

**O.P.JINDAL SCHOOL, SAVITRINAGAR**  
**HALF YEARLY EXAMINATION-(2023-24)**

**CLASS-XII**  
**SUBJECT-CHEMISTRY**

**MAX.MARKS-70**  
**MAX.TIME-3HOURS**

**General Instruction:-**

- (i) All questions are compulsory. There are 35 questions in all.  
(ii) SECTION –A: Question numbers 1 to 18 are MCQs carrying one mark each.  
(iii) SECTION –B: Question numbers 19 to 25 are short answer type-I questions, carrying 2 marks each.  
(iv) SECTION –C: Question numbers 26 to 30 are short answer type-II questions, carrying 3 marks each.  
(v) SECTION –D: Question numbers 31 and 32 are case-based questions carrying 4 marks each.  
(v) SECTION –E: Question numbers 33 to 35 are all long answer type questions and carrying 5 marks each.  
(vi) There is no overall choice. However, an internal choice has been provided in some questions.  
(vii) Use of calculator is not permitted. However, you may use log tables, if necessary.

**SECTION-A**

- The order of reactivities of the following alkyl halides for  $S_N2$  reaction is :  

(a) $RF > RCl > RBr > RI$	(b) $RF > RBr > RCl > RI$
(c) $RCl > RBr > RF > RI$	(d) $RI > RBr > RCl > RF$
- Which of the following compound has the highest boiling point ?  

(a) $CH_3CH_2CH_2Cl$	(b) $CH_3CH_2CH_2CH_2Cl$
(c) $CH_3CH(CH_3)CH_2Cl$	(d) $(CH_3)_3CCl$
- $\alpha$ -D(+) glucose and  $\beta$ -D(+) glucose are  

(a) enantiomers	(b) geometrical isomers
(c) epimers	(d) anomers
- The oxidation state of iron in  $[Fe(en)_2(Cl)_2]Cl$  is  

(a) +2	(b) +3
(c) -2	(d) -3
- The amount of electricity required to produce one mole Zn from  $ZnSO_4$  solution will be  

(a) 3F	(b) 2F
(c) 1F	(d) 4F
- In DNA, the complementary bases are :  

(a) adenine and thymine; guanine and cytosine	(b) adenine and thymine; guanine and uracil
(c) adenine and guanine; thymine and cytosine	(d) uracil and adenine; cytosine and guanine

**(XII-CHEM-01)**

7. How many coulombs of electricity are required for the reduction of 1 mol of  $\text{MnO}_4^-$  to  $\text{Mn}^{2+}$  ?

- (a) 96500 C (b)  $1.93 \times 10^5$  C  
(c)  $4.83 \times 10^5$  C (d)  $9.65 \times 10^6$  C

8. Which of the increases with dilution?

- (a) Conductance (b) Specific conductance  
(c) Molar conductance (d) Both (a) and (c)

9. The half life period of a first order reaction is 4 minutes, the time after which 99.9% reaction gets completed is:

- (a) 16 min (b) 8 min  
(c) 32 min (d) 40 min

10. For the reaction  $A \rightarrow B$ , the rate of reaction becomes three times when the concentration is increased by nine times. What is the order of reaction?

- (a) 1 (b) 2  
(c) 1/2 (d) 0

11. The Van't Hoff factor for 0.1 M  $\text{Ba}(\text{NO}_3)_2$  solution is 2.74. The degree of dissociation is

- (a) 91.3% (b) 87%  
(c) 100% (d) 74%

12. The mole fraction of solute in one molal aqueous solution is :

- (a) 0.009 (b) 0.018  
(c) 0.027 (d) 0.036

13. The product X in the following reaction is :



- (a)  $\text{C}_2\text{H}_5\text{COOH}$  (b)  $\text{CH}_3\text{COOCH}_3$   
(c)  $\text{CH}_3\text{COOC}_2\text{H}_5$  (d)  $\text{CH}_3\text{COCH}_3$

14. Phenol reacts with bromine water in  $\text{CS}_2$  at low temperature will give :

- (a) o-Bromophenol (b) o- and p-Bromophenol  
(c) p-Bromophenol (d) 2,4,6-Tribromophenol

(XII-CHEM-02)

**Questions 15-18 are Assertion and Reason questions:**

In these questions(15-18) a statement of assertion followed by a statement of reason is given. Choose the correct answer out of the following choices:

- (a) Assertion and reason both are correct statements and reason is the correct explanation for assertion.
- (b) Assertion and reason both are correct statements and reason is not the correct explanation for assertion.
- (c) Assertion is correct statement but reason is wrong statement .
- (d) Assertion is wrong statement but reason is correct statement .
- 15. Assertion:** The molecularity of the reaction:  $\text{H}_2 + \text{Br}_2 \rightarrow 2\text{HBr}$  is 2.  
**Reason:** Order of the reaction is  $3/2$ .
- 16. Assertion:** Sodium chloride is used to clear snow on the roads.  
**Reason:** Sodium chloride depresses the freezing point of water.
- 17. Assertion:** Sucrose is a non-reducing sugar.  
**Reason:** It has glycosidic linkage.
- 18. Assertion:** o-Nitrophenol is less volatile than p-nitrophenol.  
**Reason:** There is intramolecular hydrogen bonding in o-nitrophenol and intermolecular hydrogen bonding in p-nitrophenol.

**SECTION-B**

**19. Explain why**

- (i) Alkyl halides though polar, are immiscible with water.
- (ii) Grignard reagents should be prepared under anhydrous conditions.

OR

Give reasons for the following :

- (i) t-butyl bromide is more reactive towards  $\text{S}_{\text{N}}1$  reaction as compared to n-butyl bromide.
- (ii)  $\text{CH}_3\text{CH}_2\text{I}$  undergoes  $\text{S}_{\text{N}}2$  reaction faster than  $\text{CH}_3\text{CH}_2\text{Br}$ .
- 20.** A reaction is of second order with respect to a reactant. How will the rate of reaction be affected if the concentration of this reactant is (i) doubled (ii) reduced to half.
- 21.** Using VBT, explain the following relation to the paramagnetic complex,  $[\text{Fe}(\text{CN})_6]^{3-}$
- (i) type of hybridization
- (ii) type of complex : inner or outer orbital complex
- 22.** An aqueous solution of glucose is made by dissolving 10 g of glucose in 90 g of water at 303K. If the vapour pressure of pure water at 303K be 32.8 mm Hg, what would be the vapour pressure of the solution?

23. Write the following reactions:

- (i) Williamson synthesis                      (ii) Reimer-Tiemann reaction

24. The molar conductivities at infinite dilution for sodium acetate, hydrochloric acid and sodium chloride are 91.0, 425.4 and 126.4 S cm<sup>2</sup> mol<sup>-1</sup> respectively at 298K. Calculate the molar conductivity of acetic acid at infinite dilution.

25. How are the following conversions carried out?

- (i) Propene → Propan-2-ol                      (ii) Methanal → Propan-1-ol

### SECTION-C

26. What happens when D-glucose

- (i) is treated with HNO<sub>3</sub>                      (ii) is heated with HI                      (iii) Br<sub>2</sub> water

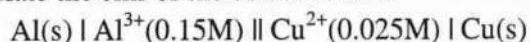
OR

Explain what is meant by

- (i) Glycosidic linkage                      (ii) Peptide linkage                      (iii) Zwitter ion

27. Although chlorine is an electron withdrawing group, yet it is ortho-, para- directing in electrophilic aromatic substitution reactions. Why?

28. Calculate the emf of the cell at 298K :



(Given  $E^0_{(\text{Al}^{3+}/\text{Al})} = -1.66 \text{ V}$ ,  $E^0_{(\text{Cu}^{2+}/\text{Cu})} = 0.34 \text{ V}$ ,  $\log 0.15 = -0.8239$ ,  $\log 0.025 = -1.6020$ )

OR

The electrical resistance of a column of 0.05M NaOH solution of diameter 1 cm and length 50 cm is  $5.55 \times 10^3$  ohm. Calculate its

- (i) resistivity                      and                      (ii) Molar conductivity.

29. Write the mechanism of conversion of ethanol to ethoxy ethane.

30. A first order reaction is 25% completed in 40 minutes. In what time will the reaction be 80% completed. ( $\log 2 = 0.3010$ ,  $\log 3 = 0.4771$ ,  $\log 4 = 0.6020$ ,  $\log 5 = 0.6991$ ,  $\log 8 = 0.9030$ )

OR

The rate of a chemical reaction doubles for an increase of 10K in absolute temperature from 298K. Calculate  $E_a$ .

### SECTION-D

31. Abhishika was finding the chemical kinetics of a reaction. She took A and B reactants and performed the reaction with different concentrations of reactants. The experimental data for the reaction:

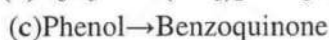


Experiment	[A]M	[B <sub>2</sub> ]M	Initial rate(mol L <sup>-1</sup> s <sup>-1</sup> )
1	0.50	0.5	1.6X10 <sup>-4</sup>
2	0.50	1.0	3.2X10 <sup>-4</sup>
3	1.00	1.0	3.2X10 <sup>-4</sup>

- (i) Write the most probable rate equation for the reaction.  
(ii) Why did Abhishika collect three sets of reading?  
(iii) Calculate the half life period of the reaction if this reaction follows first order kinetics and the value of rate constant is  $2.3 \times 10^{-3} \text{ s}^{-1}$ .  
(iv) Give one example of pseudo first order reaction.
32. Elimination and substitution reactions can occur simultaneously. When alkyl halide reacts with nucleophile, it may undergo either substitution via S<sub>N</sub>1 and S<sub>N</sub>2 or elimination reaction. It depends upon the nature of alkyl halide, strength and size of nucleophile, conditions of the reaction. Primary alkyl halide will prefer S<sub>N</sub>2 reaction. Secondary alkyl halide can undergo substitution or elimination depending upon the strength of the nucleophile. Stronger the nucleophile like <sup>-</sup>OC<sub>2</sub>H<sub>5</sub> will bring out elimination whereas nucleophiles like <sup>-</sup>OH will bring out substitution. Tertiary alkyl halide will undergo substitution or elimination depending upon the stability of carbocation or the more substituted alkene.
- (i) What type of solvents favour S<sub>N</sub>1 mechanism?  
(ii) Out of C<sub>2</sub>H<sub>5</sub>-Br and C<sub>2</sub>H<sub>5</sub>-I which one undergoes S<sub>N</sub>2 reaction faster?  
(iii) Predict the order of reactivity of the following compounds in S<sub>N</sub>1 reactions:  
C<sub>6</sub>H<sub>5</sub>CH(C<sub>6</sub>H<sub>5</sub>)Br, C<sub>6</sub>H<sub>5</sub>CH<sub>2</sub>Br, C<sub>6</sub>H<sub>5</sub>CH(CH<sub>3</sub>)Br, C<sub>6</sub>H<sub>5</sub>C(CH<sub>3</sub>)(C<sub>6</sub>H<sub>5</sub>)Br  
(iv) The p-isomer of dichlorobenzene has higher melting point than o- and m-isomers. Why?

### SECTION-E

33. (i) Accounts for the following:  
(a) Phenol is stronger acid than alcohol.  
(b) Propanol has higher boiling point than butane.  
(ii) How would you convert the following:  
(a) C<sub>6</sub>H<sub>5</sub>-OH → C<sub>6</sub>H<sub>6</sub>



OR

(i) Accounts for the following:

(a) o-Nitrophenol is more acidic than o-Methoxyphenol.

(b) The boiling point of alcohols decrease with the increase in branching of alkyl chain.

(ii) Write the mechanism for acid catalysed hydration of ethene forming ethanol.

34. (i) What is meant by positive deviation from Raoult's law? Draw a diagram to illustrate the relationship between vapour pressure and mole fraction of components in a solution to represent positive deviation.

(ii) How does Raoult's law become a special case of Henry's law? Explain

OR

(i) Calculate the freezing point of an aqueous solution containing 10.50g of  $MgBr_2$  in 200g of water. (Molar mass of  $MgBr_2 = 184$ ,  $K_f$  for water =  $1.86 K kg mol^{-1}$ )

(ii) Differentiate between molarity and molality for a solution. How does a change in temperature influence their values?

35. (i) Find out the coordination number of central metal ion in  $[Co(en)_3]^{3+}$

(ii) Indicate the type of isomerism exhibited by the following complex:  $[CoCl_3(NH_3)_3]$

(iii) Define crystal field splitting energy. On the basis of crystal field theory, write the electronic configuration for  $d^4$  ion, if  $\Delta_0 < p$ .

(iv) Nickel(II) does not form low spin octahedral complexes. Why?

(v) Why is  $[NiCl_4]^{2-}$  paramagnetic?

OR

(i) Write the IUPAC name of the complex:  $[Co(en)_2Cl_2]^+$ . Draw its geometrical and optical isomers.

(ii) Define the term ambident ligand by giving one example

(iii) Write the formula of the following complex: Pentaamminenitrito-O-cobalt(III)chloride.

(iv) Calculate the magnetic moment of  $Fe^{3+}$  in  $[Fe(CN)_6]^{3-}$ .

(v) Why are low spin tetrahedral complexes not formed?