction $\text{H}_2\text{O(l)} \rightleftharpoons \text{H}_2\text{O(g)}$ at 100°C and 1 atmosphere

(1) $\Delta S = 0$ (2) $\Delta H = 0$
 (3) $\Delta H = \Delta E$ (4) $\Delta H = T\Delta S$

TD0074

- 67.** For the reaction $\text{A(s)} \longrightarrow \text{B(s)} + \text{C(g)}$ the value of $\Delta H = 30.56 \text{ kJ mol}^{-1}$ and $\Delta S = 66 \text{ J K}^{-1} \text{ mol}^{-1}$. 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

TD0075

- 68.** For hypothetical reversible reaction $\frac{1}{2} \text{A}_2\text{(g)} + \frac{3}{2} \text{B}_2\text{(g)} \longrightarrow \text{AB}_3\text{(g)}$; $\Delta H = -20 \text{ kJ}$ if standard entropies of A_2 , B_2 and AB_3 are 60, 40 and $50 \text{ J K}^{-1} \text{ mole}^{-1}$ respectively. The above reaction will be in equilibrium at :-

(1) 400 K (2) 500 K
 (3) 250 K (4) 200 K

TD0076

- 69.** For the precipitation of AgCl by Ag^+ ions and HCl

(1) $\Delta H = 0$ (2) $\Delta G = 0$
 (3) $\Delta G = -ve$ (4) $\Delta H = \Delta G$

TD0077

- 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

TD0078

- 71.** A reaction $\text{A} + \text{B} \longrightarrow \text{C} + \text{D} + q$ 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

TD0080

- 72.** Equilibrium constant of a reaction is related to :

(1) Standard free energy change ΔG°
 (2) Free energy change ΔG
 (3) Entropy change
 (4) None

TD0081

- 73.** The Vant Hoff equation is :

(1) $\Delta G^\circ = RT \log_e K_p$ (2) $-\Delta G^\circ = RT \log_e K_p$
 (3) $\Delta G^\circ = RT^2 \ln K_p$ (4) None

TD0082

- 74.** If $\Delta G^\circ > 0$ for a reaction then :

(1) $K_p > 1$
 (2) $K_p < 1$
 (3) The products predominate in the equilibrium mixture
 (4) None

TD0083

- 75.** If the equilibrium constant for a reaction is 10, then the value of ΔG° will be

($R = 8 \text{ J K}^{-1} \text{ mol}^{-1}$, $T = 300 \text{ K}$)
 (1) $+ 5.527 \text{ kJ mol}^{-1}$ (2) $- 5.527 \text{ kJ mol}^{-1}$
 (3) $+ 55.27 \text{ kJ mol}^{-1}$ (4) $- 55.27 \text{ kJ mol}^{-1}$

TD0084

- 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

TD0085

77. For the process, $\text{CO}_2(\text{s}) \longrightarrow \text{CO}_2(\text{g})$:
- (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

TD0086

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

TD0087

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

TD0088

80. Which of the following reaction is expected never to be spontaneous :-
- (1) $2\text{O}_3(\text{g}) \rightarrow 3\text{O}_2(\text{g})$ $\Delta H = -Ve, \Delta S = +Ve$
 - (2) $\text{Mg}(\text{s}) + \text{H}_2(\text{g}) \rightarrow \text{MgH}_2$ $\Delta H = -Ve, \Delta S = -Ve$
 - (3) $\text{Br}_2(\text{l}) \rightarrow \text{Br}_2(\text{g})$ $\Delta H = +Ve, \Delta S = +Ve$
 - (4) $2\text{Ag}(\text{s}) + 3\text{N}_2(\text{g}) \rightarrow 2\text{AgN}_3$ $\Delta H = +Ve, \Delta S = -Ve$

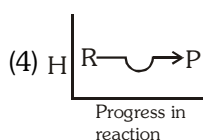
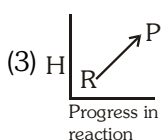
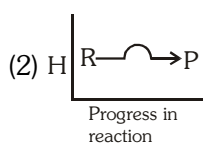
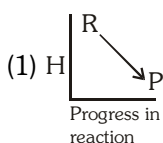
TD0089

THERMOCHEMICAL REACTION

81. The formation of water from $\text{H}_2(\text{g})$ and $\text{O}_2(\text{g})$ is an exothermic process because :
- (1) The chemical energy of $\text{H}_2(\text{g})$ and $\text{O}_2(\text{g})$ is more than that of water
 - (2) The chemical energy of $\text{H}_2(\text{g})$ and $\text{O}_2(\text{g})$ is less than that of water
 - (3) The temperature of $\text{H}_2(\text{g})$ and $\text{O}_2(\text{g})$ is higher than that of water
 - (4) The temperature of $\text{H}_2(\text{g})$ and $\text{O}_2(\text{g})$ is lower than that of water

TC0090

82. Which plot represents for an exothermic reaction:



TC0091

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

TC0092

84. The correct thermochemical equation is :
- (1) $\text{C} + \text{O}_2 \longrightarrow \text{CO}_2$; $\Delta H = -94 \text{ kCal}$
 - (2) $\text{C} + \text{O}_2 \longrightarrow \text{CO}_2$; $\Delta H = +94.0 \text{ kCal}$
 - (3) $\text{C}(\text{s}) + \text{O}_2(\text{g}) \longrightarrow \text{CO}_2(\text{g})$; $\Delta H = -94 \text{ kCal}$
 - (4) $\text{C}(\text{s}) + \text{O}_2(\text{g}) \longrightarrow \text{CO}_2(\text{g})$; $\Delta H = +94 \text{ kCal}$

TC0093

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-}

TC0094

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

TC0095

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) $+21.4 \text{ kCal}$
 - (4) $+64.8 \text{ kCal}$

TC0096

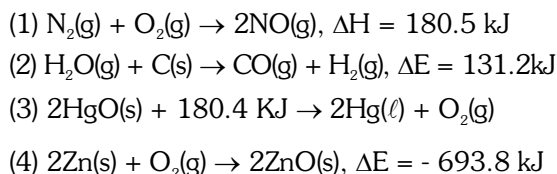
88. Heat of formation, ΔH_f° of an explosive compound like NCl_3 is -
- (1) Positive
 - (2) Negative
 - (3) Zero
 - (4) Positive or negative

TC0097

89. According to the following reaction $\text{C}(\text{s}) + 1/2 \text{O}_2(\text{g}) \rightarrow \text{CO}(\text{g})$, $\Delta H = -26.4 \text{ kCal}$
- (1) CO is an endothermic compound
 - (2) CO is an exothermic compound
 - (3) The reaction is endothermic
 - (4) None of the above

TC0098

90. Which of the following represents an exothermic reaction:-


TC0099

91. Consider the reaction $3\text{O}_2 \rightarrow 2\text{O}_3$; $\Delta H = +Ve$, from the reaction, we can say that :-
 (1) Ozone is more stable than oxygen
 (2) Ozone is less stable than 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

TC0101

92. From the reaction $\text{P(White)} \rightarrow \text{P(Red)}$; $\Delta H = -18.4 \text{ kJ}$, 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

TC0102

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

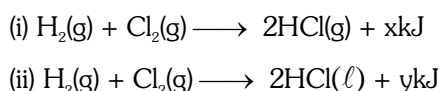
TC0103

94. The enthalpy of a reaction at 273 K is -3.57 kJ . what will be the enthalpy of reaction at 373 K if $\Delta C_p = \text{zero}$:-

- (1) -3.57 kJ (2) Zero
 (3) $-3.57 \times \frac{373}{273} \text{ kJ}$ (4) -375 kJ

TC0105

95. For the reactions,



Which one of the following statement is correct :

- (1) $x > y$ (2) $x < y$
 (3) $x = y$ (4) More data required

TC0106

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

TC0107

97. Reaction $\text{H}_2(\text{g}) + \text{I}_2(\text{s}) \longrightarrow 2\text{HI}$; $\Delta H = 12.40 \text{ kCal}$.

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

TC0108

98. Enthalpy of a compound is equal to its :-
 (When it is formed from reference state of constituent elements)

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

TC0110

99. Which of the following equations represents standard heat of formation of CH_4 ?

- (1) $\text{C}_{(\text{diamond})} + 2\text{H}_2(\text{g}) \longrightarrow \text{CH}_4(\text{g})$
 (2) $\text{C}_{(\text{graphite})} + 2\text{H}_2(\text{g}) \longrightarrow \text{CH}_4(\text{g})$
 (3) $\text{C}_{(\text{diamond})} + 4\text{H}(\text{g}) \longrightarrow \text{CH}_4(\text{g})$
 (4) $\text{C}_{(\text{graphite})} + 4\text{H}(\text{g}) \longrightarrow \text{CH}_4(\text{g})$

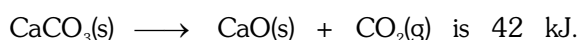
TC0111

100. The enthalpy of formation of ammonia is $-46.0 \text{ kJ mol}^{-1}$. The enthalpy change for the reaction $2\text{NH}_3(\text{g}) \rightarrow \text{N}_2(\text{g}) + 3\text{H}_2(\text{g})$ is :

- (1) 46.0 kJ mol^{-1} (2) 92.0 kJ mol^{-1}
 (3) $-23.0 \text{ kJ mol}^{-1}$ (4) $-92.0 \text{ kJ mol}^{-1}$

TC0112

101. Given enthalpy of formation of $\text{CO}_2(\text{g})$ and $\text{CaO}(\text{s})$ are -94.0 kJ and -152 kJ respectively and the enthalpy of the reaction :



The enthalpy of formation of $\text{CaCO}_3(\text{s})$ is

- (1) -42 KJ (2) -202 KJ
 (3) $+202 \text{ KJ}$ (4) -288 KJ

TC0113

- 102.** Given that standard enthalpy of formation of CH_4 , C_2H_4 and C_3H_8 are -17.9 , 12.5 , $-24.8 \text{ kCal mol}^{-1}$. The ΔH for $\text{CH}_4 + \text{C}_2\text{H}_4 \rightarrow \text{C}_3\text{H}_8$ is :
- (1) -55.2 kCal (2) -30.2 kCal
(3) 55.2 kCal (4) -19.4 kCal

TC0114

- 103.** 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

TC0115

- 104.** The ΔH_f° for $\text{CO}_2(\text{g})$, $\text{CO}(\text{g})$ and $\text{H}_2\text{O}(\text{g})$ are -393.5 , -110.5 and $-241.8 \text{ kJ mol}^{-1}$ respectively the standard enthalpy change (in kJ) for the reaction $\text{CO}_2(\text{g}) + \text{H}_2(\text{g}) \rightarrow \text{CO}(\text{g}) + \text{H}_2\text{O}(\text{g})$ is -
- (1) 524.1 (2) 41.2 (3) -262.5 (4) -41.2

TC0117

- 105.** 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

TC0118

- 106.** The standard heat of formation of $\text{CS}_2(\ell)$ will be; given that the standard heat of combustion of carbon (s), sulphur(s) and $\text{CS}_2(\ell)$ are -393.3 , -293.72 and $-1108.76 \text{ kJ mol}^{-1}$ respectively is
- (1) $-128.02 \text{ kJ mole}^{-1}$ (2) $+12.802 \text{ kJ mol}^{-1}$
(3) $+128.02 \text{ kJ mol}^{-1}$ (4) $-12.802 \text{ kJ mol}^{-1}$

TC0119

- 107.** The heat of combustion of $\text{CH}_4(\text{g})$, $\text{C}(\text{s})$ and $\text{H}_2(\text{g})$ 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) $+54.4 \text{ K Cal}$ (2) -18.4 K Cal
(3) -375.2 K Cal (4) $+212.8 \text{ K Cal}$

TC0120

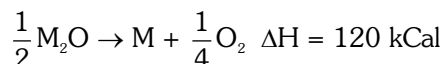
- 108.** Standard enthalpy of formation is zero for .
- (1) $\text{C}_{\text{diamond}}$ (2) $\text{Br}(\text{g})$
(3) $\text{C}_{\text{graphite}}$ (4) $\text{O}_3(\text{g})$

TC0121

- 109.** The standard heats of formation of $\text{NO}_2(\text{g})$ and $\text{N}_2\text{O}_4(\text{g})$ are 8.0 and $2.0 \text{ kCal mol}^{-1}$ respectively the heat of dimerization of NO_2 in kCal is
- (1) 10.0 (2) -6.0 (3) -12.0 (4) -14.0

TC0122

- 110.** M is a metal that forms an oxide M_2O



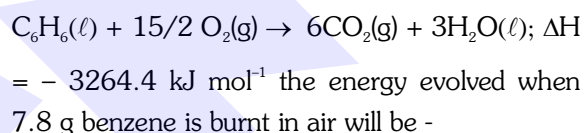
When a sample of metal M reacts with one mole of oxygen what will be the ΔH in that case

- (1) 240 kCal (2) -240 kCal
(3) 480 kCal (4) -480 kCal

TC0123

HEAT OF COMBUSTION

- 111.** According to equation,



- (1) 163.22 kJ (2) 32.64 kJ
(3) 3.264 kJ (4) 326.4 kJ

TC0124

- 112.** 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

TC0125

- 113.** 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

TC0126

- 114.** The enthalpy of formation for $\text{C}_2\text{H}_4(\text{g})$, $\text{CO}_2(\text{g})$ and $\text{H}_2\text{O}(\ell)$ at 25°C and 1 atm . pressure are 52 , -394 and $-286 \text{ kJ mole}^{-1}$ respectively. The enthalpy of combustion of C_2H_4 will be:-

- (1) $+1412 \text{ kJ mole}^{-1}$
(2) $-1412 \text{ kJ mole}^{-1}$
(3) $+142.2 \text{ kJ mole}^{-1}$
(4) $-141.2 \text{ kJ mole}^{-1}$

TC0127

- 115.** The combustion of one mole of benzene takes place at 298 K and 1 atm. After combustion, $\text{CO}_2(\text{g})$ and $\text{H}_2\text{O}(\text{l})$ 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 $\text{CO}_2(\text{g})$ and $\text{H}_2\text{O}(\text{l})$ are $-393.5 \text{ kJ mol}^{-1}$ and $-285.83 \text{ kJ mol}^{-1}$ respectively.
- (1) $48.51 \text{ kJ mol}^{-1}$ (2) $-48.51 \text{ kJ mol}^{-1}$
(3) $-97.02 \text{ kJ mol}^{-1}$ (4) $97.02 \text{ kJ mol}^{-1}$

TC0128

- 116.** 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
- $\text{H}_2(\text{g}) + \frac{1}{2} \text{O}_2(\text{g}) \rightarrow \text{H}_2\text{O}(\text{g}) ; \Delta H = -241.8 \text{ kJ}$
 $\text{CO}(\text{g}) + \frac{1}{2} \text{O}_2(\text{g}) \rightarrow \text{CO}_2(\text{g}) ; \Delta H = -283 \text{ kJ}$
- (1) 241.8 kJ (2) 283 kJ
(3) 1312 kJ (4) 1586 kJ

TC0130

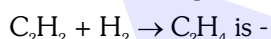
- 117.** A person requires 2870 kCal of energy to lead normal daily life. If heat of combustion of cane sugar is $-1349 \text{ kCal mol}^{-1}$, then his daily consumption of sugar is :
- (1) 728 g (2) 0.728 g
(3) 342 g (4) 0.342 g

TC0131

- 118.** The following are the heats of reactions -

- (i) $\Delta_f H^\circ$ of $\text{H}_2\text{O}(\text{l}) = -68.3 \text{ kCal mol}^{-1}$
 (ii) $\Delta H^\circ_{\text{comb.}}$ of $\text{C}_2\text{H}_2 = -337.2 \text{ kCal mol}^{-1}$
 (iii) $\Delta H^\circ_{\text{comb.}}$ of $\text{C}_2\text{H}_4 = -363.7 \text{ kCal mol}^{-1}$

Then heat change for the reaction



- (1) -716.1 kCal (2) $+ 337.2 \text{ kCal}$
(3) -41.8 kCal (4) -579.5 kCal

TC0134

- 119.** 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

TC0135

- 120.** The value of ΔH for the combustion of $\text{C}(\text{s})$ is -94.4 kCal . The heat of formation of $\text{CO}_2(\text{g})$ is :-
- (1) -49.5 kCal (2) -94.4 kCal
(3) -188.0 kCal (4) More data required

TC0136

- 121.** 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

TC0137

- 122.** If $\text{C}_6\text{H}_{12}\text{O}_6(\text{s}) + 9\text{O}_2(\text{g}) \rightarrow 6\text{CO}_2(\text{g}) + 6\text{H}_2\text{O}(\text{g})$; $\Delta H = -680 \text{ kCal}$ The weight of $\text{CO}_2(\text{g})$ 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

TC0138

- 123.** Which of the following equations corresponds to the enthalpy of combustion at 298 K :-
- (1) $\text{C}_2\text{H}_6(\text{g}) + 7/2 \text{O}_2(\text{g}) \rightarrow 2\text{CO}_2(\text{g}) + 3\text{H}_2\text{O}(\text{g})$
 (2) $2\text{C}_2\text{H}_6(\text{g}) + 7 \text{O}_2(\text{g}) \rightarrow 4\text{CO}_2(\text{g}) + 6\text{H}_2\text{O}(\text{g})$
 (3) $\text{C}_2\text{H}_6(\text{g}) + 7/2 \text{O}_2(\text{g}) \rightarrow 2\text{CO}_2(\text{g}) + 3\text{H}_2\text{O}(\text{l})$
 (4) $2\text{C}_2\text{H}_6(\text{g}) + 7\text{O}_2(\text{g}) \rightarrow 4\text{CO}_2(\text{g}) + 6\text{H}_2\text{O}(\text{l})$

TC0139

- 124.** 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

TC0140

HEAT OF NEUTRALIZATION

- 125.** 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

TC0141

- 126.** If $\text{H}^+ + \text{OH}^- = \text{H}_2\text{O} + 13.7 \text{ kCal}$, 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

TC0142

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

TC0143

- 128.** The temperature of a 5 ml of strong acid increases by 5°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°C (2) 10°C
(3) 15°C (4) Cannot be known

TC0144

- 129.** 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

TC0145

- 130.** 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

TC0146

- 131.** The change in the enthalpy of $\text{NaOH} + \text{HCl} \longrightarrow \text{NaCl} + \text{H}_2\text{O}$ is called :

(1) Heat of neutralisation
(2) Heat of reaction
(3) Heat of hydration
(4) Heat of solution

TC0147

HEAT OF HYDROGENATION

- 132.** 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

TC0149

- 133.** 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}

TC0150

BOND ENERGY/RESONANCE ENERGY

- 134.** 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

TC0151

- 135.** Among the following for which reaction heat of reaction represents bond energy of HCl

(1) $\text{HCl(g)} \longrightarrow \text{H}^{\bullet}(\text{g}) + \text{Cl}^{\bullet}(\text{g})$
(2) $\text{HCl(g)} \longrightarrow \frac{1}{2}\text{H}_2(\text{g}) + \frac{1}{2}\text{Cl}_2(\text{g})$
(3) $2\text{HCl(g)} \longrightarrow \text{H}_2(\text{g}) + \text{Cl}_2(\text{g})$
(4) $\text{HCl(g)} \longrightarrow \text{H(g)} + \text{Cl(g)}$

TC0152

- 136.** 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) $\text{F}-\text{F}$ (2) $\text{Cl}-\text{Cl}$
(3) $\text{Br}-\text{Br}$ (4) $\text{I}-\text{I}$

TC0153

- 137.** Energy required to dissociate 4g of gaseous hydrogen into free gaseous atoms is 208 kCal at 25°C . The bond energy of $\text{H}-\text{H}$ bond will be :

(1) 1.04 kCal (2) 10.4 kCal
(3) 104 kCal (4) 1040 kCal

TC0154

- 138.** Heat evolved in the reaction $\text{H}_2 + \text{Cl}_2 \longrightarrow 2\text{HCl}$ is 182 kJ . Bond energies of $\text{H}-\text{H}$ and $\text{Cl}-\text{Cl}$ are 430 and 242 kJ mol^{-1} respectively. The $\text{H}-\text{Cl}$ bond energy is :

(1) 245 kJ mol^{-1} (2) 427 kJ mol^{-1}
(3) 336 kJ mol^{-1} (4) 154 kJ mol^{-1}

TC0155

- 139.** The enthalpy change for the reaction $\text{H}_2(\text{g}) + \text{C}_2\text{H}_4(\text{g}) \rightarrow \text{C}_2\text{H}_6(\text{g})$ is..... The bond energies are in kCal mol^{-1}

$\text{H}-\text{H} = 103$, $\text{C}-\text{H} = 99$, $\text{C}-\text{C} = 80$ &
 $\text{C}=\text{C} = 145$
(1) -10 kCal mol^{-1}
(2) $+10\text{ kCal mol}^{-1}$
(3) -30 kCal mol^{-1}
(4) $+30\text{ kCal mol}^{-1}$

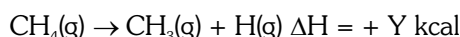
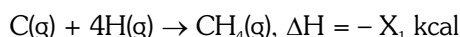
TC0156

- 140.** Bond dissociation enthalpies of $\text{H}_2(\text{g})$ and $\text{N}_2(\text{g})$ are $436.0 \text{ kJ mol}^{-1}$ and $941.8 \text{ kJ mol}^{-1}$ respectively and enthalpy of formation of $\text{NH}_3(\text{g})$ is -46 kJ mol^{-1} . What is enthalpy of atomization of $\text{NH}_3(\text{g})$?

- (1) $390.3 \text{ kJ mol}^{-1}$ (2) $1170.9 \text{ kJ mol}^{-1}$
(3) 590 kJ mol^{-1} (4) 720 kJ mol^{-1}

TC0157

- 141.** From the reactions :

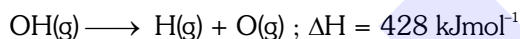
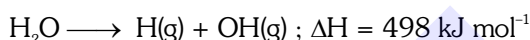


Bond energy of C-H bond is -

- (1) $\frac{X}{4} \text{ kCal mol}^{-1}$ (2) $Y \text{ kCal mol}^{-1}$
(3) $\frac{X_1}{4} \text{ kCal mol}^{-1}$ (4) $X_1 \text{ kCal mol}^{-1}$

TC0158

- 142.** The enthalpy changes at 298 K in successive breaking of O-H bonds of water are



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}

TC0159

- 143.** If ΔH_f° of ICl(g) , Cl(g) , and I(g) is 17.57 , 121.34 and $106.96 \text{ J mol}^{-1}$ respectively. Then bond dissociation energy of ICl bond is -

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

TC0160

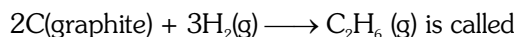
- 144.** Heat of dissociation of benzene to elements is 5535 kJ mol^{-1} . The bond enthalpies of C-C, C=C and C-H are 347.3 , 615.0 and 416.2 kJ respectively. Magnitude of resonance energy of benzene is

- (1) 1.51 kJ (2) 15.1 kJ
(3) 151 kJ (4) 1511 kJ

TC0161

SOME OTHER HEAT OF REACTIONS

- 145.** The enthalpy change for the reaction



- (1) Enthalpy of formation
(2) Enthalpy of combustion
(3) Enthalpy of hydrogenation
(4) Enthalpy of vaporisation

TC0162

- 146.** $\text{Cl}_2(\text{g}) \longrightarrow 2\text{Cl(g)}$, In this process value of ΔH will be -

- (1) Positive
(2) Negative
(3) Zero
(4) Nothing can be predicted

TC0163

- 147.** The magnitude of heat of solution on addition of solvent to solution

- (1) Decreases
(2) Increases
(3) Remains constant
(4) Increases or decreases

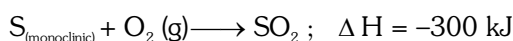
TC0164

- 148.** If $\text{H}_2(\text{g}) \longrightarrow 2\text{H(g)} ; \Delta H = 104 \text{ kCal}$, than heat of atomisation of hydrogen is :

- (1) 52 kCal (2) 104 kCal
(3) 208 kCal (4) None of these

TC0165

- 149.** $\text{S}_{(\text{rhombic})} + \text{O}_2(\text{g}) \longrightarrow \text{SO}_2(\text{g}) ; \Delta H = -297.5 \text{ kJ}$



The data can predict that -

- (1) Rhombic sulphur is yellow in colour
(2) Monoclinic sulphur has metallic lustre.
(3) Monoclinic sulphur is more stable
(4) ΔH transition of S_r to S_m is endothermic

TC0166

150. 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

TC0167

151. $2\text{CO(g)} + \text{O}_2\text{(g)} \longrightarrow 2\text{CO}_2\text{(g)} + X$ 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

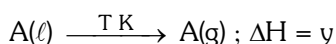
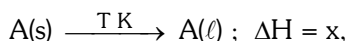
TC0169

152. ΔH for the reaction, $\text{I(g)} + \text{I(g)} \rightarrow \text{I}_2\text{(g)}$ will be:-

- (1) Zero (2) -ve (3) +ve (4) ∞

TC0171

153. Given that :



Calculate enthalpy of sublimation at 'T'K :-

- (1) $x + y$ (2) $x - y$
(3) x or y (4) $-(x + y)$

TC0172

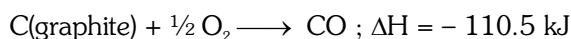
HESS LAW

154. 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

TC0173

155. From the thermochemical reactions,

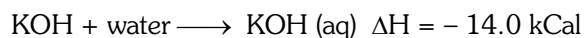
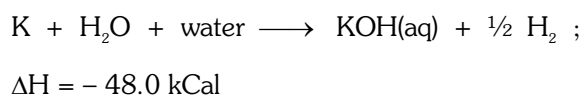


the heat of reaction of $\text{C(graphite)} + \text{O}_2 \longrightarrow \text{CO}_2$ is :

- (1) 393.7 kJ (2) -393.7 kJ
(3) -172.7 kJ (4) $+172.7$ kJ

TC0174

156. If $\text{H}_2 + \frac{1}{2} \text{O}_2 \longrightarrow \text{H}_2\text{O} ; \Delta H = -68.39$ kCal

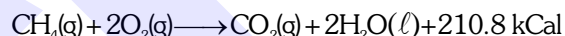
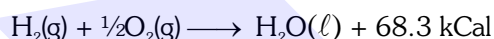


the heat of formation of KOH is -

- (1) $-68.39 + 48 - 14.0$
(2) $-68.39 - 48.0 + 14.0$
(3) $+68.39 - 48.0 + 14.0$
(4) $+68.39 + 48.0 - 14.0$

TC0175

157. Given $\text{C(s)} + \text{O}_2\text{(g)} \longrightarrow \text{CO}_2\text{(g)} + 94.2$ kCal

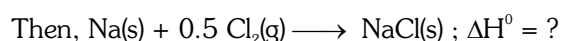
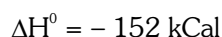
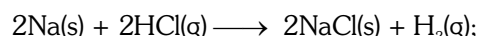


The heat of formation of methane in Kcal will be

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

TC0176

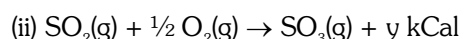
158. If, $\text{H}_2\text{(g)} + \text{Cl}_2\text{(g)} \longrightarrow 2\text{HCl(g)} ; \Delta H^\circ = -44$ kCal



- (1) 108 kCal (2) 196 kCal
(3) -98 kCal (4) 54 kCal

TC0178

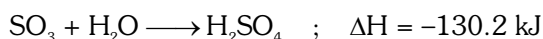
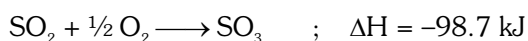
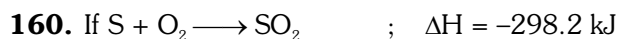
159. (i) $\text{S(s)} + \frac{3}{2} \text{O}_2\text{(g)} \rightarrow \text{SO}_3\text{(g)} + 2x$ kCal



Calculate the heat of formation of SO_2 :

- (1) $(2x + y)$ (2) $-(2x - y)$
(3) $x + y$ (4) $2x / y$

TC0179



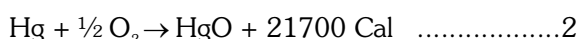
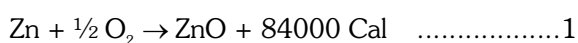
Then the enthalpy of formation of H_2SO_4 at 298 K is -

(1) -814.4 kJ (2) -650.3 kJ

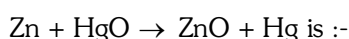
(3) -320.5 kJ (4) -433.5 kJ

TC0180

161. Given that :



The heat of reaction (ΔH) for,

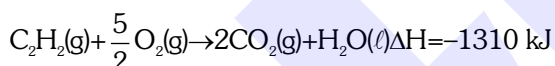


(1) 105700 Cal (2) 62300 Cal

(3) -105700 Cal (4) - 62300 Cal

TC0181

162. Given that -



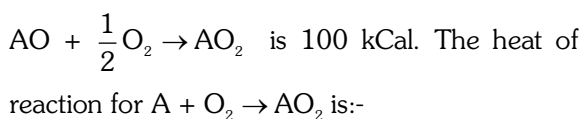
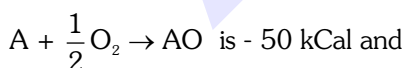
Heat of formation of acetylene is :-

(1) + 1802 kJ (2) - 1802 kJ

(3) - 800 kJ (4) + 237 kJ

TC0182

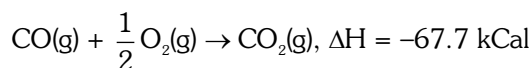
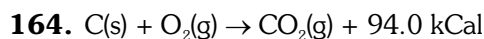
163. The heat of reaction for



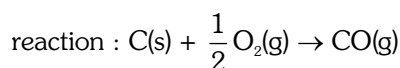
(1) - 50 kCal (2) + 50 kCal

(3) 100 kCal (4) 150 kCal

TC0184



from the above reactions find how much heat (kCal mole⁻¹) would be produced in the following



(1) 20.6

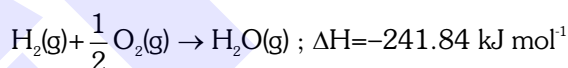
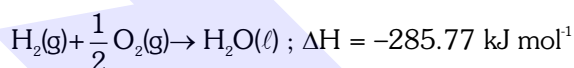
(2) 26.3

(3) 44.2

(4) 161.6

TC0185

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



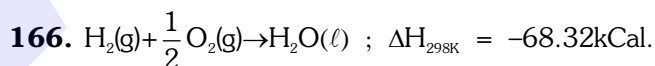
(1) + 43.93 kJ mol⁻¹

(2) - 43.93 kJ mol⁻¹

(3) + 527.61 kJ mol⁻¹

(4) - 527.61 kJ mol⁻¹

TC0187



Heat of vapourisation of water at 1 atm and 25°C is 10.52 kCal. The standard heat of formation (in kCal) of 1 mole of water vapour at 25°C is

(1) 10.52

(2) -78.84

(3) +57.80

(4) -57.80

TC0188

167. The heat of solution of anhydrous $CuSO_4$ and $CuSO_4 \cdot 5H_2O$ 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

TC0189

168. Which of the following expressions is true:-

$$(1) H_f^0(\text{CO}, g) = \frac{1}{2} \Delta H_f^0(\text{CO}_2, g)$$

$$(2) \Delta H_f^0(\text{CO}, g) = \Delta H_f^0(\text{C, graphite}) + \frac{1}{2} \Delta H_f^0(\text{O}_2, g)$$

$$(3) \Delta H_f^0(\text{CO}, g) = \Delta H_f^0(\text{CO}_2, g) - \frac{1}{2} \Delta H_f^0(\text{O}_2, g)$$

$$(4) \Delta H_f^0(\text{CO}, g) = \Delta H_{\text{comb}}^0(\text{C, graphite}) - \Delta H_{\text{comb}}^0(\text{CO}, g)$$

TC0191

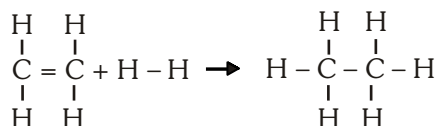
EXERCISE-I (Conceptual Questions)

ANSWER KEY

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	2	3	4	4	3	3	1	4	1	1	1	4	2	1	4
Que.	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Ans.	4	4	1	1	3	1	3	2	2	4	2	2	4	2	1
Que.	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
Ans.	1	1	2	3	4	2	2	2	3	1	1	1	2	3	4
Que.	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
Ans.	3	4	3	1	1	2	3	3	1	3	2	2	1	4	2
Que.	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
Ans.	4	3	2	2	1	4	3	2	3	3	4	1	2	2	2
Que.	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90
Ans.	4	1	4	1	4	1	1	2	3	1	3	4	1	2	4
Que.	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105
Ans.	2	4	2	1	2	4	4	2	2	2	4	4	1	2	2
Que.	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120
Ans.	3	2	3	4	4	4	1	3	2	1	3	1	3	2	2
Que.	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135
Ans.	2	2	3	1	3	2	2	1	2	1	1	1	1	2	4
Que.	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150
Ans.	2	3	2	3	2	3	4	3	3	1	1	3	2	4	4
Que.	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165
Ans.	3	2	1	3	2	2	3	3	2	1	4	4	2	2	1
Que.	166	167	168												
Ans.	4	1	4												

EXERCISE-II (Previous Year Questions)
AIPMT 2009

1. From the following bond energies :-
 H – H bond energy : $431.37 \text{ kJ mol}^{-1}$
 C = C bond energy : $606.10 \text{ kJ mol}^{-1}$
 C – C bond energy : $336.49 \text{ kJ mol}^{-1}$
 C – H bond energy : $410.50 \text{ kJ mol}^{-1}$
 Enthalpy for the reaction,



will be :-

- (1) $553.0 \text{ kJ mol}^{-1}$ (2) $1523.6 \text{ kJ mol}^{-1}$
 (3) $-243.6 \text{ kJ mol}^{-1}$ (4) $-120.0 \text{ kJ mol}^{-1}$

TC0205

2. The values of ΔH and ΔS for the reaction,
 $\text{C}_{(\text{graphite})} + \text{CO}_2(\text{g}) \rightarrow 2\text{CO}(\text{g})$ are 170 kJ and
 170 JK^{-1} , respectively. This reaction will be
 spontaneous at :-
 (1) 510 K (2) 710 K
 (3) 910 K (4) 1110 K

TD0206
AIPMT 2010

3. For vaporization of water at 1 atmospheric
 pressure, the values of ΔH and ΔS are $40.63 \text{ kJ mol}^{-1}$
 and $108.8 \text{ JK}^{-1}\text{mol}^{-1}$, respectively. The
 temperature when Gibbs energy change (ΔG) for
 this transformation will be zero, is :-
 (1) 393.4 K (2) 373.4 K
 (3) 293.4 K (4) 273.4 K

TD0207

4. Three moles of an ideal gas expanded spontaneously
 into vacuum. The work done will be :-
 (1) 3 Joule (2) 9 Joule
 (3) Zero (4) Infinite

TH0208

5. The following two reactions are known :
 $\text{Fe}_2\text{O}_3(\text{s}) + 3\text{CO}(\text{g}) \rightarrow 2\text{Fe}(\text{s}) + 3\text{CO}_2(\text{g})$;
 $\Delta H = -26.8 \text{ kJ}$
 $\text{FeO}(\text{s}) + \text{CO}(\text{g}) \rightarrow \text{Fe}(\text{s}) + \text{CO}_2(\text{g})$;
 $\Delta H = -16.5 \text{ kJ}$
 Correct target equation is
 $\text{Fe}_2\text{O}_3(\text{s}) + \text{CO}(\text{g}) \rightarrow 2\text{FeO}(\text{s}) + \text{CO}_2(\text{g})$, $\Delta H = ?$
 (1) -43.3 kJ (2) -10.3 kJ
 (3) $+6.2 \text{ kJ}$ (4) $+10.3 \text{ kJ}$

TC0209
AIPMT/NEET

6. Standard entropies of X_2 , Y_2 and XY_3 are 60, 40
 and $50 \text{ JK}^{-1} \text{ mol}^{-1}$ respectively. For the reaction
 $\frac{1}{2}\text{X}_2 + \frac{3}{2}\text{Y}_2 \rightleftharpoons \text{XY}_3$, $\Delta H = -30 \text{ kJ}$ to be at
 equilibrium, the temperature should be :-
 (1) 500 K (2) 750 K
 (3) 1000 K (4) 1250 K

TD0210
AIPMT Pre. 2011

7. If the enthalpy change for the transition of liquid
 water to steam is 30 kJ mol^{-1} at 27°C , the
 entropy changes for the process would be:
 (1) $10 \text{ J mol}^{-1} \text{ K}^{-1}$ (2) $1.0 \text{ J mol}^{-1} \text{ K}^{-1}$
 (3) $0.1 \text{ J mol}^{-1} \text{ K}^{-1}$ (4) $100 \text{ J mol}^{-1} \text{ K}^{-1}$

TD0214

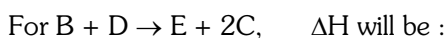
8. Enthalpy change for the reaction,
 $4\text{H}(\text{g}) \rightarrow 2\text{H}_2(\text{g})$ is -869.6 kJ
 The dissociation energy of H–H bond is :
 (1) -434.8 kJ (2) 869.6 kJ
 (3) $+434.8 \text{ kJ}$ (4) $+217.4 \text{ kJ}$

TC0215

9. Which of the following correct option for free
 expansion of an ideal gas under adiabatic
 condition ?
 (1) $q = 0$, $\Delta T \neq 0$, $w = 0$
 (2) $q \neq 0$, $\Delta T = 0$, $w = 0$
 (3) $q = 0$, $\Delta T = 0$, $w = 0$
 (4) $q = 0$, $\Delta T < 0$, $w \neq 0$

TH0216
AIPMT Msins 2011

10. Consider the following processes :-

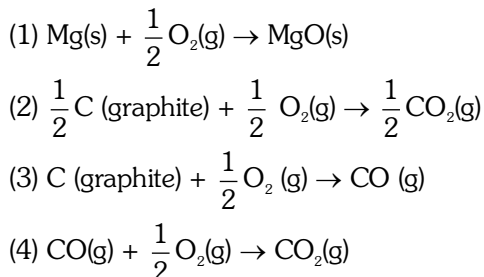
 $\Delta H(\text{kJ mol}^{-1})$


- (1) 325 kJ mol^{-1} (2) 525 kJ mol^{-1}
 (3) -175 kJ mol^{-1} (4) -325 kJ mol^{-1}

TC0217

AIPMT Pre. 2012

11. In which of the following reactions, standard reaction entropy change (ΔS°) is positive and standard Gibbs energy change (ΔG°) decreases sharply with increasing temperature?



TD0222

12. Standard enthalpy of vapourisation $\Delta_{\text{vap}}H^\circ$ for water at 100°C is $40.66 \text{ kJ mol}^{-1}$. The internal energy of vaporisation of water at 100°C (in kJ mol^{-1}) is

(1) +43.76 (2) +40.66 (3) +37.56 (4) -43.76

TH0223

13. The enthalpy of fusion of water is $1.435 \text{ kCal mol}^{-1}$. The molar entropy change for the melting of ice at 0°C is:

(1) $5.260 \text{ Cal mol}^{-1} \text{ K}^{-1}$ (2) $0.526 \text{ Cal mol}^{-1} \text{ K}^{-1}$
 (3) $10.52 \text{ Cal mol}^{-1} \text{ K}^{-1}$ (4) $21.04 \text{ Cal mol}^{-1} \text{ K}^{-1}$

TD0224

AIPMT 2014

14. For the reaction : $\text{X}_2\text{O}_4(\ell) \longrightarrow 2\text{XO}_2(\text{g})$
 $\Delta U = 2.1 \text{ kCal}$, $\Delta S = 20 \text{ cal K}^{-1}$ at 300 K

Hence ΔG is :-

(1) 2.7 kCal (2) -2.7 kCal
 (3) 9.3 kCal (4) -9.3 kCal

TD0228

AIPMT 2015

15. 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) $\Delta G = -2.30 RT \log K$

TD0230

Re-AIPMT 2015

16. The heat of combustion of carbon to CO_2 is $-393.5 \text{ kJ mol}^{-1}$. 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) $+315 \text{ kJ}$

TC0231

NEET-I 2016

17. 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 $\Delta S < 0$

TD0235

NEET-II 2016

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

TD0236

NEET(UG) 2017

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

(1) $T > 425 \text{ K}$ (2) All temperatures
 (3) $T > 298 \text{ K}$ (4) $T < 425 \text{ K}$

TD0242

20. 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) $+505 \text{ J}$ (4) 1136.25 J

TH0243

NEET (UG) 2018

21. 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}

TC0248

NEET(UG) 2019

22. 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

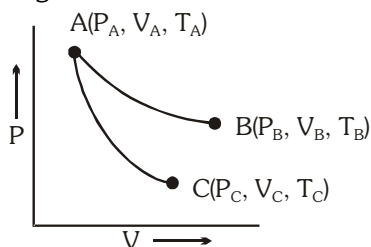
TC0310

NEET(UG) 2019 (Odisha)

23. 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

TC0311

24. 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) $\Delta S_{\text{isothermal}} > \Delta S_{\text{adiabatic}}$ (2) $T_A = T_B$
(3) $W_{\text{isothermal}} > W_{\text{adiabatic}}$ (4) $T_C > T_A$

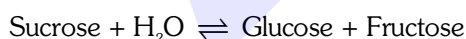
TC0312

NEET (UG) 2020

25. 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 $w = 0$

TD0347

26. Hydrolysis of sucrose is given by the following reaction.



If the equilibrium constant (K_c) is 2×10^{13} at 300K, the value of $\Delta_r G^\ominus$ at the same temperature will be:

- (1) $-8.314 \text{ J mol}^{-1} \text{ K}^{-1} \times 300 \text{ K} \times \ln(4 \times 10^{13})$
(2) $-8.314 \text{ J mol}^{-1} \text{ K}^{-1} \times 300 \text{ K} \times \ln(2 \times 10^{13})$
(3) $8.314 \text{ J mol}^{-1} \text{ K}^{-1} \times 300 \text{ K} \times \ln(2 \times 10^{13})$
(4) $8.314 \text{ J mol}^{-1} \text{ K}^{-1} \times 300 \text{ K} \times \ln(3 \times 10^{13})$

TD0348

27. For the reaction $2\text{Cl(g)} \rightarrow \text{Cl}_2(\text{g})$, 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 $\Delta_r S > 0$

TD0349

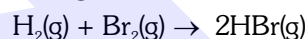
NEET (UG) 2020 (COVID-19)

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

- (1) 70 (2) -33
(3) 33 (4) -70

TD0350

29. At standard conditions, if the change in the enthalpy for the following reaction is -109 kJ mol^{-1}



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

TC0351

NEET (UG) 2021

30. 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) $C_v = RC_p$

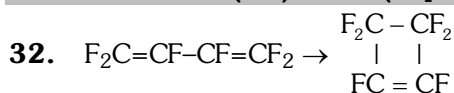
TH0352

31. For irreversible expansion of an ideal gas under isothermal condition, the correct option is :

- (1) $\Delta U = 0$, $\Delta S_{\text{total}} = 0$
(2) $\Delta U \neq 0$, $\Delta S_{\text{total}} \neq 0$
(3) $\Delta U = 0$, $\Delta S_{\text{total}} \neq 0$
(4) $\Delta U \neq 0$, $\Delta S_{\text{total}} = 0$

TC0353

NEET(UG) 2021 (Paper-2)

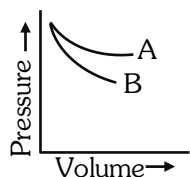


for this reaction (ring closure), $\Delta H = -49 \text{ kJ mol}^{-1}$, $\Delta S = -40.2 \text{ J K}^{-1} \text{ mol}^{-1}$. Upto what temperature is the forward reaction spontaneous?

- (1) 1492°C (2) 1219°C
(3) 946°C (4) 1080°C

TC0354

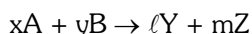
33. P-V plots for two gases during adiabatic processes are given in the given figure.



Plot A and plot B should correspond to
 (1) He and O₂ (2) He and Ar
 (3) O₂ and He (4) O₂ and F₂

TH0355

34. For the homogeneous reactions :



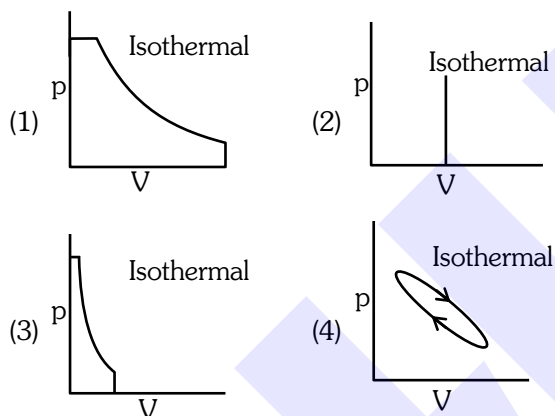
$\Delta H = -30 \text{ kJ mol}^{-1}$, $\Delta S = -100 \text{ J K}^{-1} \text{ mol}^{-1}$. At what temperature the reaction is at equilibrium?

- (1) 50°C (2) 250°C (3) 100 K (4) 27°C

TH0356

NEET (UG) 2022

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



TH0357

NEET (UG) 2022 (OVERSEAS)

36. The work done when 1 mole of a gas expands reversibly and isothermally from pressure of 5 atm to 1 atm at 300 K is

(Given $\log 5 = 0.6989$ and $R = 8.314 \text{ J K}^{-1} \text{ mol}^{-1}$)

- (1) 150 J
 (2) + 4014.6 J
 (3) -4014.6 J
 (4) zero J

TH0358

Re-NEET (UG) 2022

37. 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 $R = 8.314 \text{ J K}^{-1} \text{ mol}^{-1}$)

- (1) 1260 J
 (2) 2520 J
 (3) 5040 J
 (4) 0 J

TH0359

EXERCISE-II (Previous Year Questions)

ANSWER KEY

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	4	4	2	3	3	2	4	3	3	3	3	3	1	2	2
Que.	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Ans.	3	3	4	1	2	3	4	2	4	2	2	1	1	1	2
Que.	31	32	33	34	35	36	37								
Ans.	3	3	3	4	1	3	4								

EXERCISE-III (Analytical Questions)
Master Your Understanding

1. Consider the reaction : $N_2 + 3H_2 \rightarrow 2NH_3$ carried out at constant temperature and pressure. If ΔH and ΔU are the enthalpy and internal energy changes for the reaction, which of the following expressions is true ?

- (1) $\Delta H < \Delta U$ (2) $\Delta H > \Delta U$
(3) $\Delta H = 0$ (4) $\Delta H = \Delta U$

TH0258

2. For a reversible process at $T = 300K$, the volume is increased from $V_i = 1L$ to $V_f = 10L$. Calculate ΔH if the process is isothermal -

- (1) 11.47 kJ (2) 4.98 kJ
(3) 0 (4) -11.47 kJ

TH0259

3. A piston filled with 0.04 mol of an ideal gas expands reversibly from 50.0 mL to 375 mL at a constant temperature of $37.0^\circ C$. As it does so, it absorbs 208 J of heat. The values of q and w for the process will be :-

($R = 8.314 \text{ J mol}^{-1} \text{ K}^{-1}$) ($\ln 7.5 = 2.01$)

- (1) $q = +208 \text{ J}$, $w = -208 \text{ J}$
(2) $q = -208 \text{ J}$, $w = -208 \text{ J}$
(3) $q = -208 \text{ J}$, $w = +208 \text{ J}$
(4) $q = +208 \text{ J}$, $w = +208 \text{ J}$

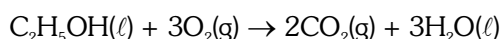
TH0261

4. The entropy change involved in the isothermal reversible expansion of 2 moles of an ideal gas from a volume of 10 dm^3 to a volume of 100 dm^3 at $27^\circ C$ is :-

- (1) $32.3 \text{ J mol}^{-1} \text{ K}^{-1}$ (2) $42.3 \text{ J mol}^{-1} \text{ K}^{-1}$
(3) $38.3 \text{ J mol}^{-1} \text{ K}^{-1}$ (4) $35.8 \text{ J mol}^{-1} \text{ K}^{-1}$

TD0262

5. The value of enthalpy change (ΔH) for the reaction



at $27^\circ C$ is $-1366.5 \text{ kJ mol}^{-1}$. The value of internal energy change for the above reaction at this temperature will be :-

- (1) -1371.5 kJ (2) -1369.0 kJ
(3) -1364.0 kJ (4) -1361.5 kJ

TH0263

6. For the process $H_2O(l)$ (1 bar, $373K$) $\rightarrow H_2O(g)$ (1 bar, $373K$), the correct set of thermodynamic parameters is :

- (1) $\Delta G = 0$, $\Delta S = +ve$
(2) $\Delta G = 0$, $\Delta S = -ve$
(3) $\Delta G = +ve$, $\Delta S = 0$
(4) $\Delta G = -ve$, $\Delta S = +ve$

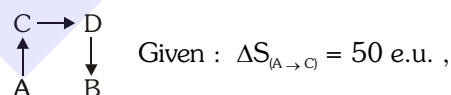
TD0264

7. Which of the following pairs of a chemical reaction is certain to result in a spontaneous reaction.?

- (1) endothermic and decreasing disorder
(2) exothermic and increasing disorder
(3) endothermic and increasing disorder
(4) exothermic and decreasing disorder

TD0265

8. The conversion A to B is carried out by the following path :



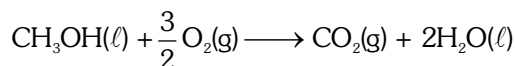
$$\Delta S_{(C \rightarrow D)} = 30 \text{ e.u.}, \Delta S_{(B \rightarrow D)} = 20 \text{ e.u.}$$

where e.u. is entropy unit then $\Delta S_{(A \rightarrow B)}$ is

- (1) + 100 e.u. (2) + 60 e.u.
(3) - 100 e.u. (4) - 60 e.u.

TD0266

9. In a fuel cell methanol is used as fuel and oxygen gas is used as an oxidizer. The reaction is



At 298 K standard Gibb's energies of formation for $CH_3OH(l)$, $H_2O(l)$ and $CO_2(g)$ are -166.2, -237.2 and $-394.4 \text{ kJ mol}^{-1}$ respectively.

If standard enthalpy of combustion of methanol is -726 kJ mol^{-1} , efficiency of the fuel cell will be

- (1) 90% (2) 97% (3) 80% (4) 87%

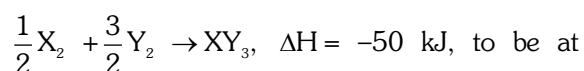
TC0268

10. Identify the correct statement regarding a spontaneous process :-

- (1) For a spontaneous process in an isolate system, the change in total entropy is positive
- (2) Endothermic processes are never spontaneous
- (3) Exothermic processes are always spontaneous
- (4) Lowering of energy in the reaction process is the only criterion for spontaneity

TD0269

11. Standard entropy of X_2 , Y_2 and XY_3 are 60, 40 and $50 \text{ JK}^{-1} \text{ mol}^{-1}$, respectively. For the reaction,



equilibrium, the temperature will be

- (1) 1250 K
- (2) 500 K
- (3) 750 K
- (4) 1000 K

TD0270

12. Consider the reaction :



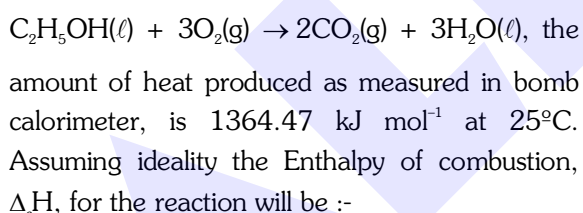
If $\text{N}_2\text{O}_5(\text{s})$ is formed instead of $\text{N}_2\text{O}_5(\text{g})$ in the above reaction, the $\Delta_r H$ value will be :-

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

- (1) -165 kJ
- (2) +54 kJ
- (3) +219 kJ
- (4) -219 kJ

TC0273

13. For complete combustion of ethanol,



($R = 8.314 \text{ kJ mol}^{-1}$)

- (1) -1460.50 kJ mol^{-1}
- (2) -1350.50 kJ mol^{-1}
- (3) -1366.95 kJ mol^{-1}
- (4) -1361.95 kJ mol^{-1}

TH0274

14. If the bond dissociation energies of XY , X_2 and Y_2 (all diatomic molecules) are in the ratio of 1 : 1 : 0.5 and $\Delta_r H$ for the formation of XY is -400 kJ mol^{-1} . The bond dissociation energy of X_2 will be :-

- (1) 200 kJ mol^{-1}
- (2) 100 kJ mol^{-1}
- (3) 1600 kJ mol^{-1}
- (4) 300 kJ mol^{-1}

TC0275

15. The standard enthalpy of formation ($\Delta_f H^\circ$) at 298K for methane, $\text{CH}_4(\text{g})$, is $-74.8 \text{ kJ mol}^{-1}$. The additional information required to determine the average energy for C-H bond formation would be:-

- (1) Latent heat of vapourization of methane
- (2) The first four ionization energies of carbon and electron gain enthalpy of hydrogen
- (3) The dissociation energy of hydrogen molecule H_2
- (4) The dissociation energy of H_2 and enthalpy of sublimation of carbon

TC0276

16. The incorrect expression among the following is :-

$$(1) K = e^{-\Delta G^\circ/RT}$$

$$(2) \frac{\Delta G_{\text{system}}}{\Delta S_{\text{total}}} = -T$$

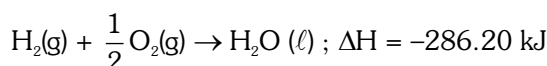
$$(3) \text{ In isothermal process, } W_{\text{reversible}} = -nRT \ln \frac{V_f}{V_i}$$

$$(4) \ln K = \frac{\Delta H^\circ - T\Delta S^\circ}{RT}$$

TD0278

17. On the basis of the following thermochemical

$$\text{data : } [\Delta H_f^\circ (\text{H}_{(\text{aq})}^+) = 0]$$



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

- (1) +228.88 kJ
- (2) -343.52 kJ
- (3) -22.88 kJ
- (4) -228.88 kJ

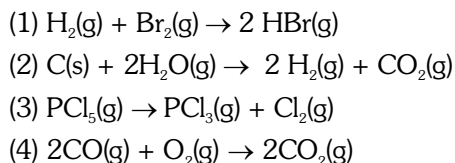
TC0280

18. Identify the correct statement for change of Gibbs energy for a system (ΔG_{system}) at constant temperature and pressure.

- (1) If $\Delta G_{\text{system}} > 0$, the process is spontaneous.
- (2) If $\Delta G_{\text{system}} = 0$, the system has attained equilibrium.
- (3) If $\Delta G_{\text{system}} = 0$, the system is still moving in a particular direction.
- (4) If $\Delta G_{\text{system}} < 0$, the process is not spontaneous.

TD0192

19. Assume each reaction is carried out in an open container. For which reaction will $\Delta H = \Delta E$?



TH0193

20. The enthalpy and entropy change for reaction $\text{Br}_2(\text{l}) + \text{Cl}_2(\text{g}) \rightarrow 2 \text{BrCl}(\text{g})$ are 30 kJ mol^{-1} and $105 \text{ JK}^{-1} \text{ mol}^{-1}$ respectively. The temperature at which the reaction will be in equilibrium is

- (1) 285.7 K (2) 273 K
 (3) 450 K (4) 300 K

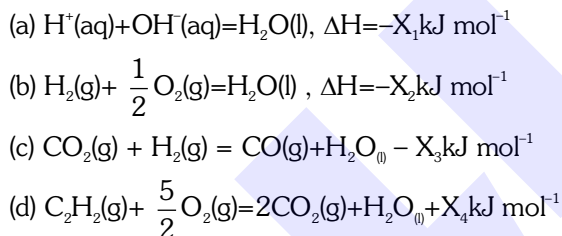
TD0194

21. The enthalpy of hydrogenation of cyclohexene is $-119.5 \text{ kJ mol}^{-1}$. If resonance energy of benzene is $-150.4 \text{ kJ mol}^{-1}$, its enthalpy of hydrogenation would be

- (1) $-508.9 \text{ kJ mol}^{-1}$ (2) $-208.1 \text{ kJ mol}^{-1}$
 (3) $-269.9 \text{ kJ mol}^{-1}$ (4) $-358.5 \text{ kJ mol}^{-1}$

TC0195

22. Consider the following reactions :



Enthalpy of formation of $\text{H}_2\text{O}(\text{g})$ is :

- (1) $+X_1 \text{ kJ mol}^{-1}$ (2) $-X_2 \text{ kJ mol}^{-1}$
 (3) $+X_3 \text{ kJ mol}^{-1}$ (4) $-X_4 \text{ kJ mol}^{-1}$

TC0200

23. Given that bond energies of H-H and Cl-Cl are 430 kJ mol^{-1} and 240 kJ mol^{-1} respectively and $\Delta_f H$ for HCl is -90 kJ mol^{-1} . Bond enthalpy of HCl is :

- (1) 245 kJ mol^{-1} (2) 290 kJ mol^{-1}
 (3) 380 kJ mol^{-1} (4) 425 kJ mol^{-1}

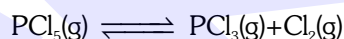
TC0201

24. Bond dissociation enthalpy of H_2 , Cl_2 and HCl are 434, 242 and 431 kJ mol^{-1} respectively. Enthalpy of formation of HCl is:-

- (1) -93 kJ mol^{-1} (2) 245 kJ mol^{-1}
 (3) 93 kJ mol^{-1} (4) -245 kJ mol^{-1}

TC0202

25. For the gas phase reaction,



Which of the following conditions are correct ?

- (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 $\Delta S > 0$

TD0203

26. Which of the following does not depends on path?

- (I) $q + w$ (II) q
 (III) w (IV) H-TS
 (1) (I), (II) and (III) (2) (II) and (III)
 (3) (I) and (IV) (4) (II), (III) and (IV)

TH0204

EXERCISE-III (Analytical Questions)

ANSWER KEY

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	1	3	1	3	3	1	2	2	2	1	1	4	3	3	4
Que.	16	17	18	19	20	21	22	23	24	25	26				
Ans.	4	4	2	1	1	2	2	4	1	4	3				