



Additional Problems for Self Practice (APSP)

➤ Marked questions are recommended for Revision.

This Section is not meant for classroom discussion. It is being given to promote self-study and self testing amongst the Resonance students.

PART - I : PRACTICE TEST-1 (IIT-JEE (MAIN Pattern))

Max. Time : 1 Hr.

Max. Marks : 120

Important Instructions

1. The test is of **1 hour** duration.
2. The Test Booklet consists of **30** questions. The maximum marks are **120**.
3. Each question is allotted **4 (four)** marks for correct response.
4. Candidates will be awarded marks as stated above in Instructions No. 3 for correct response of each question. $\frac{1}{4}$ (**one fourth**) marks will be deducted for indicating incorrect response of each question. No deduction from the total score will be made if no response is indicated for an item in the answer sheet.
5. There is only one correct response for each question. Filling up more than one response in any question will be treated as wrong response and marks for wrong response will be deducted accordingly as per instructions 4 above.

1. For adsorption of a gas on a solid, the plot of $\log(x/m)$ Vs $\log P$ is linear with a slope equal to :
[n being a whole number]
(1) K (2) $\log K$ (3) n (4) $1/n$
2. Surface tension of lyophilic sols is :
(1) Lower than that of H_2O (2) More than that of H_2O
(3) Equal to that of H_2O (4) None of the above
3. On passing light from colloidal solution, the effect due to scattering of light is known as :
(1) Electrophoresis (2) Tyndall effect (3) Electro osmosis (4) Coagulation
4. Tyndall effect is shown by :
(1) Colloid (2) True Solution (3) Suspension (4) all of these
5. Milk is an example of :
(1) True solution (2) Gel (3) Suspension (4) Emulsion
6. Most effective ion to coagulate a negative sol is :
(1) PO_4^{3-} (2) Al^{3+} (3) Ba^{2+} (4) K^+
7. Which of the following electrolytes will be most effective in the coagulation of gold sol :
(1) $NaNO_3$ (2) $K_4[Fe(CN)_6]$ (3) Na_3PO_4 (4) $MgCl_2$
8. ➤ The stability of lyophilic colloid is due to which of the following :
(1) Charge on their particles (2) Large size of their particles
(3) Small size of their particles (4) Solvation by dispersion medium
9. ➤ A colloidal solution is subjected to an electrical field. The particles move towards anode. The coagulation of the same solution is studied using $NaCl$, $BaCl_2$ and $AlCl_3$ solutions. Their coagulating power should be
(1) $NaCl > BaCl_2 > AlCl_3$ (2) $BaCl_2 > AlCl_3 > NaCl$
(3) $AlCl_3 > BaCl_2 > NaCl$ (4) $BaCl_2 > NaCl > AlCl_3$
10. Which of the following is most effective in coagulating a ferric hydroxide sol :
(1) KCl (2) KNO_3 (3) K_2SO_4 (4) $K_3[Fe(CN)_6]$
11. Fog is an example of colloidal system of :
(1) Liquid dispersed in gas (2) Gas dispersed in gas
(3) Solid dispersed in gas (4) Solid dispersed in liquid



12. The charge on As_2S_3 sol is due to the adsorbed :
 (1) H^+ (2) OH^- (3) O^{2-} (4) S^{2-}
13. The sky looks blue due to :
 (1) Dispersion (2) Reflection (3) Transmission (4) Scattering
14. Tyndall effect will be mainly observed in :
 (1) Lyophilic colloid (2) Lyophobic colloid (3) True solution (4) Vapour
15. The Brownian motion is due to :
 (1) Temperature fluctuation within the liquid phase
 (2) Attraction and repulsion between charge on the colloidal particles
 (3) Impact of molecules of the dispersion medium on the colloidal particles
 (4) All of these
16. In coagulating the colloidal solution of As_2S_3 which has the minimum coagulating value :
 (1) NaCl (2) KCl (3) BaCl_2 (4) AlCl_3
17. Positive sol is :
 (1) Gold (2) Gelatin (3) As_2S_3 (4) None of these
18. Which one is a lyophobic colloid :
 (1) Gelatin (2) Starch (3) Sulphur (4) Gum arabic
19. Smoke is an example of :
 (1) Gas dispersed in liquid (2) Gas dispersed in solid
 (3) Solid dispersed in gas (4) Solid dispersed in solid
20. A colloidal solution of arsenious sulphide is most readily coagulated by the addition of a normal solution?
 (1) NaCl (2) CaCl_2 (3) Na_3PO_4 (4) $\text{Al}_2(\text{SO}_4)_3$
21. A colloid always :
 (1) Contains two phases (2) Is a true solution
 (3) Contains three phases (4) Contains only water soluble particles
22. Which of the following ions has maximum flocculation value :
 (1) $[\text{Fe}(\text{CN})_6]^{4-}$ (2) Cl^- (3) SO_4^{2-} (4) PO_4^{3-}
23. Which of the following gases, will be adsorbed maximum on a solid surface :
 (1) CO_2 (2) O_2 (3) N_2 (4) H_2
24. Which of the following is a mismatch :
 (1) Lyophilic colloids – reversible sols
 (2) Associated colloids – micelles
 (3) Tyndall effect – scattering of light by colloidal particle
 (4) Electrophoresis – movement of dispersion medium under the influence of electric field
25. A negative catalyst will
 (1) raise the energy of activation for a given reaction
 (2) take away the internal energy of reactants and deactivate them
 (3) catalyse the backward reaction more than the forward one, thereby shifting equilibrium backward.
 (4) none of these
26. A liquid is found to scatter a beam of light but leaves no residue when passed through the filter paper. The liquid can be described as
 (1) a suspension (2) Oil (3) a colloidal sol (4) a true solution
27. Which of the following kinds of catalysis can be explained by the adsorption theory?
 (1) heterogeneous catalysis (2) enzyme catalysis
 (3) homogeneous catalysis (4) acid base catalysis



28. Which of the following relations is (are) correct according to Freundlich ?
 (i) $x/m = \text{constant}$
 (ii) $x/m = \text{constant} \times p^{1/n}$ ($n > 1$)
 (iii) $x/m = \text{constant} \times p^n$ ($n > 1$)
 (1) All are correct (2) All are wrong (3) (ii) is correct (4) (iii) is correct
29. The physical adsorption of gases on the solid surface is due to
 (1) vander Waals forces (2) covalent bonding
 (3) hydrogen bonding (4) All of these
30. Correct equation of Freundlich isotherm is
 (1) $\log \left(\frac{x}{m} \right) = \log K + \frac{1}{n} \log C$ (2) $\log \left(\frac{x}{m} \right) = \log m + \frac{1}{n} \log C$
 (3) $\log \left(\frac{x}{m} \right) = \log C + \frac{1}{K} \log C$ (4) $\log \left(\frac{x}{m} \right) = \log C + \frac{1}{n} \log K$

Practice Test-1 (IIT-JEE (Main Pattern))

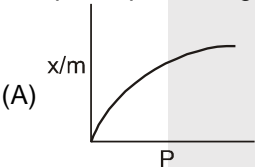
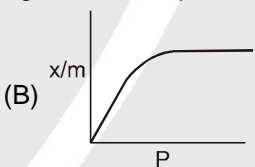
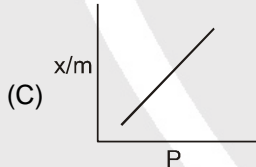
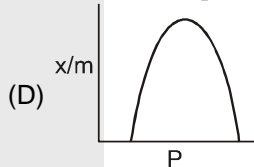
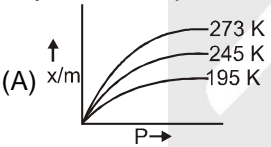
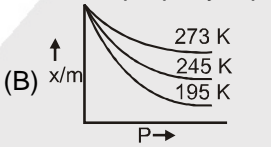
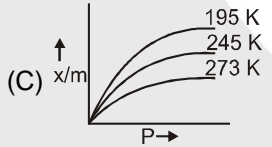
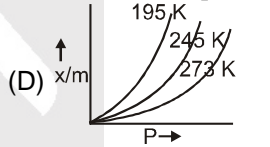
OBJECTIVE RESPONSE SHEET (ORS)

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

PART - II : NATIONAL STANDARD EXAMINATION IN CHEMISTRY (NSEC) STAGE-I

1. Smoke is a colloidal sol of [NSEC-2000]
 (A) gas dispersed in a solid (B) solid dispersed in a gas
 (C) solid dispersed in a liquid (D) gas dispersed in a liquid
2. A catalyst : [NSEC-2001]
 (A) alters the reaction mechanism
 (B) decreases the activation energy
 (C) increases the average kinetic energy of reacting molecule
 (D) increases the frequency of collisions of reacting species
3. The colloidal system in which the disperse phase and dispersion medium are both liquids is known as : [NSEC-2001]
 (A) an emulsion (B) an aerosol (C) gel (D) a foam
4. Soaps essentially form a colloidal solution in water and remove the greasy matters by : [NSEC-2001]
 (A) adsorption (B) emulsification (C) coagulation (D) absorption
5. Swimming for a long time in salt water makes the skin of one's finger tips wrinkled. Which one of the following properties is responsible for this observation ? [NSEC-2002]
 (A) osmosis (B) dialysis (C) electrodialysis (D) coagulation.
6. Tyndal effect in a colloid is due to [NSEC-2002]
 (A) interference of light (B) defraction of light
 (C) reflection of light (D) scattering of light.



7. Ferric chloride is used to stop bleeding in cuts, because [NSEC-2002]
 (A) Fe^{3+} coagulates blood which is a positively charged sol
 (B) Fe^{3+} coagulates blood which is a negatively charged sol
 (C) Cl^- coagulates blood which is a positively charged sol
 (D) Cl^- coagulates blood which is negatively charged sol
8. A catalyst is a substance which [NSEC-2002]
 (A) accelerates the rate of reaction
 (B) does not influence the rate of reaction
 (C) changes the equilibrium position
 (D) does not alter the energy of activation of the reaction
9. In nature, ammonia is synthesised by nitrifying bacteria using enzymes while in industry it is manufactured from N_2 and H_2 using iron oxide catalyst at 550°C . Under the same industrial conditions, enzymes cannot be used because [NSEC-2003]
 (A) enzymes get deactivated at high temperature
 (B) enzymes catalyze reactions only in living systems
 (C) the reaction becomes vigorous and uncontrollable
 (D) the enzymes use nitrates in place of N_2 .
10. A catalyst increases the [NSEC-2003]
 (A) rate of forward reaction only
 (B) free energy change in the reaction
 (C) rates of both forward and reverse reactions
 (D) equilibrium constant of the reaction.
11. A soap solution in water removes greasy substances by [NSEC-2004]
 (A) adsorption
 (B) peptization
 (C) coagulation
 (D) emulsification.
12. Smoke is an example of [NSEC-2005]
 (A) sol
 (B) aerosol
 (C) emulsion
 (D) gel.
13. A catalyst speeds up a chemical reaction by [NSEC-2008]
 (A) shifting the equilibrium
 (B) increasing the activation energy
 (C) initiating the reaction
 (D) decreasing energy of activation
14. The plot representing Langmuir's adsorption isotherm is : [NSEC-2009]
 (A)  (B)  (C)  (D) 
15. Physical adsorption isotherms are properly represented as in [NSEC-2010]
 (A)  (B)  (C)  (D) 
16. A gold sol is prepared by : [NSEC-2010]
 (A) dissolving gold in Aqua-regia and precipitation by dilution
 (B) double decomposition of AuCl_3
 (C) Bredy's arc method
 (D) grinding in a colloidal mill
17. Effective electrolyte to cause the flocculation of a negatively charged arsenium sulphide colloid is: [NSEC-2012]
 (A) NaCl
 (B) BaCl_2
 (C) $\text{K}_3\text{Fe}(\text{CN})_6$
 (D) AlCl_3
18. A catalyst is a substance that : [NSEC-2013]
 (A) undergoes chemical change to accelerate the rate of the reaction
 (B) decreases the energy of activation of the reaction
 (C) increases the kinetic energy of the reaction
 (D) lowers the potential energy of the products with respect to that of the reactants.



19. Which of the following reaction parameters will change due to addition of a catalyst ? [NSEC-2013]
 (A) Free energy (B) Only equilibrium constant
 (C) Only rate constant (D) Both equilibrium constant and rate constant
20. In electrophoresis, [NSEC-2014]
 (A) the colloidal particles migrate in an applied electric field.
 (B) the medium migrates in an applied electric field
 (C) both colloidal particles and the medium migrate.
 (D) neither the particles nor the medium migrate.
21. 100 mL of 0.3 M acetic acid is shaken with 0.8 g wood charcoal. The final concentration of acetic acid in the solution after adsorption is 0.125 M. The mass of "acetic acid adsorbed per gram of charcoal is: [NSEC-2015]
 (A) 1.05 g (B) 0.0131 g (C) 1.31 g (D) 0.131 g
22. The mass of argon adsorbed per unit mass of carbon surface is plotted against pressure. Which of the following plots is correct if x and m represent the masses of argon and carbon respectively ? (..... represents extrapolated data) [NSEC-2016]
- (A) x/m

(B) x/m

(C) x/m

(D) x/m
23. An adsorption isotherm equation proposed by Langmuir is of the form $V = \frac{V_0 b P}{(1 + bP)}$ where V is the volume of gas adsorbed at pressure P . For a given adsorbate/adsorbent system, V_0 and b are constants. The dependence of V on P can be depicted as [NSEC-2018]
- (A) $1/V$

(B) $1/V$

(C) V

(D) $1/V$

PART - III : HIGH LEVEL PROBLEMS (HLP)

SUBJECTIVE QUESTIONS

- A 1 cm × 1 cm square paper coated with a suitable adsorbent on both sides. The paper is dipped in a aqueous solution of glucose of volume 20 mL and concentration 20 ppm. Final concentration glucose was dropped to 19 ppm due to adsorption. Find the number of glucose particles per unit area of the paper.
- When 9.0 ml of arsenious sulphide sol and 1.0 ml of 0.1 M BaCl₂ are mixed, turbidity due to precipitation just appears after 2 hours. Find the coagulating value of the effective ion.

ONLY ONE OPTION CORRECT TYPE

- Some type of gels like gelatin loose water slowly. The process is known as :
 (A) Syneresis (B) Thixotropy (C) Peptisation (D) Imbibition



4. Select correct statement (s) :
 (A) hydrophilic colloid is a colloid in which there is a strong attraction between the dispersed phase and water
 (B) hydrophobic colloid is a colloid in which there is a lack of attraction between the dispersed phase and water
 (C) hydrophobic sols are often formed when a solid crystallises rapidly from a chemical reaction or a supersaturated solution
 (D) all of the above
5. A reddish brown sol (containing Fe^{3+}) is obtained by:
 (A) the addition of small amount of FeCl_3 solution to freshly prepared $\text{Fe}(\text{OH})_3$ precipitate
 (B) the addition of $\text{Fe}(\text{OH})_3$ to freshly prepared FeCl_3 solution
 (C) the addition of NH_4OH to FeCl_3 solution dropwise
 (D) the addition of NaOH to FeCl_3 solution dropwise
6. The stabilisation of a lyophobic colloid is due to :
 (A) preferential adsorption of similar charged particle on colloids surface.
 (B) interaction between dispersed phase and dispersion medium
 (C) the formation of a covalent bond between two phases.
 (D) the viscosity of the medium.
7. Compared to common colloidal sols, micelles have :
 (A) higher colligative properties
 (B) lower colligative properties
 (C) same colligative properties
 (D) none of these
8. Graph between $\log x/m$ and $\log p$ is a straight line inclined at an angle of 45° . When pressure is 0.5 atm and $\ln k = 0.693$, the amount of solute adsorbed per gram of adsorbent will be :
 (A) 1
 (B) 1.5
 (C) 0.25
 (D) 2.5
9. The coagulation of 200 mL of a positive colloid took place when 0.73 g HCl was added to it without changing the volume much. The flocculation value of HCl for the colloid is :
 (A) 0.36
 (B) 36.5
 (C) 100
 (D) 150

SINGLE AND DOUBLE VALUE INTEGER TYPE

10. 0.02 g of gelatin is required to protect 10 mL of gold sol from 10% NaCl, then find the gold number for gelatin. Report your answer by multiplying by 100.

ONE OR MORE THAN ONE OPTIONS CORRECT TYPE

11. The **incorrect** statements are -
 (A) For coagulation of As_2S_3 sol, +ve ions are effective.
 (B) For coagulation of aluminium hydroxide sol Ba^{2+} ions are more effective than Na^+
 (C) Cellulose solution is an example of multimolecular colloid system
 (D) Colloidal sol of metals such as gold, silver etc are prepared by Bredig's arc method.
12. An example of extrinsic colloid (lyophobic colloids) is :
 (A) As_2S_3 sol
 (B) $\text{Fe}(\text{OH})_3$ sol
 (C) Egg albumin
 (D) Au sol
13. Which of the following are the characteristic of chemisorption :
 (A) Multilayer adsorption
 (B) Exothermic nature
 (C) Strong adsorption by adsorption sites
 (D) Irreversible
14. If Cl_2 gas is enclosed in presence of powdered charcoal in a closed vessel, the pressure of the gas decreases. It is because
 (A) the gas molecules are absorbed at the surface
 (B) the gas molecules concentrate at the surface of the charcoal
 (C) the gas molecules are adsorbed at the surface
 (D) the gas molecules are desorbed by the surface
15. Which of the following colloidal solutions contain negatively charged colloidal particles?
 (A) $\text{Fe}(\text{OH})_3$ sol
 (B) As_2S_3 sol
 (C) Blood
 (D) Gold sol



16. Which of the following statements is correct for a lyophobic solution ?
 (A) It can be easily solvated (B) It carries charges
 (C) The coagulation of this sol is irreversible in nature (D) It is less stable in a solvent
17. Which one of the following statements is/are not correct ?
 (A) Brownian movement is more pronounced for smaller particles than for bigger ones
 (B) Sols of metal sulphides are lyophilic
 (C) Schulze-Hardy law states, the bigger the size of the ion, the greater is its coagulating power
 (D) One would expect charcoal to adsorb hydrogen gas more strongly than chlorine.

PART - IV : PRACTICE TEST-2 (IIT-JEE (ADVANCED Pattern))

Max. Time : 1 Hr.

Max. Marks : 66

Important Instructions

A. General :

- The test is of 1 hour duration.
- The Test Booklet consists of 22 questions. The maximum marks are 66.

B. Question Paper Format :

- Each part consists of five sections.
- Section-1 contains 7 multiple choice questions. Each question has four choices (A), (B), (C) and (D) out of which ONE is correct.
- Section-2 contains 5 multiple choice questions. Each question has four choices (A), (B), (C) and (D) out of which ONE OR MORE THAN ONE are correct.
- Section-3 contains 6 questions. The answer to each of the questions is a single-digit integer, ranging from 0 to 9 (both inclusive).
- Section-4 contains 1 paragraphs each describing theory, experiment and data etc. 3 questions relate to paragraph. Each question pertaining to a particular passage should have only one correct answer among the four given choices (A), (B), (C) and (D).
- Section-5 contains 1 multiple choice questions. Question has two lists (list-1 : P, Q, R and S; List-2 : 1, 2, 3 and 4). The options for the correct match are provided as (A), (B), (C) and (D) out of which ONLY ONE is correct.

C. Marking Scheme :

- For each question in Section-1, 4 and 5 you will be awarded 3 marks if you darken the bubble corresponding to the correct answer and zero mark if no bubble is darkened. In all other cases, minus one (– 1) mark will be awarded.
- For each question in Section-2, you will be awarded 3 marks. If you darken all the bubble(s) corresponding to the correct answer(s) and zero mark. If no bubbles are darkened. No negative marks will be awarded for incorrect answer in this section.
- For each question in Section-3, you will be awarded 3 marks if you darken only the bubble corresponding to the correct answer and zero mark if no bubble is darkened. No negative marks will be awarded for incorrect answer in this section.

SECTION-1 : (Only One option correct Type)

This section contains 7 multiple choice questions. Each questions has four choices (A), (B), (C) and (D) out of which Only ONE option is correct.

- An arsenious sulphide sol carries a negative charge. The maximum precipitating power of this sol is :
 possessed by :
 (A) K_2SO_4 (B) $CaCl_2$ (C) Na_3PO_4 (D) $AlCl_3$
- According to Hardy-Schulze rule, the coagulating power of cation follows the order :
 (A) $Na^+ > Ba^{2+} > Al^{3+}$ (B) $Al^{3+} > Ba^{2+} > Na^+$
 (C) $Ba^{2+} > Al^{3+} > Na^+$ (D) $Al^{3+} > Na^+ > Ba^{2+}$
- Which of the following electrolytes is least effective in causing flocculation of ferric hydroxide sol :
 (A) $K_4[Fe(CN)_6]$ (B) K_2CrO_4 (C) KBr (D) K_2SO_4
- Lyophobic colloids are :
 (A) Reversible colloids (B) Irreversible colloids (C) Protective colloids (D) Gum proteins





5. Which among the following statements is false ?
 (A) Increase of pressure increases the amount of adsorption.
 (B) Increase of temperature may decrease the amount of adsorption.
 (C) The adsorption may be monolayered or multilayered.
 (D) Particle size of the adsorbent will not affect the amount of adsorption.
6. (i) At 298 K the volume of NH_3 adsorbed by 1g of charcoal is higher than that of H_2 under similar conditions.
 (ii) The movement of colloidal particles towards the oppositely charged electrodes on passing electric current is known as Brownian movement.
 (A) T, T (B) T, F (C) F, T (D) F, F
7. Identify the correct statement regarding enzymes.
 (A) Enzymes are specific biological catalysts that can normally function at very high temp. ($T \approx 1000 \text{ K}$)
 (B) Enzymes are normally heterogeneous catalysts that are very specific in action
 (C) Enzymes are specific biological catalysts that can not be poisoned
 (D) Enzymes are non-biological catalysts.

Section-2 : (One or More than one options correct Type)

This section contains 5 multiple choice questions. Each questions has four choices (A), (B), (C) and (D) out of which ONE or MORE THAN ONE are correct.

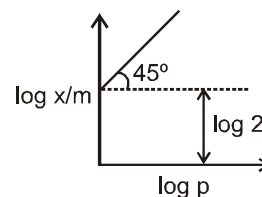
8. Which of the following statements is correct?
 (A) The efficiency of a heterogeneous catalyst depends upon its surface area.
 (B) Catalyst operates by providing alternate path for the reaction that involves a lower activation energy.
 (C) Catalyst lowers the energy of activation of the forward direction without affecting the energy of activation of the backward direction.
 (D) Catalyst does not affect the overall enthalpy change of the reaction.
9. Which of the following statements is (are) true?
 (A) The concentration of a homogeneous catalyst may appear in the rate expression.
 (B) A catalyst is always consumed in the reaction.
 (C) A catalyst must always be in the same phase as the reactants.
 (D) None of these
10. The correct statement(s) pertaining to the adsorption of a gas on a solid surface is (are)
 (A) Adsorption is always exothermic
 (B) Physisorption may transform into chemisorption at high temperature
 (C) Physisorption increases with increasing temperature but chemisorption decreases with increasing temperature
 (D) Chemisorption is more exothermic than physisorption, however it is very slow due to higher energy of activation.
11. The **incorrect** statements are -
 (A) For coagulation of As_2S_3 sol, +ve ions are effective.
 (B) For coagulation of aluminium hydroxide sol Ba^{2+} ions are more effective than Na^+
 (C) Cellulose solution is an example of multimolecular colloid system
 (D) Colloidal sol of metals such as gold, silver etc are prepared by Bredig's arc method.
12. Select the **CORRECT** statements :
 (A) Langmuir adsorption isotherm is expected to be applicable at low gas pressure and moderately high temperature.
 (B) The rate of an enzyme catalysed reaction depends upon enzyme concentration.
 (C) A negative catalyst raises the activation energy barrier of a reaction and thus reduces its rate.
 (D) In physisorption gases having higher critical temperature are adsorbed to a greater extent than those with lower critical temperature.

Section-3 : (One Integer Value Correct Type.)

This section contains 6 questions. Each question, when worked out will result in one integer from 0 to 9 (both inclusive)



13. On addition of one ml solution of 10% NaCl to 10 ml gold sol in the presence of 0.0250 g of starch the coagulation is just prevented. Starch has the following gold number :
14. At 2 atm pressure the value of $\frac{x}{m}$ will be : ($\log 2 = 0.3010$)
15. 1 L of 0.6 M acetic acid is shaken with 2 g activated carbon. Activated carbon absorbs some acetic acid on its surface only. This process is called adsorption. The final concentration of the solution after adsorption is 0.5 M. What is the amount of acetic acid adsorbed per gram of carbon.
16. A detergent ($C_{12}H_{25}SO_4Na$) solution becomes a colloidal solution at a concentration of 10^{-3} mol/lit. On an average 10^{13} colloidal particles are present in 1 mm^3 what is average number of $C_{12}H_{25}SO_4Na$ in one colloidal particle ?
17. For the coagulation of 200 mL of As_2S_3 solution, 10 mL of 1 M NaCl is required. What is the coagulating value of NaCl.
18. A solution of palmitic acid (Molar mass = 256 g) in Benzene contain 5.12 g of acid per litre of solution. When this solution is dropped on a water surface, the Benzene evaporates and acid forms a monolayer film of solid type. If 500 cm^2 area is to be covered by a monolayer, then find X, where $X = 10^5 V$, when V is volume required (in L) of solution. The area covered by 1 molecule = 0.2 nm^2 .



SECTION-4 : Comprehension Type (Only One options correct)

This section contains 1 paragraphs, each describing theory, experiments, data etc. 3 questions relate to the paragraph. Each question has only one correct answer among the four given options (A), (B), (C) and (D).

Paragraph for Questions 19 to 21

Read the following passage carefully and answer the questions.

The Colloidal particles are electrically charged as is indicated by their migration towards cathode or anode under the applied electric field. In a particular colloidal system, all particles carry either positive charge or negative charge.

The electric charge on colloidal particles originate in several ways. According to preferential adsorption theory, the freshly obtained precipitate particles adsorb ions from the dispersion medium, which are common to their lattice and acquire the charge of adsorbed ions. For example, freshly obtained $Fe(OH)_3$ precipitated is dispersed, by a little $FeCl_3$, into colloidal solution owing to the adsorptions of Fe^{3+} ions in preference. Thus sol particles will be positively charged.

In some cases the colloidal particles are aggregates of cations or anions having amphiphilic character. When the ions possess hydrophobic part (hydrocarbon end) as well as hydrophilic part (polar end group), they undergo association in aqueous solution to form particles having colloidal size. The formation of such particles, called micelles plays a very important role in the solubilization of water insoluble substances, (hydrocarbon, oils, fats, grease etc.). In micelles, the polar end groups are directed towards water and the hydrocarbon ends into the centre.

The charge on sol particles of the proteins depends on the pH. At low pH, the basic group of protein molecule is ionized (protonated) and at higher pH (alkaline medium), the acidic group is ionized. At Isoelectric pH, characteristic to the protein, both basic and acidic groups are equally ionized.

The stability of colloidal solution is attributed largely to the electric charge of the dispersed particles. This charge causes them to be coagulated or precipitated. On addition of small amount of electrolytes, the ions carrying opposite charge are adsorbed by sol particles resulting in the neutralization of their charge. When the sol particles either with no charge or reduced charge, come closer due to Brownian movement, they aggregate to form bigger particles resulting in their separation from the dispersion medium. This is what is called coagulation or precipitation of the colloidal solution. The coagulating power of the effective ion, which depend on its charge, is expressed in terms of its coagulating value, defined as its minimum concentration (m mol/L) needed to precipitate a given sol.



19. How would you obtain a sol of AgI, the particles of which migrate toward cathode under the electric field?
 (A) By adding little excess of KI to AgNO₃ solution
 (B) By adding little excess of AgNO₃ to KI solution
 (C) By mixing equal volumes of 0.010 M AgNO₃ and 0.010 M KI
 (D) None of these
20. 100 ml each of two sols of AgI, one obtained by adding AgNO₃ to slight excess of KI and another obtained by adding KI to slight excess of AgNO₃, are mixed together. Then
 (A) The two sols will stabilize each other (B) The sol particles will acquire more electric charge
 (C) The sols will coagulate each other mutually (D) A true solution will be obtained
21. Under the influence of an electric field, the particles in a sol migrate towards cathode. The coagulation of the same sol is studied using NaCl, Na₂SO₄ and Na₃PO₄ solutions. Their coagulating values will be in the order
 (A) NaCl > Na₂SO₄ > Na₃PO₄ (B) Na₂SO₄ > Na₃PO₄ > NaCl
 (C) Na₃PO₄ > Na₂SO₄ > NaCl (D) Na₂SO₄ > NaCl > Na₃PO₄

SECTION-5 : Matching List Type (Only One options correct)

This section contains 1 questions, each having two matching lists. Choices for the correct combination of elements from List-I and List-II are given as options (A), (B), (C) and (D) out of which one is correct.

22. Match list I with list II and select the correct answer :

	List I		List II
P	Coagulation	1.	Scattering of light
Q	Dialysis	2.	Formation of colloidal solution from precipitates.
R	Peptization	3.	Purification of colloids
S	Tyndall effect	4.	Accumulation of collidal sols

Code:

	P	Q	R	S		P	Q	R	S
(A)	3	4	1	2	(B)	1	2	4	3
(C)	3	3	2	1	(D)	2	3	1	4

Practice Test-2 ((IIT-JEE (ADVANCED Pattern)) OBJECTIVE RESPONSE SHEET (ORS)

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



APSP Answers

PART - I

1. (4)	2. (1)	3. (2)	4. (1)	5. (4)
6. (2)	7. (4)	8. (4)	9. (3)	10. (4)
11. (1)	12. (4)	13. (4)	14. (2)	15. (3)
16. (4)	17. (4)	18. (3)	19. (3)	20. (4)
21. (1)	22. (2)	23. (1)	24. (4)	25. (2)
26. (3)	27. (1)	28. (3)	29. (1)	30. (1)

PART - II

1. (B)	2. (B)	3. (A)	4. (B)	5. (A)
6. (D)	7. (B)	8. (A)	9. (A)	10. (C)
11. (D)	12. (B)	13. (D)	14. (B)	15. (C)
16. (C)	17. (D)	18. (B)	19. (C)	20. (A)
21. (C)	22. (D)	23. (B)		

PART - III

1. $3.33 \times 10^{16} \text{ cm}^{-2}$	2. Ba^{2+} , 10 m mol/L	3. (A)
4. (D)	5. (A)	6. (A)
7. (B)	8. (A)	
9. (C)	10. 20	11. (BC)
12. (ABD)	13. (BCD)	
14. (BC)	15. (BCD)	16. (BCD)
		17. (BCD)

PART - IV

1. (D)	2. (B)	3. (C)	4. (B)	5. (D)
6. (B)	7. (B)	8. (ABD)	9. (A)	10. (ABD)
11. (BC)	12. (ABD)	13. 25	14. 4	15. 03
16. 60	17. 50	18. 2	19. (B)	20. (C)
21. (A)	22. (C)			



APSP Solutions

PART - I

- $\frac{x}{m} = KP^{1/n}$, $\log \frac{x}{m} = \log K + \frac{1}{n} \log P$
- That's why lyophilic colloid has affinity for water.
- Scattering of light by colloidal particles is known as Tyndall effect.
- Tyndall effect is shown by colloidal solution.
- In milk, liquid fat particles are dispersed in water.
- Higher the charge on coagulating ion, higher the coagulating power.
- Gold sol is – ve sol, so coagulating ion is cation.
- Lyophilic colloid is solvated by dispersion medium and becomes more stable.
- Coagulating power \propto charge on coagulating ion.
- Effectiveness of coagulation by electrolyte \propto charge on coagulating ion.
- Fog is an example of liquid dispersed in gas.
- As_2S_3 colloidal sol is obtained when As_2O_3 is saturated with H_2S :
 $As_2O_3 + 3H_2S \rightarrow As_2S_3 + 3H_2O$.
 As_2S_3 adsorbs S^{2-} ions (common between H_2S and As_2S_3 and thus is negatively charged).
 $As_2S_3 + H_2S \rightarrow As_2S_3 \quad S^{2-} : 2H^+$.
- Light is scattered by colloidal particles present in environment so sky looks blue.
- Colloidal particle shows Tyndall effect because of its larger size.
- Brownian motion is due to impact of molecules of the dispersion medium on the colloidal particles.
- As_2S_3 is negatively charged sol so more positively charged ion will have minimum coagulating value.
- All are negative sols.
- Sulphur is a lyophobic colloid.
- Smoke is an example of solid dispersed in gas.
- Arsenious sulphide is negatively charged sol so more the charge on cation of electrolyte, more the efficiency of electrolyte for coagulation.
- Colloid is heterogeneous, biphasic solution.
- Smaller the charge on coagulating ion, higher the flocculation value.
- Easily liquefiable gases like CO_2 are adsorbed to a greater extent than gases like O_2 , N_2 and H_2



24. Electrophoresis means movement of colloidal particles under the influence of electric field.
25. Negative catalyst provides a path of higher activation energy
26. These are the properties of colloidal solution.
27. Adsorption theory is given for heterogeneous catalyst. Example : adsorption of gas on solid surface.
28. According to Freundlich adsorption isotherm, $\frac{x}{m} \propto kp^{1/n}$ ($n > 1$).
29. Physical adsorption is due to vander waals forces.
30. According to Freundlich isotherm : $\frac{x}{m} = Kp^{1/n}$ or $\log \frac{x}{m} = \log K + \frac{1}{n} \log P$ (For solution, $P = C$).

PART - III

1. Mass of glucose adsorbed = $(20 - 19) \times \frac{20}{10^6} = 2 \times 10^{-5}$ g.
 Moles of glucose adsorbed = $\frac{2 \times 10^{-5}}{180} = \frac{10^{-6}}{9}$.
 Number of glucose molecules = $\frac{10^{-6}}{9} \times 6 \times 10^{23} = \frac{20}{3} \times 10^{16}$
 Number of glucose molecules per unit area = $\frac{1}{2} \times \frac{20}{3} \times 10^{16} = 3.33 \times 10^{16} \text{ cm}^{-2}$.
2. Conc. of $\text{Ba}^{2+} = \frac{10^{-4}}{10 \times 10^{-3}} \text{ M} = 10^{-2} \text{ M} = 10 \text{ mmole/L}$.
3. Loss of water from gel is known as syneresis.
4. All are facts to remember.
5. Reddish brown sol is prepared by adding FeCl_3 in $\text{Fe}(\text{OH})_3$ precipitate.
6. Similar charged colloidal particles will repel each other so colloidal system will not be suspended.
7. Micelles have large molar mass so less colligative property.
8. $\log \frac{x}{M} = \log k + \frac{1}{n} \log P$
 $\frac{1}{n} = \tan 45^\circ$ $\ln k = 0.69$
 $n = 1$ $k = 2$
 $\frac{x}{m} = 2 \times (0.5)^1$
 $x = 1$



9. 200 mL of the sol require = 0.73 g HCl

$$= \frac{0.73}{36.5} \text{ mol} = 0.02 \text{ mol} = 20 \text{ mmol}$$
 So, flocculation value of HCl = $\frac{20 \text{ mmol}}{0.2 \text{ lit}} = 100$
10. Gold number is minimum amount of protective colloid which can protect 10 mL standard gold sol from coagulation when 1 mL of 10% NaCl is added.
11. (B) Aluminium hydroxide is a +ve sol, so – ve ions are effective in coagulation.
 (C) Cellulose solution is an example of macromolecular colloid.
12. Egg albumin is lyophilic colloid.
13. Monolayer is formed during chemisorption.
14. This is because of absorption.
15. $\text{Fe}(\text{OH})_3$ is positive sol, remaining all three are negative sol.
16. Lyophobic colloid are solvent hating.
17. Small particles has more random behaviour.

PART - IV

1. –ve charged sol is coagulated by cation of electrolyte. More the charge on cation, higher the precipitating power.
2. More the charge on cation, higher the coagulating power.
3. Ferric hydroxide sol is + vely charged sol.
4. Lyophobic colloids are irreversible colloids.
5. Particle size of the adsorbent affects the amount of adsorption.
6. (i) NH_3 is easily liquifiable, so ordered more than H_2 .
 (ii) This phenomenon is known as electrophoresis, not Brownian movement.
7. Enzymes are highly specific heterogeneous catalyst.
8. Efficiency of a heterogeneous catalyst increases with its surface area.
 Catalyst provides a path of lower activation energy but enthalpy of reaction is not affected.
9. Catalyst may appear in rate expression. But it is not consumed in the reaction.
10. (A) $\Delta H = -ve$ for adsorption
 (B) fact
 (D) chemical bonds are stronger than vander waal's forces so chemical adsorption is more exothermic.
11. (B) Aluminium hydroxide is a +ve sol, so – ve ions are effective in coagulation.
 (C) Cellulose solution is an example of macromolecular colloid.
12. A negative catalyst does not raises the activation energy barrier of a reaction; it actually functions to remove the active intermediate from the reaction and thus, it retards the rate of a reaction.



13. Gold number is minimum amount of protective colloid which can protect 10 ml standard gold sol from coagulation when 1 ml of 10% NaCl is added.
15. Mass of acetic acid adsorbed = $(0.6 - 0.5) \times 1 \times 60 = 6 \text{ g}$
 Mass of acetic acid adsorbed per gram of carbon = $\frac{6}{2} = 3 \text{ g}$
16. 1 litre colloidal solution contains = $10^{-3} \times N_A$ molecule of $\text{C}_{12}\text{H}_{25}\text{SO}_4\text{Na}$.
 1 mm^3 colloidal solution contains = $\frac{10^{-3} \times N_A \times 1}{10^6} = 6 \times 10^{14}$ molecule of $\text{C}_{12}\text{H}_{25}\text{SO}_4\text{Na}$.
 10¹³ colloidal particles = 6×10^{14} molecule of $\text{C}_{12}\text{H}_{25}\text{SO}_4\text{Na}$.
 1 colloidal particle = $\frac{6 \times 10^{14}}{10^{13}}$ molecule of $\text{C}_{12}\text{H}_{25}\text{SO}_4\text{Na} = 60$ molecules.
17. 10 ml of 1 M NaCl contains NaCl = $10 \times 1 = 10$ milli mole
 200 ml of As_2S_3 required NaCl for the coagulation = 10 milli mole
 \therefore 1000 ml of As_2S_3 required NaCl for the coagulation = $10 \times 1000 / 200 = 50$ milli mole
18. Let V litre of palmitic acid is required.
 Number of molecules = $\frac{5.12 \text{ V}}{256} \times 6.023 \times 10^{23} = 1.2 \times 10^{22} \text{ V}$
 Area covered = $(1.2 \times 10^{22} \text{ V})(0.2 \times 10^{-14} \text{ cm}^2) = 2.4 \times 10^7 \text{ V cm}^2$
 $2.4 \times 10^7 \text{ V cm}^2 = 500 \text{ cm}^2$
 $V \approx 2 \times 10^{-5} \text{ L}$
 $X = 2$
19. We want to prepare sol of AgI having positively charged particles, so a little excess of Ag^+ should be added to KI.
20. The sols will neutralise each other so will coagulate each other because of opposite charge.
21. Greater the charge on negative ions of salt used (since sol is positively charged) smaller will be its coagulating value.
22. P. Coagulation is known as accumulation of collidal sols.
 Q. Dialysis is purification of colloids.
 R. Peptization is formation of colloidal solution from precipitates.
 S. Tyndall effect is scattering of light by colloidal particle.