

CHEMICAL KINETICS

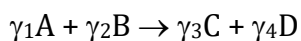
1. NO_2 required for a reaction is produced by the decomposition of N_2O_5 in CCl_4 as per the equation, $2 \text{N}_2\text{O}_5(\text{g}) \rightarrow 4 \text{NO}_2(\text{g}) + \text{O}_2(\text{g})$

The initial concentration of N_2O_5 is 3.00 mol L^{-1} and it is 2.75 mol L^{-1} after 30 minutes. The rate of formation of NO_2 is:

- (A) $1.667 \times 10^{-2} \text{ mol L}^{-1} \text{ min}^{-1}$ (B) $2.083 \times 10^{-3} \text{ mol L}^{-1} \text{ min}^{-1}$
(C) $4.167 \times 10^{-3} \text{ mol L}^{-1} \text{ min}^{-1}$ (D) $8.333 \times 10^{-3} \text{ mol L}^{-1} \text{ min}^{-1}$

[Jee Main, April 2019]

2. For a given chemical reaction



Concentration of C changes from 10 mmol dm^{-3} to 20 mmol dm^{-3} in 10 seconds. Rate of appearance of D is 1.5 times the rate of disappearance of B which is twice the rate of disappearance A. The rate of appearance of D has been experimentally determined to be $9 \text{ mmol dm}^{-3} \text{ s}^{-1}$. Therefore, the rate of reaction is _____ $\text{mmol dm}^{-3} \text{ s}^{-1}$. (Nearest Integer)

[JEE Main, June 2022]

3. For a first order reaction, the time required for completion of 90% reaction is 'x' times the half life of the reaction. The value of 'x' is

(Given: $\ln 10 = 2.303$ and $\log 2 = 0.3010$)

- (A) 1.12 (B) 2.43 (C) 3.32 (D) 33.31

[JEE Main, June 2022]

4. At 30°C , the half life for the decomposition of AB_2 is 200 s and is independent of the initial concentration of AB_2 . The time required for 80% of the AB_2 to decompose is

(Given: $\log 2 = 0.30$; $\log 3 = 0.48$)

- (A) 200 s (B) 323 s (C) 467 s (D) 532 s

[JEE Main, July 2022]

5. Sucrose hydrolyses in acid solution into glucose and fructose following first order rate law with a half-life of 3.33 h at 25°C . After 9 h, the fraction of sucrose remaining is f. The value of $\log_{10} =$

$\left(\frac{1}{f}\right)$ is _____ $\times 10^{-2}$. (Rounded off to the nearest integer)

(Physical Chemistry)

[Assume : $\ln 10 = 2.303$, $\ln 2 = 0.693$]

[JEE Main, Feb 2021]

6. For the first order reaction $A \rightarrow 2B$, 1 mole of reactant A gives 0.2 moles of B after 100 minutes. The half life of the reaction is min. (Round off to the nearest integer).

[Use : $\ln 2 = 0.69$, $\ln 10 = 2.3$]

Properties of logarithms : $\ln x^y = y \ln x$; $\ln \left(\frac{x}{y} \right) = \ln x - \ln y$]

(Round off to the nearest integer)

[JEE Main, July 2021]

7. For the reaction $2A + B \rightarrow C$, the values of initial rate at different reactant concentrations are given in the table below. The rate law for the reaction is :

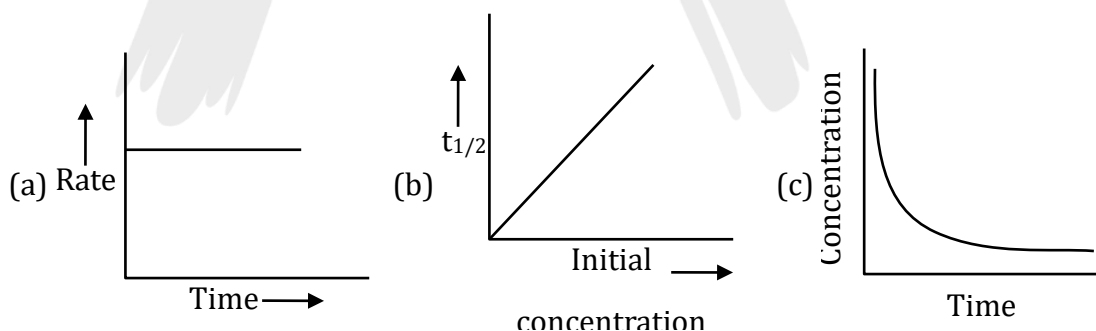
(Chemical Kinetics)

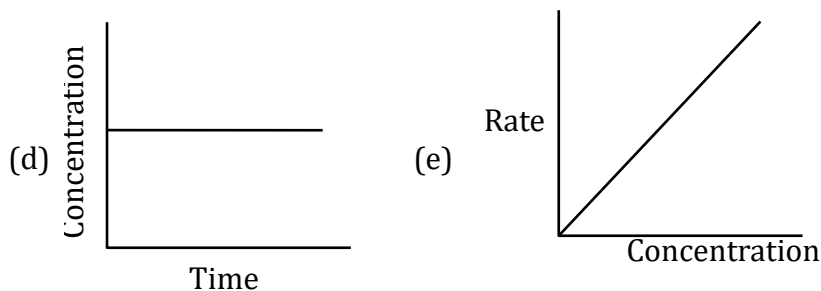
[A] (mol L ⁻¹)	[B] (mol L ⁻¹)	Initial Rate (mol L ⁻¹ s ⁻¹)
0.05	0.05	0.045
0.10	0.05	0.090
0.20	0.10	0.72

(A) Rate = $k[A][B]$ (B) Rate = $k[A]^2[B]^2$ (C) Rate = $k[A]^2[B]$ (D) Rate = $k[A][B]^2$

[Jee Main, April 2019]

8. For the following graph:





Choose from the options given below, the correct one regarding order of reaction is :

- (A) (b) zero order (c) and (e) First order
 (B) (a) and (b) Zero order (e) First order
 (C) (b) and (d) zero order (e) first order
 (D) (a) and (b) Zero order (c) and (e) First order

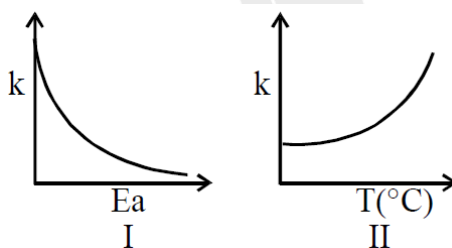
[JEE Main, July 2021]

9. For a reaction $A \rightarrow 2B + C$ the half lives are 100 s and 50 s when the concentration of reactant A is 0.5 and 1.0 mol L⁻¹ respectively. The order of the reaction is _____. (Nearest Integer)

[JEE Main, July 2022]

10. Consider the given plots for a reaction obeying Arrhenius equation ($0^\circ\text{C} < T < 300^\circ\text{C}$) : (k and E_a are rate constant and activation energy, respectively)

[Chemical Kinetics]

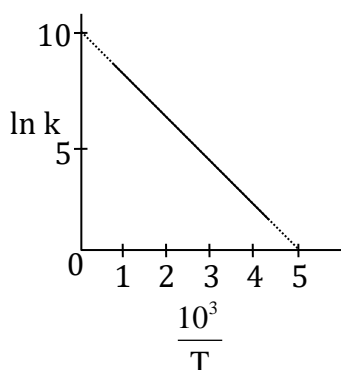


Choose the correct option :

- (A) I is right but II is wrong
 (B) Both I and II are wrong
 (C) I is wrong but II is right
 (D) Both I and II are correct

[Jee Main, Jan 2019]

11. The rate constant (k) of a reaction is measured at different temperature (T), and the data are plotted in the given figure. The activation energy of the reaction in kJ mol⁻¹ is : (R is constant)



(A) $2R$

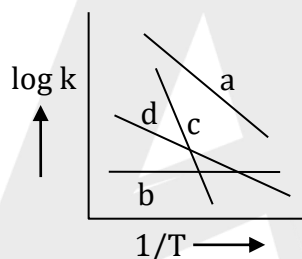
(B) $1/R$

(C) $2/R$

(D) R

[Jee Main, 2020]

12. Consider the following plots of rate constant versus $\frac{1}{T}$ for four different reactions. Which of the following orders is correct for the activation energies of these reactions?



(A) $E_a > E_c > E_d > E_b$

(B) $E_b > E_a > E_d > E_c$

(C) $E_c > E_a > E_d > E_b$

(D) $E_b > E_d > E_c > E_a$

[Jee Main, 2020]

13. Catalyst A reduces the activation energy for a reaction by 10 kJ mol^{-1} at 300 K . The ratio of rate constants, $\frac{k_{\text{T, Catalysed}}}{k_{\text{T, Uncatalysed}}}$ is e^x . The value of x is _____. [nearest integer]

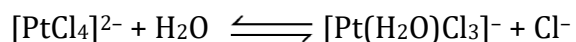
[Assume that the pre-exponential factor is same in both the cases.]

Given $R = 8.31 \text{ J K}^{-1} \text{ mol}^{-1}$

[JEE Main, June 2022]

14. If the activation energy of a reaction is 80.9 kJ mol^{-1} , the fraction of molecules at 700 K , having enough energy to react to form products is e^{-x} . The value of x is _____.
(Rounded off to the nearest integer) [Use $R = 8.31 \text{ J K}^{-1} \text{ mol}^{-1}$]

15. The reaction rate for the reaction



was measured as a function of concentrations of different species. It was observed that

$$\frac{-d[\text{PtCl}_4]^{2-}}{dt} = 4.8 \times 10^{-5} [\text{PtCl}_4]^{2-} - 2.4 \times 10^{-3} [\text{Pt}(\text{H}_2\text{O})\text{Cl}_3]^- [\text{Cl}^-]$$

where square brackets are used to denote molar concentrations. The equilibrium constant

$K_c = \text{_____}$. (Nearest integer)

[JEE Main, August 2021]

ANSWER KEY

CHEMICAL KINETICS

- | | | | | | | | | | | | | | |
|-----|------|----|-------|-----|-----|-----|-----|-----|------|-----|-------|-----|------|
| 1. | (A) | 2. | (1) | 3. | (C) | 4. | (C) | 5. | (81) | 6. | (300) | 7. | (D) |
| 8. | (D) | 9. | 02.00 | 10. | (D) | 11. | (A) | 12. | (C) | 13. | (4) | 14. | (14) |
| 15. | (50) | | | | | | | | | | | | |

Thermodynamics

1. Among the following the number of state variable is _____. [JEE Main, July 2022]
Internal energy (U)
Volume (V)
Heat (q)
Enthalpy (H)
2. 5 moles of an ideal gas at 100 K are allowed to undergo reversible compression till its temperature becomes 200 K. If $C_{v,m} = 28 \text{ J K}^{-1} \text{ mol}^{-1}$, calculate ΔU and ΔPV for this process. ($R = 8.0 \text{ J K}^{-1} \text{ mol}^{-1}$) [Jee Main, April 2019]
(A) $\Delta U = 14 \text{ J}$; $\Delta(PV) = 0.8 \text{ J}$ (B) $\Delta U = 2.8 \text{ kJ}$; $\Delta(PV) = 0.8 \text{ kJ}$
(C) $\Delta U = 14 \text{ kJ}$; $\Delta(PV) = 18 \text{ kJ}$ (D) $\Delta U = 14 \text{ kJ}$; $\Delta(PV) = 4 \text{ kJ}$
3. For one mole of an ideal gas, which of these statements must be true?
(a) U and H each depends only on temperature
(b) Compressibility factor z is not equal to 1
(c) $C_{p,m} - C_{v,m} = R$
(d) $dU = C_v dT$ for any process
(A) (a) and (c) (B) (b), (c) and (d) (C) (a), (c) and (d) (D) (c) and (d) [Jee Main, 2020]
4. For water $\Delta_{\text{vap}} H = 41 \text{ kJ mol}^{-1}$ at 373 K and 1 bar pressure. Assuming that water vapour is an ideal gas that occupies a much larger volume than liquid water, the internal energy change during evaporation of water is ____ kJ mol^{-1} [Use : $R = 8.3 \text{ J mol}^{-1} \text{ K}^{-1}$] [JEE Main, August 2021]
5. For combustion of one mole of magnesium in an open container at 300 K and 1 bar pressure, $\Delta_c H^\circ = -601.70 \text{ kJ mol}^{-1}$, the magnitude of change in internal energy for the reaction is ____ kJ. (Nearest integer)
(Given : $R = 8.3 \text{ J K}^{-1} \text{ mol}^{-1}$) [JEE Main, June 2022]

(Physical Chemistry)

6. 2.2 g of nitrous oxide (N_2O) gas is cooled at a constant pressure of 1 atm from 310 K to 270 K causing the compression of the gas from 217.1 mL to 167.75 mL. The change in internal energy of the process, ΔU is $-x$ J. The value of x is _____. [Nearest integer]

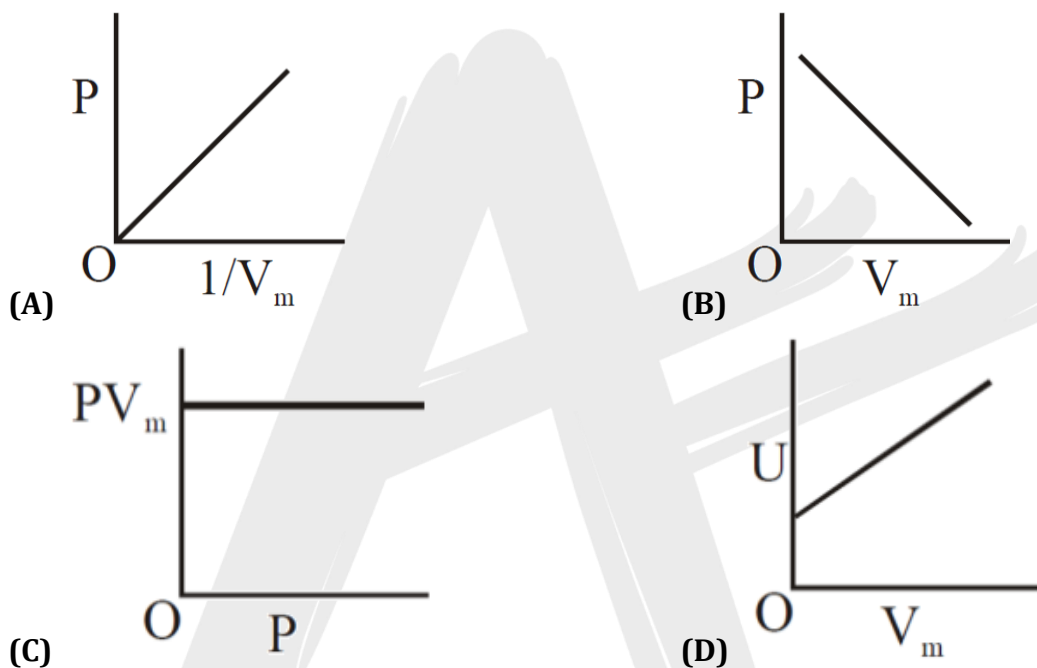
(Given: atomic mass of N = 14 g mol⁻¹ and of O = 16 g mol⁻¹.)

Molar heat capacity of N_2O is 100 JK⁻¹ mol⁻¹)

[JEE Main, June 2022]

7. The combination of plots which does not represent isothermal expansion of an ideal gas is:

[Thermodynamics]



- (A) (B) and (D) (B) (A) and (D) (C) (A) and (C) (D) (B) and (C)

[Jee Main, Jan 2019]

8. An ideal gas undergoes isothermal compression from 5 m³ to 1 m³ against a constant external pressure of 4 Nm⁻². Heat released in this process is used to increase the temperature of 1 mole of Al. If molar heat capacity of Al is 24 J mol⁻¹ K⁻¹, the temperature of Al increases by :

[Thermodynamics]

- (A) $\frac{3}{2}$ K (B) 2 K (C) 1 K (D) $\frac{2}{3}$ K

[Jee Main, Jan 2019]

9. Match List-I with List-II

	List-I		List-II
(A)	Spontaneous process	(I)	$\Delta H < 0$

(B)	Process with $\Delta P = 0, \Delta T = 0$	(II)	$\Delta G_{T,P} < 0$
(C)	$\Delta H_{\text{reaction}}$	(III)	Isothermal and isobaric process
(D)	Exothermic process	(IV)	[Bond energies of molecules in reactants] - [Bond energies of product molecules]

Choose the correct answer from the options given below:

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

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

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

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

[JEE Main, June 2022]

10. Which of the following relation is not correct?

(A) $\Delta H = \Delta U - P\Delta V$

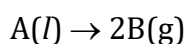
(B) $\Delta U = q + W$

(C) $\Delta S_{\text{sys}} + \Delta S_{\text{surr}} \geq 0$

(D) $\Delta G = \Delta H - T\Delta S$

[JEE Main, July 2022]

11. For the reaction;



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

Hence ΔG in kcal is _____ :

[Jee Main, 2020]

12. A process has $\Delta H = 200 \text{ J mol}^{-1}$ and $\Delta S = 40 \text{ J K}^{-1} \text{ mol}^{-1}$. Out of the values given below, choose the minimum temperature above which the process will be spontaneous : [Thermodynamics]

(A) 12K

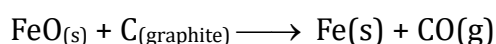
(B) 20K

(C) 4K

(D) 5K

[Jee Main, Jan 2019]

13. Data given for the following reaction is as follows:



Substance	ΔH° (kJ mol ⁻¹)	ΔS° (J mol ⁻¹ K ⁻¹)
FeO _(s)	-266.3	57.49
C _(graphite)	0	5.74
Fe _(s)	0	27.28
CO _(g)	-110.5	197.6

The minimum temperature in K at which the reaction becomes spontaneous is _____. (Integer answer)
[JEE Main, July 2021]

14. For the chemical reaction $X \rightleftharpoons Y$, the standard reaction Gibbs energy depends on temperature T (in K) as : [Thermodynamics]

$$\Delta_r G^\circ \text{ (in kJ mol}^{-1}\text{)} = 120 - \frac{3}{8}T$$

The major component of the reaction mixture at T is :

- (A) Y if T = 280 K (B) X if T = 315 K (C) Y if T = 300 K (D) X if T = 350 K

[Jee Main, Jan 2019]

15. $2O_3(g) \rightleftharpoons 3O_2(g)$

At 300 K, ozone is fifty percent dissociated. The standard free energy change at this temperature and 1 atm pressure is (-) _____ J mol⁻¹ (Nearest integer)

[Given: $\ln 1.35 = 0.3$ and $R = 8.3 \text{ J K}^{-1} \text{ mol}^{-1}$]

[JEE Main, June 2022]

Answer key

1. (3) 2. (D) 3. (C) 4. (38) 5. (600) 6. (195) 7. (A)
8. (D) 9. (B) 10. (A) 11. (-2.70) 12. (D) 13. (964)
14. (B) 15. (747)

IONIC EQUILIBRIUM

1. K_a for butyric acid (C_3H_7COOH) is 2×10^{-5} . The pH of 0.2 M solution of butyric acid is _____ $\times 10^{-1}$. (Nearest integer) [Given $\log 2 = 0.30$] [JEE Main, July 2022]
2. 200 mL of 0.01 M HCl is mixed with 400 mL of 0.01M H_2SO_4 . The pH of the mixture is _____.
(A) 1.14 (B) 1.78 (C) 2.34 (D) 3.02 [JEE Main, July 2022]
3. Arrange the following solutions in the decreasing order of pOH:
(a) 0.01 M HCl (b) 0.01 M NaOH
(c) 0.01 M CH_3COONa (d) 0.01 M NaCl
(A) (b) > (c) > (d) > (a) (B) (a) > (c) > (d) > (b)
(C) (b) > (d) > (c) > (a) (D) (a) > (d) > (c) > (b) [Jee Main, 2020]
4. 20 mL of 0.1 M H_2SO_4 solution is added to 30 mL of 0.2 M NH_4OH solution. The pH of the resultant mixture is : [pK_b of $NH_4OH = 4.7$]. [Ionic Equilibrium]
(A) 9.4 (B) 5.0 (C) 9.0 (D) 5.2 [Jee Main, Jan 2019]
5. Class XII students were asked to prepare one litre of buffer solution of pH 8.26 by their chemistry teacher. The amount of ammonium chloride to be dissolved by the student in 0.2 M ammonia solution to make one litre of the buffer is
(Given $pK_b(NH_3) = 4.74$; Molar mass of $NH_3 = 17g\ mol^{-1}$; Molar mass of $NH_4Cl = 53.5g\ mol^{-1}$)
(A) 53.5 g (B) 72.3 g (C) 107.0 g (D) 126.0 g [JEE Main, July 2022]
6. Consider the following statements
(a) The pH of a mixture containing 400 mL of 0.1 M H_2SO_4 and 400 mL of 0.1 M NaOH will be approximately 1.3.
(b) Ionic product of water is temperature dependent.
(c) A monobasic acid with $K_a = 10^{-5}$ has a pH = 5. The degree of dissociation of this acid is 50%.

(Physical Chemistry)

(d) The Le Chatelier's principle is not applicable to common-ion effect.

The correct statements are :

- (A) (a), (b) and (c) (B) (a) and (b) (C) (b) and (c) (D) (a), (b) and (d)

[Jee Main, April 2019]

7. An acidic buffer is obtained on mixing :

- (a) 100 mL of 0.1 M HCl and 200 mL of 0.1 M NaCl
(B) 100 mL of 0.1 M HCl and 200 mL of 0.1 M CH_3COONa
(C) 100 mL of 0.1 M CH_3COOH and 100 mL of 0.1 M NaOH
(D) 100 mL of 0.1 M CH_3COOH and 200 mL of 0.1 M NaOH

[Jee Main, 2020]

8. Given below are two statements.

Statement I: In the titration between strong acid and weak base methyl orange is suitable as an indicator.

Statement II: For titration of acetic acid with NaOH phenolphthalein is not a suitable indicator.

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

- (A) Statement I is false but Statement II is true
(B) Statement I is true but Statement II is false
(C) Both Statement I and Statement II are true
(D) Both Statement I and Statement II are false

[JEE Main, August 2021]

9. In base vs. Acid titration, at the end point methyl orange is present as

- (A) quinonoid form (B) heterocyclic form (C) phenolic form (D) benzenoid form

[JEE Main, July 2022]

10. If K_{sp} of Ag_2CO_3 is 8×10^{-12} , the molar solubility of Ag_2CO_3 in 0.1M AgNO_3 is :

[Ionic Equilibrium]

- (A) 8×10^{-10} M (B) 8×10^{-13} M (C) 8×10^{-12} M (D) 8×10^{-11} M

[Jee Main, Jan 2019]

(Physical Chemistry)

11. The solubility of Ca(OH)_2 in water is:

[Given : The solubility product of Ca(OH)_2 in water = 5.5×10^{-6}]

- (A) 1.77×10^{-6}
 (B) 1.11×10^{-6}
 (C) 1.11×10^{-2}
 (D) 1.77×10^{-2}

[JEE Main, Feb 2021]

12. The solubility of AgCl will be maximum in which of the following?

- (A) 0.01 M KCl (B) 0.01 M HCl
 (C) 0.01 M AgNO_3 (D) De-ionised water

[JEE Main, June 2022]

13. When 35 mL of 0.15 M lead nitrate solution is mixed with 20 mL of 0.12 M chromic sulphate solution, $\text{_____} \times 10^{-5}$ moles of lead sulphate precipitate out. (Round off to the Nearest Integer)

[JEE Main, March 2021]

14. The solubility of AgCN in a buffer solution of $\text{pH}=3$ is x . The value of x is: (Assume : No cyano complex is formed; $K_{\text{sp}}(\text{AgCN}) = 2.2 \times 10^{-16}$ and $K_{\text{a}}(\text{HCN}) = 6.2 \times 10^{-10}$)

- (A) 0.625×10^{-6}
 (B) 1.9×10^{-5}
 (C) 2.2×10^{-16}
 (D) 1.6×10^{-6}

[JEE Main, Feb 2021]

15. The number of moles of NH_3 , that must be added to 2 L of 0.80 M AgNO_3 in order to reduce the concentration of Ag^+ ions to 5.0×10^{-8} M ($K_{\text{formation}}$ for $[\text{Ag}(\text{NH}_3)_2]^+ = 1.0 \times 10^8$) is _____. (Nearest integer)

[Assume no volume change on adding NH_3]

[JEE Main, August 2021]

ANSWER KEY

1. (27) 2. (B) 3. (D) 4. (C) 5. (C) 6. (A) 7. (B)
 8. (B) 9. (A) 10. (A) 11. (C) 12. (D) 13. (525) 14. (B)
 15. (D)

Electrochemistry

1. For the reaction
 $2\text{Fe}^{3+}(\text{aq}) + 2\text{I}^{-}(\text{aq}) \rightarrow 2\text{Fe}^{2+}(\text{aq}) + \text{I}_2(\text{s})$
 the magnitude of the standard molar free energy change, $\Delta_r G_m^{\circ} = - \text{_____ kJ}$.
 (Round off to the Nearest Integer)

$$\left[\begin{array}{l} E_{\text{Fe}^{2+}/\text{Fe}(\text{s})}^{\circ} = -0.440\text{V}; \quad E_{\text{Fe}^{3+}/\text{Fe}(\text{s})}^{\circ} = -0.036\text{V} \\ E_{\text{I}_2/2\text{I}^{-}}^{\circ} = 0.539\text{V}; \quad F = 96500\text{C} \end{array} \right]$$

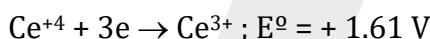
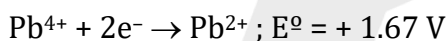
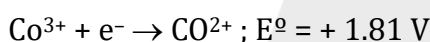
[JEE Main, March 2021]

2. Given that the standard potentials (E°) of Cu^{2+}/Cu and Cu^{+}/Cu are 0.34 V and 0.522 V respectively, the E° of $\text{Cu}^{2+}/\text{Cu}^{+}$ is :

(A) -0.182 V (B) -0.158 V (C) 0.182 V (D) +0.158 V

[Jee Main, 2020]

3. Given:



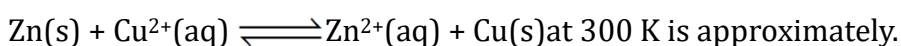
Oxidizing power of the species will increase in the order:

- (A) $\text{Ce}^{4+} < \text{Pb}^{4+} < \text{Bi}^{3+} < \text{Co}^{3+}$ (B) $\text{Co}^{3+} < \text{Pb}^{4+} < \text{Ce}^{4+} < \text{Bi}^{3+}$
 (C) $\text{Bi}^{3+} < \text{Ce}^{4+} < \text{Pb}^{4+} < \text{Co}^{3+}$ (D) $\text{Co}^{3+} < \text{Ce}^{4+} < \text{Bi}^{3+} < \text{Pb}^{4+}$

[Jee Main, April 2019]

4. If the standard electrode potential for a cell is 2 V at 300 K, the equilibrium constant (K) for the reaction

[Electrochemistry]



$$(R = 8 \text{ J K}^{-1} \text{ mol}^{-1}, F = 96000 \text{ C mol}^{-1})$$

- (A) e^{-80} (B) e^{-160} (C) e^{160} (D) e^{320}

[Jee Main, Jan 2019]

5. For the given cell ;

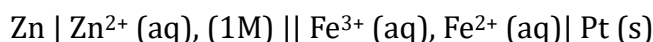
(Physical Chemistry)

$\text{Cu(s)}|\text{Cu}^{2+}(\text{C}_1\text{M})||\text{Cu}^{2+}(\text{C}_2\text{M})|\text{Cu(s)}$ change in Gibbs energy (ΔG) is negative, if :

- (A) $\text{C}_1 = 2\text{C}_2$ (B) $\text{C}_2 = \frac{\text{C}_1}{\sqrt{2}}$ (C) $\text{C}_1 = \text{C}_2$ (D) $\text{C}_2 = \sqrt{2}\text{C}_1$

[Jee Main, 2020]

6. Consider the cell at 25°C



The fraction of total iron present as Fe^{3+} ion at the cell potential of 1.500 V is $x \times 10^{-2}$. The value of x is _____. (Nearest integer)

(Given: $E_{\text{Fe}^{3+}/\text{Fe}^{2+}}^0 = 0.77\text{V}$, $E_{\text{Zn}^{2+}/\text{Zn}}^0 = -0.76\text{V}$)

[JEE Main, July 2021]

7. In the cell $\text{Pt(s)}|\text{H}_2(\text{g}, 1\text{bar})|\text{HCl}(\text{aq})|\text{AgCl(s)}|\text{Ag(s)}|\text{Pt(s)}$ the cell potential is 0.92 V when a 10^{-6} molal HCl solution is used. The standard electrode potential of $(\text{AgCl}/\text{Ag}, \text{Cl}^-)$ electrode is :

$\left\{ \text{Given, } \frac{2.303RT}{F} = 0.06\text{ V at } 298\text{ K} \right\}$ [Electrochemistry]

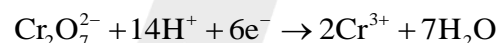
- (A) 0.94 V (B) 0.40 V (C) 0.20 V (D) 0.76 V

[Jee Main, Jan 2019]

8. 108g of silver (molar mass 108g mol^{-1}) is deposited at cathode from $\text{AgNO}_3(\text{aq})$ solution by a certain quantity of electricity. The volume (in L) of oxygen gas produced at 273 K and 1 bar pressure from water by the same quantity of electricity is _____.

[Jee Main, 2020]

9. An acidic solution of dichromate is electrolyzed for 8 minutes using 2A current. As per the following equation



The amount of Cr^{3+} obtained was 0.104 g . The efficiency of the process (in %) is

(Take : $F = 96000\text{ C}$, At. mass of chromium = 52) _____.

Given 60.31

[Jee Main, 2020]

10. A dilute solution of Sulphuric acid is electrolysed using a current of 0.10 A for 2 hours to produce hydrogen and oxygen gas. The total volume of gases produced at STP is _____ cm^3 . (Nearest integer) [Given : Faraday constant $F = 96500\text{ C mol}^{-1}$ at STP, molar volume of an ideal gas is 22.7 L mol^{-1}]

[JEE Main, June 2022]

11. Consider the statements S1 and S2 :

S1: Conductivity always increases with decrease in the concentration of electrolyte.

(Physical Chemistry)

S2: Molar conductivity always increases with decrease in the concentration of electrolyte.

The correct option among the following is:

- (A) Both S1 and S2 are wrong (B) Both S1 and S2 are correct
(C) S1 is wrong and S2 is correct (D) S1 is correct and S2 is wrong

[Jee Main, April 2019]

12. Given below are two statements:

Statement I: The limiting molar conductivity of KCl (strong electrolyte) is higher compared to that of CH_3COOH (weak electrolyte).

Statement II: Molar conductivity decreases with decrease in concentration of electrolyte.

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

- (A) Statement I is true but Statement II is false.
(B) Statement I is false but Statement II is true.
(C) Both Statement I and Statement II are true.
(D) Both Statement I and Statement II are false.

[JEE Main, August 2021]

13. The molar conductivity of a conductivity cell filled with 10 mole of 20 mL NaCl solution is Λ_{m1} and that of 20 moles another identical cell having 80 mL NaCl solution is Λ_{m2} , The conductivities exhibited by these two cells are same.

The relationship between Λ_{m2} and Λ_{m1} is

- (A) $\Lambda_{m2} = 2\Lambda_{m1}$ (B) $\Lambda_{m2} = \Lambda_{m1} / 2$ (C) $\Lambda_{m2} = 2\Lambda_{m1}$ (D) $\Lambda_{m2} = 4\Lambda_{m1}$

[JEE Main, July 2022]

14. The limiting molar conductivities of NaI, NaNO_3 and AgNO_3 are 12.7, 12.0 and 13.3 $\text{mS m}^2 \text{mol}^{-1}$, respectively (all at 25°C). The limiting molar conductivity of AgI at this temperature is ____ $\text{mS m}^2 \text{mol}^{-1}$

[JEE Main, June 2022]

15. The conductivity of a weak acid HA of concentration 0.001 mol L^{-1} is $2.0 \times 10^{-5} \text{ S cm}^{-1}$. If $\Lambda_m^0(\text{HA}) = 190 \text{ S cm}^2 \text{mol}^{-1}$, the ionization constant (K_a) of HA is equal to ____ $\times 10^{-6}$.

(Round off to the nearest integer)

[JEE Main, July 2021]

ANSWER KEY

1. (46) 2. (D) 3. (C) 4. (C) 5. (D) 6. (24) 7. (C)
8. (5.67 or 5.68) NTA Ans. (5.66 to 5.67) 9. (60) 10. (127) 11. (C)
12. (D) 13. (A) 14. (14) 15. (12)



liquid solution

1. The resistance of a conductivity cell with cell constant 1.14 cm^{-1} , containing 0.001 M KCl at 298 K is 1500Ω . The molar conductivity of 0.001 M KCl solution at 298 K in $\text{S cm}^2 \text{ mol}^{-1}$ is _____.
(Integer answer)

[JEE Main, August 2021]

2. The vapour pressures of pure liquids A and B are 400 and 600 mmHg , respectively at 298 K . On mixing the two liquids, the sum of their initial volumes is equal to the volume of the final mixture. The mole fraction of liquid B is 0.5 in the mixture. The vapour pressure of the final solution, the mole fractions of components A and B in vapour phase, respectively are :

(Liquid Solution)

- (A) 450 mmHg , 0.4 , 0.6 (B) 500 mmHg , 0.4 , 0.6
(C) 500 mmHg , 0.5 , 0.5 (D) 450 mmHg , 0.5 , 0.5

[Jee Main, April 2019]

3. A gaseous mixture of two substances A and B, under a total pressure of 0.8 atm is in equilibrium with an ideal liquid solution. The mole fraction of substance A is 0.5 in the vapour phase and 0.2 in the liquid phase. The vapour pressure of pure liquid A is ____ atm. (Nearest integer)

[JEE Main, July 2022]

4. Two open beakers one containing a solvent and the other containing a mixture of that solvent with a non volatile solute are together sealed in a container. Over time :
- (A) The volume of the solution decreases and the volume of the solvent increases
(B) The volume of the solution increases and the volume of the solvent decreases
(C) The volume of the solution does not change and the volume of the solvent decreases
(D) The volume of the solution and the solvent does not change

[Jee Main, 2020]

5. When a certain amount of solid A is dissolved in 100 g of water at 25°C to make a dilute solution, the vapour pressure of the solution is reduced to one-half of that of pure water. The vapour pressure of pure water is 23.76 mmHg . The number of moles of solute A added is _____.
(Nearest Integer)

[JEE Main, July 2022]

(Physical Chemistry)

6. When 3.00 g of a substance 'X' is dissolved in 100 g of CCl_4 , it raises the boiling point by 0.60 K. The molar mass of the substance 'X' is _____ g mol^{-1} . (Nearest integer)

[Given K_b for CCl_4 is 5.0 K kg mol^{-1}]

[JEE Main, July 2021]

7. 1 kg of 0.75 molal aqueous solution of sucrose can be cooled up to -4°C before freezing. The amount of ice (in g) that will be separated out is _____. (Nearest integer)

[Given : $K_f(\text{H}_2\text{O}) = 1.86 \text{ K kg mol}^{-1}$]

[JEE Main, August 2021]

8. If 250 cm^3 of an aqueous solution containing 0.73 g of a protein A is isotonic with one litre of another aqueous solution containing 1.65 g of a protein B, at 298 K, the ratio of the molecular masses of A and B is _____ $\times 10^{-2}$ (to the nearest integer).

[JEE Main, 2020]

9. A 1 molal $\text{K}_4\text{Fe}(\text{CN})_6$ solution has a degree of dissociation of 0.4. Its boiling point is equal to that of another solution which contains 18.1 weight percent of a non electrolytic solute A. The molar mass of A is _____ u.

(Round off to the Nearest Integer).

[Density of water = 1.0 g cm^{-3}]

[JEE Main, March 2021]

10. Molecules of benzoic acid ($\text{C}_6\text{H}_5\text{COOH}$) dimerise in benzene. 'w' g of the acid dissolved in 30 g of benzene shows a depression in freezing point equal to 2K. If the percentage association of the acid to form dimer in the solution is 80, then w is :

[Liquid Solution]

(Given that $K_f = 5 \text{ K kg mol}^{-1}$, Molar mass of benzoic acid = 122 g mol^{-1})

(A) 1.5 g (B) 1.0 g (C) 2.4 g (D) 1.8 g

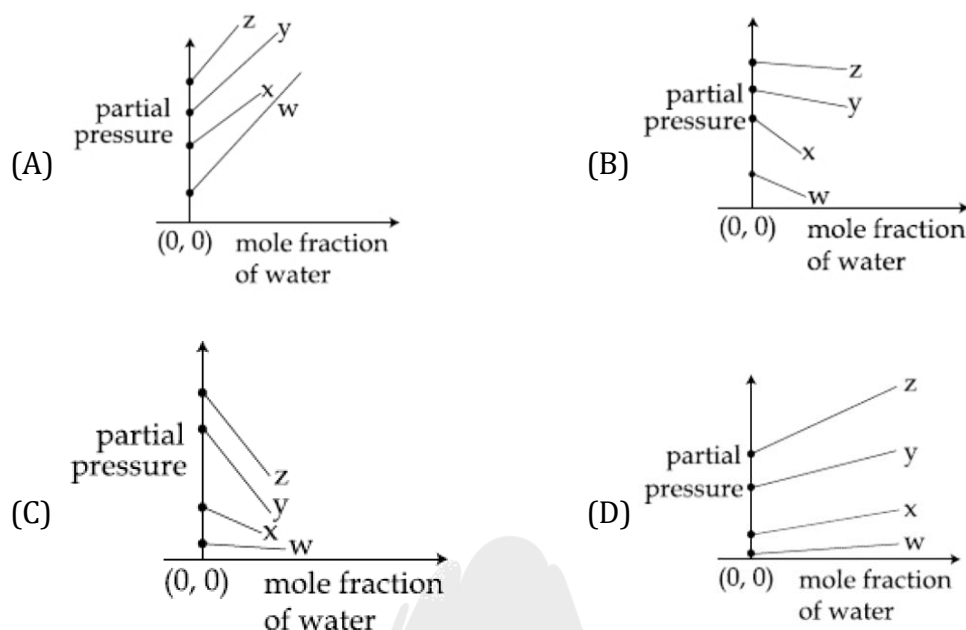
[JEE Main, Jan 2019]

11. The depression in freezing point observed for a formic acid solution of concentration 0.5 mL L^{-1} is 0.0405°C . Density of formic acid is 1.05 g mL^{-1} . The Van't Hoff factor of the formic acid solution is nearly: [Given for water $K_f = 1.86 \text{ K kg mol}^{-1}$]

(A) 0.8 (B) 1.1 (C) 1.9 (D) 2.4

[JEE Main, July 2022]

12. For the solution of the gases w, x, y and z in water at 298 K, the Henry's law constants (K_H) are 0.5, 2, 35 and 40 k bar, respectively. The correct plot for the given data is :



[Jee Main, April 2019]

13. The oxygen dissolved in water exerts a partial pressure of 20 kPa in the vapour above water. The molar solubility of oxygen in water is $\text{_____} \times 10^{-5} \text{ mol dm}^{-3}$.

(Round off to the Nearest Integer)

[Given : Henry's law constant = $K_H = 8.0 \times 10^4 \text{ kPa}$ for O_2 .

Density of water with dissolved oxygen = 1.0 kg dm^{-3}]

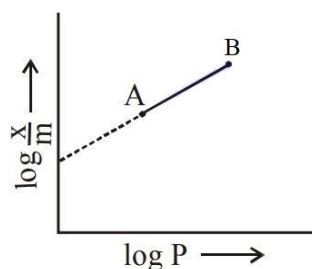
[JEE Main, March 2021]

ANSWER KEY

- | | | | | | | | | | | | | | |
|----|-------|----|------|-----|-----|-----|-----|-----|-----|-----|-------|----|-------|
| 1. | (760) | 2. | (B) | 3. | (2) | 4. | (B) | 5. | (3) | 6. | (250) | 7. | (518) |
| 8. | 177 | 9. | (85) | 10. | (C) | 11. | (C) | 12. | (C) | 13. | (25) | | |

SURFACE CHEMISTRY

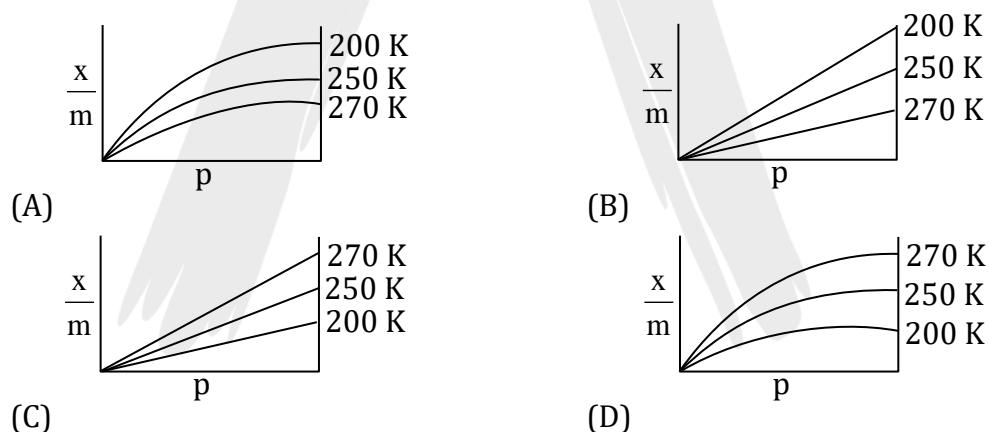
1. In Freundlich adsorption isotherm, slope of AB line is:



- (A) $\log n$ with $(n > 1)$
 (B) n with $(n, 0.1 \text{ to } 0.5)$
 (C) $\log \frac{1}{n}$ with $(n < 1)$
 (D) $\frac{1}{n}$ with $\left(\frac{1}{n} = 0 \text{ to } 1\right)$

[JEE Main, Feb 2021]

2. Adsorption of a gas follows Freundlich adsorption isotherm. If x is the mass of the gas adsorbed on mass m of the adsorbent, the correct plot of $\frac{x}{m}$ versus p is :



[Jee Main, 2020]

3. Given below are the critical temperatures of some of the gases:

Gas	Critical temperature (K)
He	5.2
CH ₄	190
CO ₂	304.2
NH ₃	405.5

The gas showing least adsorption on a definite amount of charcoal is:

(Physical Chemistry)

(A) He

(B) CH₄

(C) CO₂

(D) NH₃

[JEE Main, July 2022]

4. CO₂ gas adsorbs on charcoal following Freundlich adsorption isotherm. For a given amount of charcoal, the mass of CO₂ adsorbed becomes 64 times when the pressure of CO₂ is doubled.

The value of n in the Freundlich isotherm equation is $___ \times 10^{-2}$.

(Round off to the Nearest Integer)

[JEE Main, July 2021]

5. Which one of the following statements is not true about enzymes?

(A) Enzymes are non-specific for a reaction and substrate.

(B) Almost all enzymes are proteins.

(C) Enzymes work as catalysts by lowering the activation energy of a biochemical reaction.

(D) The action of enzymes is temperature and pH specific

[JEE Main, July 2021]

6. Match List I with List II.

List-I (Enzyme)		List-II (Conversion of	
A.	Invertase	I.	Starch into maltose
B.	Zymase	II.	Maltose into glucose
C.	Diastase	III.	Glucose into ethanol
D.	Maltase	IV.	Cane sugar into glucose

Choose the most appropriate answer from the options given below :

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

(B) A-III. B-II. C-I. D-IV

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

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

[JEE Main, June 2022]

7. Match List - I with List - II.

List-I

List-II

(Processes/Reactions)

(Catalyst)

(Physical Chemistry)

- | | | | |
|-----|---|-------|---|
| (a) | $2\text{SO}_2(\text{g}) + \text{O}_2(\text{g}) \rightarrow 2\text{SO}_3(\text{g})$ | (I) | $\text{Fe}(\text{s})$ |
| (b) | $4\text{NH}_3(\text{g}) + 5\text{O}_2(\text{g}) \rightarrow 4\text{NO}(\text{g}) + 6\text{H}_2\text{O}(\text{g})$ | (II) | $\text{Pt}(\text{s}) - \text{Rh}(\text{s})$ |
| (c) | $\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \rightarrow 2\text{NH}_3(\text{g})$ | (III) | V_2O_5 |
| (d) | $\text{Vegetable oil}(\text{l}) + \text{H}_2 \rightarrow \text{Vegetable ghee}(\text{s})$ | (IV) | $\text{Ni}(\text{s})$ |

Choose the correct answer from the options given below:

- (A) (a) - (III), (b) - (I), (c) - (II), (d) - (IV)
 (B) (a) - (III), (b) - (II), (c) - (I), (d) - (IV)
 (C) (a) - (IV), (b) - (III), (c) - (I), (d) - (II)
 (D) (a) - (IV), (b) - (II), (c) - (III), (d) - (I)

[JEE Main, July 2022]

8. Match List I with List II

List-I

Example of Colloids

(a) Cheese

(b) Pumice stone

(c) Hair cream

(d) Cloud

List-II

Classification

(i) dispersion of liquid in liquid

(ii) dispersion of liquid in gas

(iii) dispersion of gas in solid

(iv) dispersion of liquid in solid

Choose the most appropriate answer from the options given below

- (A) (a)-(iv), (b)-(iii), (c)-(ii), (d)-(i)
 (B) (a)-(iv), (b)-(i), (c)-(iii), (d)-(ii)
 (C) (a)-(iii), (b)-(iv), (c)-(i), (d)-(ii)
 (D) (a)-(iv), (b)-(iii), (c)-(i), (d)-(ii)

[JEE Main, July 2021]

9. Haemoglobin and gold sol are examples of :

[Surface Chemistry]

- (A) negatively and positively charged sols, respectively
 (B) positively and negatively charged sols, respectively
 (C) negatively charged sols
 (D) positively charged sols

[Jee Main, Jan 2019]

10. The sol given below with negatively charged colloidal particles is :

- (a) FeCl_3 added to hot water
- (B) KI added to AgNO_3 solution
- (C) AgNO_3 added to KI solution
- (D) $\text{Al}_2\text{O}_3 \cdot x\text{H}_2\text{O}$ in water

[JEE Main, August 2021]

11. Which one of the following statements is FALSE for hydrophilic sols?

- (A) Their viscosity is of the order of that of H_2O
- (B) The sols cannot be easily coagulated
- (C) They do not require electrolytes for stability.
- (D) These sols are reversible in nature.

[JEE Main, Feb 2021]

12. Using very little soap while washing clothes, does not serve the purpose of cleaning of clothes because

- (A) soap particles remain floating in water as ions
- (B) the hydrophobic part of soap is not able to take away grease
- (C) the micelles are not formed due to concentration of soap, below its CMC value
- (D) colloidal structure of soap in water is completely disturbed.

[JEE Main, June 2022]

13. Incorrect statement for Tyndall effect is :-

- (A) The refractive indices of the dispersed phase and the dispersion medium differ greatly in magnitude.
- (B) The diameter of the dispersed particles is much smaller than the wavelength of the light used.
- (C) During projection of movies in the cinemas hall, Tyndall effect is noticed.
- (D) It is used to distinguish a true solution from a colloidal solution.

[JEE Main, June 2022]

14. Most suitable salt which can be used for efficient clotting of blood will be :

- (A) NaHCO_3
- (B) FeSO_4
- (C) $\text{Mg}(\text{HCO}_3)_2$
- (D) FeCl_3

[JEE Main, Feb 2021]

(Physical Chemistry)

15. Among the following, the false statement is : [Surface chemistry]
 (A) Latex is a colloidal solution of rubber particles which are positively charged
 (B) Lyophilic sol can be coagulated by adding an electrolyte.
 (C) It is possible to cause artificial rain by throwing electrified sand carrying charge opposite to the one on clouds from an aeroplane.
 (D) Tyndall effect can be used to distinguish between a colloidal solution and a true solution.
[Jee Main, Jan 2019]
16. The INCORRECT statements below regarding colloidal solutions is:
 (A) A colloidal solution shows colligative properties.
 (B) An ordinary filter paper can stop the flow of colloidal particles.
 (B) The flocculating power of Al^{3+} is more than that of Na^+ .
 (D) A colloidal solution shows Brownian motion of colloidal particles.
[JEE Main, March 2021]
17. 100 mL of a water sample contains 0.81 g of calcium bicarbonate and 0.73 g of magnesium bicarbonate. The hardness of this water sample expressed in terms of equivalents of CaCO_3 is :
 (molar mass of calcium bicarbonate is 162 g mol^{-1} and magnesium bicarbonate is 146 g mol^{-1})
(Surface Chemistry)
 (A) 10,000 ppm (B) 100 ppm (C) 5,000 ppm (D) 1000 ppm
[Jee Main, April 2019]
18. The flocculation value of HCl for arsenic sulphide sol. is 30 m mol L^{-1} . If H_2SO_4 is used for the flocculation of arsenic sulphide, the amount, in grams, of H_2SO_4 in 250 ml required for the above purpose is _____.
 (Molecular mass of $\text{H}_2\text{SO}_4 = 98 \text{ g/mol}$)
[Jee Main, 2020]

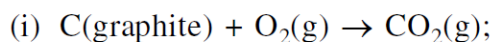
ANSWER KEY

- | | | | | | | | | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|------------------------------|-----|-----|-----|-----|-----|-----|
| 1. | (4) | 2. | (A) | 3. | (A) | 4. | (17) | 5. | (A) | 6. | (C) | 7. | (B) |
| 8. | (D) | 9. | (B) | 10. | (C) | 11. | (A) | 12. | (C) | 13. | (B) | 14. | (D) |
| 15. | (A) | 16. | (B) | 17. | (A) | 18. | (0.37) NTA Ans. 0.36 to 0.38 | | | | | | |

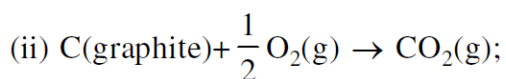
(Physical Chemistry)

Thermochemistry

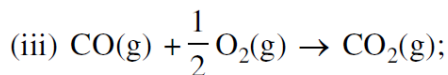
1. Given :



$$\Delta_r H^\circ = x \text{ kJ mol}^{-1}$$



$$\Delta_r H^\circ = y \text{ kJ mol}^{-1}$$



$$\Delta_r H^\circ = z \text{ kJ mol}^{-1}$$

Based on the above thermochemical equations, find out which one of the following algebraic relationships is correct ?

(A) $x = y - z$

(B) $y = 2z - x$

(C) $z = x + z$

(D) $x = y + y$

[Jee Main, Jan 2019]

2. The standard heat of formation ($\Delta_f H_{298}^\circ$) of ethane (in kJ/mol), if the heat of combustion of ethane, hydrogen and graphite are -1560 , -393.5 and -286 kJ/mol, respectively is _____.

[Jee Main, 2020]

3. At 25°C and 1 atm pressure, the enthalpy of combustion of benzene (l) and acetylene (g) are $-3268 \text{ kJ mol}^{-1}$ and $-1300 \text{ kJ mol}^{-1}$, respectively. The change in enthalpy for the reaction $3\text{C}_2\text{H}_2(\text{g}) \rightarrow \text{C}_6\text{H}_6(\text{l})$, is

(A) $+324 \text{ kJ mol}^{-1}$

(B) $+632 \text{ kJ mol}^{-1}$

(C) -632 kJ mol^{-1}

(D) -732 kJ mol^{-1}

[JEE Main, June 2022]

4. 2.4 g coal is burnt in a bomb calorimeter in excess of oxygen at 298 K and 1 atm pressure. The temperature of the calorimeter rises from 298 K to 300 K. The enthalpy change during the combustion of coal is $-x \text{ kJ mol}^{-1}$. The value of x is _____. (Nearest integer)

(Given : Heat capacity of bomb calorimeter 20.0 kJ K^{-1} . Assume coal to be pure carbon)

[JEE Main, July 2022]

5. For the reaction



the reaction enthalpy $\Delta_r H = \text{_____ kJ mol}^{-1}$.

(Round off to the Nearest Integer).

[Given : Bond enthalpies in kJ mol^{-1} : C–C : 347, C=C : 611; C–H : 414, H–H : 436]

[JEE Main, March 2021]

(Physical Chemistry)

6. If enthalpy of atomisation for $\text{Br}_{2(l)}$ is x kJ/mol and bond enthalpy for Br_2 is y kJ/mol, the relation between them :

(A) is $x = y$ (B) is $x > y$ (C) does not exist (D) is $x < y$

[Jee Main, 2020]

7. The Born-Haber cycle for KCl is evaluated with the following data:

$$\Delta_f H^- \text{ for KCl} = -436.7 \text{ kJ mol}^{-1};$$

$$\Delta_{\text{sub}} H^- \text{ for K} = 89.2 \text{ kJ mol}^{-1};$$

$$\Delta_{\text{ionization}} H^- \text{ for K} = 419.0 \text{ kJ mol}^{-1};$$

$$\Delta_{\text{electron gain}} H^- \text{ for Cl}_{(g)} = -348.6 \text{ kJ mol}^{-1};$$

$$\Delta_{\text{bond}} H^- \text{ for Cl}_2 = 243.0 \text{ kJ mol}^{-1};$$

The magnitude of lattice enthalpy of KCl in kJ mol^{-1} is _____ (Nearest integer)

[JEE Main, August 2021]

8. Lattice enthalpy and enthalpy of solution of NaCl are 788 kJ mol^{-1} and 4 kJ mol^{-1} , respectively. The hydration enthalpy of NaCl is :

(A) 784 kJ mol^{-1} (B) -780 kJ mol^{-1} (C) -784 kJ mol^{-1} (D) 780 kJ mol^{-1}

[Jee Main, 2020]

9. While performing a thermodynamics experiment, a student made the following observations,
 $\text{HCl} + \text{NaOH} \rightarrow \text{NaCl} + \text{H}_2\text{O} \quad \Delta H = -57.3 \text{ kJ mol}^{-1}$



The enthalpy of ionization of CH_3COOH as calculated by the student is _____ kJ mol^{-1} .

(Nearest integer)

[JEE Main, July 2022]

10. When 600 mL of 0.2 M HNO_3 is mixed with 400 mL of 0.1M NaOH solution in a flask, the rise in temperature of the flask is _____ $\times 10^{-2} ^\circ\text{C}$.

(Enthalpy of neutralization = 57 kJ mol^{-1} and specific heat of water = $4.2 \text{ JK}^{-1} \text{ g}^{-1}$)

(Neglect heat capacity of flask)

[JEE Main, July 2022]

ANSWER KEY

1. (D) 2. (-192.50) NTA Ans. (-192.00 to -193.00) 3. (C) 4. (200)
5. (128) 6. (B) 7. (718) 8. (C) 9. (2) 10. (54)

A

SOLID STATE

1. Select the correct statements.

- (a) Crystalline solids have long range order.
- (b) Crystalline solids are isotropic.
- (c) Amorphous solid are sometimes called pseudo solids.
- (d) Amorphous solids soften over a range of temperatures.
- (e) Amorphous solids have a definite heat of fusion.

Choose the most appropriate answer from the options given below.

- (A) (a), (b), (e) only
- (B) (b), (d) only
- (C) (c), (d) only
- (D) (a), (c), (d) only

[JEE Main, July 2021]

2. The parameters of the unit cell of a substance are

$$a = 2.5, b = 3.0, c = 4.0, \alpha = 90^\circ, \beta = 120^\circ, \gamma = 90^\circ.$$

The crystal system of the substance is :

- (A) Hexagonal
- (B) Orthorhombic
- (C) Monoclinic
- (D) Triclinic

[JEE Main, July 2021]

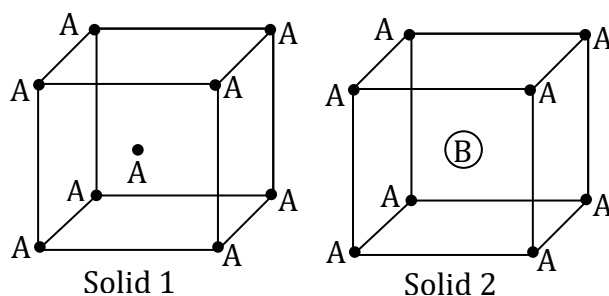
3. The radius of the largest sphere which fits properly at the centre of the edge of body centred cubic unit cell is : (Edge length is represented by 'a') :

[Solid State]

- (A) $0.047 a$
- (B) $0.027 a$
- (C) $0.067 a$
- (D) $0.134 a$

[Jee Main, Jan 2019]

4. Consider the bcc unit cells of the solids 1 and 2 with the position of atoms as shown below. The radius of atom B is twice that of atom A. The unit cell edge length is 50% more in solid 2 than in 1. What is the approximate packing efficiency in solid 2 ?



- (A) 90% (B) 45% (C) 75% (D) 65%

[Jee Main, April 2019]

5. A diatomic molecule X_2 has a body-centred cubic (bcc) structure with a cell edge of 300 pm. The density of the molecule is 6.17 g cm^{-3} . The number of molecules present in 200 g of X_2 is: (Avogadro constant (N_A) = $6 \times 10^{23} \text{ mol}^{-1}$)

- (A) $8 N_A$ (B) $2 N_A$ (C) $4 N_A$ (D) $40 N_A$

[Jee Main, 2020]

6. An element with molar mass $2.7 \times 10^{-2} \text{ kg mol}^{-1}$ forms a cubic unit cell with edge length 405 pm. If its density is $2.7 \times 10^3 \text{ kg m}^{-3}$, the radius of the element is approximately $__\times 10^{-12} \text{ m}$ (to the nearest integer).

[Jee Main, 2020]

7. An element crystallizes in a face-centred cubic (fcc) unit cell with cell edge a . The distance between the centres of two nearest octahedral voids in the crystal lattice is:

- (A) $\frac{a}{\sqrt{2}}$ (B) $\frac{a}{2}$ (C) a (D) $\sqrt{2}a$

[Jee Main, 2020]

8. Element 'B' forms ccp structure and 'A' occupies half of the octahedral voids, while oxygen atoms occupy all the tetrahedral voids. The structure of bimetallic oxide is : **(Solid State)**

- (A) AB_2O_4 (B) A_4B_2O (C) A_4BO_4 (D) A_2B_2O

[Jee Main, April 2019]

9. An element has a face-centred cubic (fcc) structure with a cell edge of a . The distance between the centres of two nearest tetrahedral voids in the lattice is:

- (A) $\sqrt{2}a$ (B) a (C) $\frac{a}{2}$ (D) $\frac{3}{2}a$

(Physical Chemistry)

[Jee Main, April 2019]

10. In a binary compound, atoms of element A form a hcp structure and those of element M occupy $\frac{2}{3}$ of the tetrahedral voids of the hcp structure. The formula of the binary compound is:
- (A) M_2A_3 (B) M_4A_3 (C) M_4A (D) MA_3

[JEE Main, March 2021]

11. In a solid AB. A atoms are in ccp arrangement and B atoms occupy all the octahedral sites. If two atoms from the opposite faces are removed, then the resultant stoichiometry of the compound is A_xB_y . The value of x is _____. [nearest integer]

[JEE Main, June 2022]

12. Given below are two statements.

Statement I: Frenkel defects are vacancy as well as interstitial defects.

Statement II: Frenkel defect leads to colour in ionic solids due to presence of F-centres.

Choose the most appropriate answer for the statements from the options given below:

- (A) Statement I is false but Statement II is true
 (B) Both Statement I and Statement II are true
 (C) Statement I is true but Statement II is false
 (D) Both Statement I and Statement II are false

[JEE Main, August 2021]

13. Metal deficiency defect is shown by $Fe_{0.93}O$. In the crystal, some Fe^{2+} cations are missing and loss of positive charge is compensated by the presence of Fe^{3+} ions. The percentage of Fe^{2+} ions in the $Fe_{0.93}O$ crystals is _____. (Nearest integer)

[JEE Main, June 2022]

14. A hard substance melts at high temperature and is an insulator in both solid and in molten state. This solid is most likely to be a / an :
- (A) Ionic solid (B) Molecular solid
 (C) Metallic solid (D) Covalent solid

[JEE Main, March 2021]

15. Match items of List-I with those of List-II :

[JEE Main, August 2021]

List-I**List-II**

(Property)

(Example)

(a) Diamagnetism

(i) MnO

(Physical Chemistry)

- | | |
|------------------------|----------------|
| (b) Ferrimagnetism | (ii) O_2 |
| (c) Paramagnetism | (iii) NaCl |
| (d) Antiferromagnetism | (iv) Fe_3O_4 |

Choose the most appropriate answer from the options given below:

- (A) (a)–(ii), (b)–(i), (c)–(iii), (d)–(iv)
(B) (a)–(i), (b)–(iii), (c)–(iv), (d)–(ii)
(C) (a)–(iii), (b)–(iv), (c)–(ii), (d)–(i)
(D) (a)–(iv), (b)–(ii), (c)–(i), (d)–(iii)



ANSWER KEY

1. (D) 2. (C) 3. (C) 4. (A) 5. (C) 6. (143) 7. (A)
8. (A) 9. (C) 10. (B) 11. (3) 12. (C) 13. (85) 14. (D)
15. (C)

A