DPP - Daily Practice Problems

Name : _____ Date : _____

Start Time : _____ End Time : _____

CHEMISTRY 37

SYLLABUS : SURFACE CHEMISTRY

Max. Marks : 120 **Time : 60 min.**

GENERAL INSTRUCTIONS

- The Daily Practice Problem Sheet contains 30 MCQ's. For each question only one option is correct. Darken the correct circle/ bubble in the Response Grid provided on each page.
- You have to evaluate your Response Grids yourself with the help of solution booklet.
- Each correct answer will get you 4 marks and 1 mark shall be deduced for each incorrect answer. No mark will be given/ deducted if no bubble is filled. Keep a timer in front of you and stop immediately at the end of 60 min.
- The sheet follows a particular syllabus. Do not attempt the sheet before you have completed your preparation for that syllabus. Refer syllabus sheet in the starting of the book for the syllabus of all the DPP sheets.
- After completing the sheet check your answers with the solution booklet and complete the Result Grid. Finally spend time to analyse your performance and revise the areas which emerge out as weak in your evaluation.

DIRECTIONS (Q.1-Q.21) : There are 21 multiple choice questions. Each question has 4 choices (a), (b), (c) and (d), out of which ONLY ONE choice is correct.

Q.1 Which among the following statement is false ?
(a) The adsorption may be monolayered or multilayered
(b) Particle size of adsorbent will not affect the amount of adsorption
(c) Increase of pressure increases amount of adsorption
(d) Increase of temperature may decrease the amount of adsorption

Q.2 Wood charcoal is used to decolourise sugar because it
(a) Adsorbs coloured material
(b) Absorbs decolorised material
(c) Reduces coloured material
(d) None of these

Q.3 When the temperature is lowered and pressure is raised, the adsorption of a gas on a solid
(a) Decreases
(b) Increases
(c) Remains unaffected
(d) Decreases first then increases

Q.4 In physical adsorption, the gas molecules are held on solid surface by
(a) Chemical forces (b) Electrostatic forces
(c) Gravitational forces (d) Van der Waal's forces

Q.5 Which of the following statement is not applicable to chemisorption ?
(a) It is slow
(b) It is irreversible
(c) It is highly specific
(d) It is independent of temperature

RESPONSE GRID	1. ⓐⓑⓒⓓ	2. ⓐⓑⓒⓓ	3. ⓐⓑⓒⓓ	4. ⓐⓑⓒⓓ	5. ⓐⓑⓒⓓ

Space for Rough Work

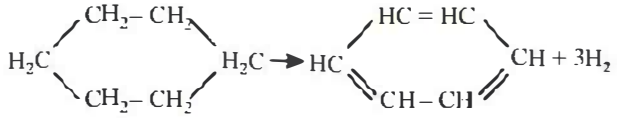
Q.6 Which of the following kinds of catalysis can be explained by the adsorption theory?
(a) Homogeneous catalysis
(b) Acid base catalysis
(c) Heterogeneous catalysis
(d) Enzyme catalysis

Q.7 50 ml of 1 M oxalic acid is shaken with 0.5 gm of wood charcoal. The final concentration of the solution after adsorption is 0.5 M. Amount of oxalic acid absorbed per gm of charcoal is
(a) 3.45 gm (b) 3.15 gm
(c) 6.30 gm (d) None

Q.8 Activated charcoal is used to remove colouring matter from pure substances. It works by
(a) Oxidation (b) Reduction
(c) Bleaching (d) Adsorption

Q.9 In the reaction $2SO_2 + O_2 \xrightarrow[As_2O_3]{Pt} 2SO_3$, As_2O_3 acts as a
(a) Autocatalyst (b) Poison
(c) Promotor (d) Positive catalyst

Q.10 In the following reaction the catalyst used is



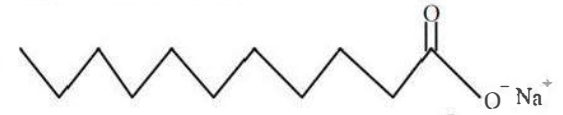
(a) Al_2O_3 (b) Cr_2O_3
(c) Cr_2O_3 and Al_2O_3 (d) Zn dust

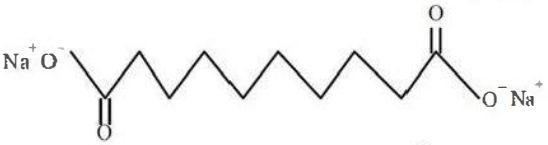
Q.11 Which of the following statements about a catalyst is true?
(a) It lowers the energy of activation
(b) The catalyst altered during the reaction is regenerated
(c) It does not alter the equilibrium
(d) All of these

Q.12 Which of the following processes does not involve a catalyst?
(a) Haber's process (b) Thermite process
(c) Ostwald process (d) Contact process

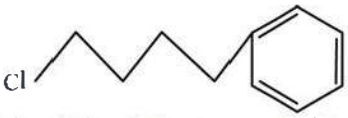
Q.13 For coagulating As_2S_3 colloidal sol, which of the following will have the lowest coagulation value
(a) NaCl (b) KCl (c) $BaCl_2$ (d) $AlCl_3$

Q.14 Which of the following molecules is most suitable to disperse benzene in water ?

(a) 

(b) 

(c) 

(d) 

Q.15 Which of the following colloids are formed when hydrogen sulphide gas is passed through a cold solution of arsenious oxide?
(a) As_2S_3 (b) As_2O_3 (c) As_2S (d) As_2H_2

Q.16 Surface tension of lyophilic sols is
(a) Lower than that of H_2O (b) More than that of H_2O
(c) Equal to that of H_2O (d) None of these

Q.17 Bredig arc method can not be used to prepare colloidal solution of which of the following
(a) Pt (b) Fe (c) Ag (d) Au

Q.18 The gold number of A, B C and D are 0.04, 0.002, 10 and 25 respectively. Protective power of A, B, C and D are in order
(a) A > B > C > D (b) B > A > C > D
(c) D > C > B > A (d) C > A > B > D

Q.19 The volume of a colloidal particle, V_C as compared to the volume of a solute particle in a true solution V_S, could be
(a) $\frac{V_C}{V_S} \simeq 1$ (b) $\frac{V_C}{V_S} \simeq 10^{23}$
(c) $\frac{V_C}{V_S} \simeq 10^{-3}$ (d) $\frac{V_C}{V_S} \simeq 10^{3}$

RESPONSE GRID					
	6. ⓐⓑⓒⓓ	7. ⓐⓑⓒⓓ	8. ⓐⓑⓒⓓ	9. ⓐⓑⓒⓓ	10. ⓐⓑⓒⓓ
	11. ⓐⓑⓒⓓ	12. ⓐⓑⓒⓓ	13. ⓐⓑⓒⓓ	14. ⓐⓑⓒⓓ	15. ⓐⓑⓒⓓ
	16. ⓐⓑⓒⓓ	17. ⓐⓑⓒⓓ	18. ⓐⓑⓒⓓ	19. ⓐⓑⓒⓓ	

Space for Rough Work

Q.20 An emulsifier is a substane which
(a) Stabilises the emulsion
(b) Homogenises the emulsion
(c) Coagulates the emulsion
(d) Accelcrates the dispersion of liquid in liquid

Q.21 Oils and fats are obtained by saponification of potassium stearate. Its formula is $CH_3 - (CH_2)_{16} - COO^-K^+$. Lyophobic end of atom is (CH_3)– and lyophilic end is $–COO^-K^+$. Potassium stearate is example of
(a) Lyophobic colloids
(b) Lyophilic colloids
(c) Poly molecular colloids
(d) Combined colloids or Miscells

DIRECTIONS (Q.22-Q.24) : In the following questions, more than one of the answers given are correct. Select the correct answers and mark it according to the following codes:

Codes :
(a) 1, 2 and 3 are correct **(b)** 1 and 2 are correct
(c) 2 and 4 are correct **(d)** 1 and 3 are correct

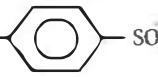
Q.22 Which of the following are correct statements
(1) Spontaneous adsorption of gases on solid surface is an exothermic process as entropy decreases during adsorption
(2) Formation of micelles takes place when temperature is below Kraft Temperature (T_k) and concentration is above critical micelle concentration (CMC)
(3) A colloid of $Fe(OH)_3$ is prepared by adding a little excess (required to completely precipitate Fe^{3+} ions as $Fe(OH)_3$) of NaOH in $FeCl_3$ solution, then particles of this sol will move towards cathode during electrophoresis.
(4) According to Hardy-Schulze rule the coagulation (flocculating) value of Fe^{3+} ion will be more than Ba^{2+} or Na^+.

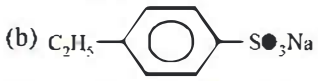
Q.23 Which of the following statements are correct?
(1) The extent of adsorption depends on the nature of the adsorbent and adsorbate
(2) The extent of adsorption depends on the pressure of the gas
(3) The extent of adsorption depends on the temperature
(4) The extent of adsorption has no upper limit

Q.24 Which of the following statements are not true for a catalyst?
(1) It increases the energy of the reactants
(2) It decreases the energy of the products
(3) It decreases the energy of the reactants
(4) It change the enthalpy of the reactants

DIRECTIONS (Q.25-Q.27) : Read the passage given below and answer the questions that follows :

Surfactants are the substances that lower down the surface tension of water. Soaps, detergents, etc fall into this class of compounds. Such substances are water soluble and tend to concentrate at the surface of water. The surfactant molecules have both hydrophobic parts (hydrocarbon ends) and hydrophilic parts (polar ends), and in consequence associate in quite a large number to form aggregates (micelles) in aqueous solution. In micelles (usually spherical in shape) the polar end groups are directed towards water and nonpolar hydrocarbon ends towards the centre. Normally water insoluble impurities, such as grease, oils, etc. having hydrophobic character find compatible environment in the interior part of the micelles and get dissolved.

Q.25 Water available in a village contains a lot of dissolved $CaCl_2$. Which of the following substances is not suitable for washing purposes?
(a)  (b) $C_{17}H_{35}COO^-Na^+$
(c) $C_{17}H_{35}N^+(CH_3)_3Br^-$ (d) $CH_3(CH_2)\bullet SO_3^-Na^+$

Q.26 Which of the following is non-ionic surfactant ?
(a) $C_{15}H_{31}COONa$
(b) 
(c) $CH_3(CH_2)_{11}N(CH_3)_3Br$
(d) $C_{15}H_{31}COOCH_2-\underset{\displaystyle CH_2OH}{\overset{\displaystyle CH_2OH}{\overset{|}{\underset{|}{C}}}}-CH_2OH$

RESPONSE GRID					
	20. ⓐⓑⓒⓓ	21. ⓐⓑⓒⓓ	22. ⓐⓑⓒⓓ	23. ⓐⓑⓒⓓ	24. ⓐⓑⓒⓓ
	25. ⓐⓑⓒⓓ	26. ⓐⓑⓒⓓ			

Space for Rough Work

Q.27 Which of the following is *not* correct statement?

(a) Micellization is a spontaneous process

(b) At critical micelle concentration conductivity, colligative properties, etc abruptly change.

(c) Micellization is an irreversible process

(d) Below critical micellization concentration a surfactant has no detergent action.

DIRECTIONS (Q. 28-Q.30) : Each of these questions contains two statements: Statement-1 (Assertion) and Statement-2 (Reason). Each of these questions has four alternative choices, only one of which is the correct answer. You have to select the correct choice.

(a) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.

(b) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1.

(c) Statement -1 is False, Statement-2 is True.

(d) Statement -1 is True, Statement-2 is False.

Q.28 **Statement-1:** ZSM – 5 is used as a catalyst in petrochemical industries

Statement-2: Zeolites are three dimensional netwoek silicates in which some silicon atoms are replaced by aluminium atoms.

Q.29 **Statement-1:** For the caogulation of sols carrying positive charge, PO_4^{3-} ions are more efficient than SO_4^{2-} or Cl^- ions.

Statement-2: This follows Hardy – Schulze rule.

Q.30 **Statement-1:** Physical absorption of molecules takes place on surface only.

Statement-2: In this process, the bonds of the absorbed molecules are not broken.

RESPONSE GRID	27.ⓐⓑⓒⓓ	28.ⓐⓑⓒⓓ	29.ⓐⓑⓒⓓ	30.ⓐⓑⓒⓓ

DAILY PRACTICE PROBLEM SHEET 37 - CHEMISTRY			
Total Questions	30	Total Marks	120
Attempted		Correct	
Incorrect		Net Score	
Cut-off Score	40	Qualifying Score	60
Success Gap = Net Score – Qualifying Score			
Net Score = (Correct × 4) – (Incorrect × 1)			

Space for Rough Work

DAILY PRACTICE PROBLEMS

CHEMISTRY SOLUTIONS

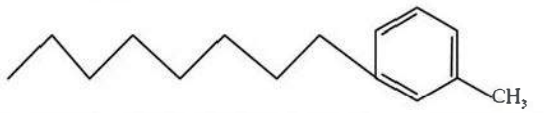
37

1. (b) Amount of adsorption depends on specific surface area.
2. (a) Wood charcoal is used for decolourising of sugar because it absorbs coloured material.
3. (b) Increase in pressure causes increased adsorption.
4. (d) Vander waal's force is a weak force.
5. (d) Chemisorption first increases and then decreases with temperature.
6. (c) Heterogeneous catalysis can be explained by the adsorption theory.
7. (c) $w = \frac{126 \times 1 \times 50}{1000} = 6.3\ g$

   Thus 1 M oxalic acid has 63 g. After adsorption 0.5 M oxalic acid solution has $\frac{6.3}{2} g = 3.65 g$.

   $\therefore$ 0.5 g of wood charcoal absorbs = 3.65 g oxalic acid

   So, 1 g of wood charcoal absorbs $= \frac{3.65 \times 1}{0.5} g = 6.3\ g$.
8. (d) It has been observed that the surface of a solid (or liquid) has the tendency to attract and retain the molecules of other immiscible phase with which it is brought into contact. These molecules remian only at the surface and do not go deeper into the bulk. This tendency of accumulation of molecular species at the surface than in the bulk of a solid (or liquid) it termed adsorption.
9. (b) $2SO_2 + O_2 \xrightarrow[As_2O_3(poison)]{Pt(Catalyst)} 2SO_3$
10. (c) Cr_2O_3 and Al_2O_3 are used as a catalyst.
11. (d) Catalyst increases rate of reaction, without altering equilibrium.
12. (b) Thermite process does not involve a catalyst.
13. (d) The amount of electrolyte required to coagulate a fixed amount of a solution depends upon the valency of the flocculation ion. The flocculating power of the various ions follows the following order, larger the valency lesser will be coagulating value, $Al^{3+} > Mg^{2+} > Na^{+}$, hence lowest coagulation value is of $AlCl_3$.
14. (c) Benzene is non polar in nature. As we know that non-polar disperses more to non-polar substances. Therefore, meta-metyl nonylbenzene being nonpolar from both sides will disperse more to benzene. All other substances (a, b and d) have either one side polar or both sides polar.



non-polar end (metamethylnonylbenzene) non-polar end

$\equiv H_{19}C_9 - C_6H_4 - CH_3$

15. (a) It is due to adsorption of S^{2-} ions on the surface of the colloidal particles present in a colloidal sol.
16. (a) Surface tension of lyophilic sol is lower than that of the dispersion medium (i.e. H_2O in this case)
17. (b) Bredig's arc method is suitable for the preparation of colloidal solution of metal like gold, silver, platinum etc. An arc is struck between the metal electrode under the surface of water containing some stabilizing agent such as a trace of KOH. However, Fe does not react with alkalies that is why it is not obtained by bredig's arc method.
18. (b) Protective power $\propto \frac{1}{\text{Gold number}}$ Hence, the correct order of protective power is B > A > C > D.
19. (d) $\frac{V_C}{V_S} = \frac{10^{-5}}{10^{-7}} = 10^3$
20. (a) For the stablisation of an emulsion a third component called emulsifying agent is usually added. The emulsifier forms an interfacial film between suspended particles and the medium.
21. (d) The substance, whose molecules associate with given solvent to form colloidal particle known as association colloidal. The molecule of soap & detergent are generally smaller than colloidal particle, these molecules associate in concentration solution to form colloidal size particle. These association of soap and detergent known as miscelle.
22. (d) (1) $\Delta G = \Delta H - T\Delta S < 0$

    As $\Delta S < 0$ so ΔH has to be negative for spontaneous adsorption.

    (2) Micelles formation will take place above T_k and above CMC

    (3) This solution will be negatively charged.

    (4) Fe^{3+} ions will have greater coagulation power so smaller coagulation value.
23. (a) Temperature, pressure and nature of adsorbent and absorbate affect adsorption.
24. (a) Catalyst change the enthalpy of the reactants. Thus statement (1), (2) and (3) are the incorrect statements.
25. (b) $C_{17}H_{35}COONa$(soap) forms insoluble soap, $(C_{17}H_{35}COO)_2Ca$ in water containing Ca^{2+} ions. Lot of soap is precipitated out and micelles formation is very much decreased.
26. (d) Compound shown in option (d) is the only compound among the given choices which is non-ionic surfactant.
27. (c) Micellization of surfactant molecules or ions is reversible process; on dilution micellization gets reversed (below *cmc*)
28. (b) Both statement-1 and statement-2 are true but statement-2 is not the correct explanation of statement-1.

    ZSM – 5 converts alcohols directly into gasoline (petrol) by dehydrating them so that a mixture of hydrocarbons is formed.
29. (a) Both statement -1 and statement -2 are true and statement -2 is the correct explanation of statement -1.

    According to Hardy –Schulze rule : Coagulating power of an electrolyte is directly proportional to the fourth power of the valency of the ions causing coagulation.
30. (c) The statement -1 that physical absorption of molecules takes place on surface only is false. Actually absorption takes place on the whole body. In Physical absorption the bonds of absorption molecules are not broken. Hence, statement -1 is false and statement -2 is true.