

# MODEL EXAMINATION 2022-23

SUBJECT – CHEMISTRY (043)

CLASS – XII

TIME – 3.00 Hours

MAX. MARKS – 70

## General Instructions –

- This question paper contains 35 questions of 70 marks.
- Section A consists of 18 MCQs carrying 1 mark each.
- Section B consists of 7 questions carrying 2 marks each.
- Section C consists of 5 questions carrying 3 marks each.
- Section D consists of 2 case based questions carrying 4 marks each.
- Section E consists of 3 questions carrying 5 marks each.
- All questions are compulsory, internal choices are given in few questions.
- Use of calculator and log table is not allowed.

## SECTION – A

This section contains 18 multiple choice questions with one correct answer and there is no internal choice.

1. The limiting molar conductivities of  $\text{CH}_3\text{COOH}$ ,  $\text{KCl}$  &  $\text{HCl}$  are 390, 150 & 425  $\text{S cm}^2/\text{mol}$  respectively. Molar conductivity of  $\text{CH}_3\text{COOK}$  would be –  
(a) 100  $\text{S cm}^2/\text{mol}$  (b) 125  $\text{S cm}^2/\text{mol}$  (c) 115  $\text{S cm}^2/\text{mol}$  (d) 150  $\text{S cm}^2/\text{mol}$
2. For a reaction  $\text{A} + 2\text{B} \rightarrow \text{Product}$ , order of reaction wrt both A & B is 2. What will be effect on reaction rate if the concentration of the reactants A is doubled and B is halved?  
(a) Remains same (b) Increases four times  
(c) Decreases four times (d) Increases two times
3. Actinoid contraction from element to element is greater than Lanthanoid contraction, due to –  
(a) Poor shielding effect of 5f orbitals (b) Lower effective nuclear charge  
(c) Greater shielding effect of 5f orbitals (d) All of the above
4. 0.1 mol of a coordination compound  $\text{CoCl}_3 \cdot 5\text{NH}_3$  gives 0.2 mol equivalent of precipitate of  $\text{AgCl}$  with excess of  $\text{AgNO}_3$ . The correct formula of the complex is –  
(a)  $[\text{CoCl}_3(\text{NH}_3)_3]\text{Cl}$  (b)  $[\text{Co}(\text{NH}_3)_5\text{Cl}]\text{Cl}_2$   
(c)  $[\text{Co}(\text{NH}_3)_5]\text{Cl}_3$  (d)  $[\text{Co}(\text{NH}_3)_5\text{Cl}_2]\text{Cl}$
5. Major product that would be formed by the dehydrohalogenation of the compound 2-chloro-2-methyl butane with alcoholic  $\text{KOH}$ .  
(a) 2-methylbut-2-ene (b) 2-methylbut-1-ene  
(c) 3-methylbut-2-ene (d) 3-methylbut-1-ene
6. The C-O bond length in phenol is less than that in methanol, due to-  
(a) Partial double bond character (b)  $\text{sp}^2$  hybrid state of C  
(c)  $\text{sp}^3$  hybrid state of C (d) both (a) & (b)
7. The correct order of acidic strength is-  
(a) Phenol < Ethanol < Chloroacetic acid < Acetic acid  
(b) Phenol > Ethanol > Chloroacetic acid > Acetic acid  
(c) Ethanol < Phenol < Acetic acid < Chloroacetic acid  
(d) Acetic acid < Phenol < Ethanol < Chloroacetic acid

8. An organic compound **A** on treatment with  $\text{NH}_3$  gives **B** which on heating gives **C**. **C** gives ethanamine upon Hoffmann bromamide degradation. Compound **A** would be-
- (a)  $\text{CH}_3\text{CH}_2\text{CH}_2\text{COOH}$  (b)  $\text{CH}_3\text{COOH}$   
 (c)  $\text{CH}_3\text{CH}_2\text{COOH}$  (d)  $(\text{CH}_3)_2\text{CHCOOH}$
9. The rate constant for a first order reaction is equal to the initial rate of the reaction when the initial concentration of the reactant is –
- (a) 0.01M (b) 1M (c) 10M (d) 0.1M
10. Which statement regarding  $[\text{Cr}(\text{NH}_3)_6]^{3+}$  is incorrect?
- (a) It has octahedral geometry (b) It has  $d^2sp^3$  hybridization  
 (c) It is diamagnetic (d) It is a low spin complex
11. The major product of acid catalyzed hydration of Propene is –
- (a) 1- propanol (b) 2-propanol  
 (c) Ethanol (d) 2- methylpropan-1-ol
12. Which of the following is primary battery?
- (a) Lead storage battery (b) Nickle Cadmium cell  
 (c) Dry cell (d) None of these
13. Which of the following will not give Hinsberg's test?
- (a) N-methylethanamine (b) N,N-dimethylethanamine  
 (c) N-ethyl ethanamine (d) Propanamine
14. The role of a catalyst to change –
- (a) Gibb's energy of reaction (b) Enthalpy of reaction  
 (c) Activation energy of reaction (d) Equilibrium constant

Answer assertion reason questions. Read following & carefully give the answer.

- (a) Both A & R are true and R is the correct explanation of A.  
 (b) Both A & R are true and R is not the correct explanation of A.  
 (c) A is correct and R is not the correct statement.  
 (d) A is not correct and R is the correct statement.

15. **ASSERTION (A)** - In transition elements ns orbital is filled first and (n-1) d afterwards, and during ionisation, ns electron are lost prior to (n-1) d electrons.  
**REASON (R)** - The Effective nuclear charge felt by (n-1) d electron is higher as compared to that by ns electrons.
16. **ASSERTION (A)** - p- nitrophenol is more acidic than Phenol.  
**REASON (R)** – Nitro group stabilize the conjugate base as it is electron withdrawing.
17. **ASSERTION (A)** – Basic strength of secondary amine is greater than primary & tertiary amines in both aqueous and gaseous phase.  
**REASON (R)** – Positive inductive effect is responsible for basic strength of amines in gaseous phase.
18. **ASSERTION (A)** - DNA has double strand alpha helix structure.  
**REASON (R)** – DNA contains cytosine and thymine as pyrimidine base.



## SECTION – B

**This section contains 7 questions carrying two marks each with internal choice in two questions.**

19. The energy of combustion of fuels like hydrogen, methane etc. is directly converted into electrical energy. This cell was first used in the Apollo space programme. Write the reaction occurred in a  $H_2-O_2$  fuel cell at anode and cathode.
20. Show that in a 1<sup>st</sup> order reaction, the time required for completion of 99.9% is 10 times of half-life of the reaction.
21. The rate of a reaction quadruples when the temperature changes from 293 K to 303 K. Calculate the energy of activation of the reaction assuming that it does not change with temperature.

$$(\text{Log } 4 = 0.6021)$$

22. Out of  $[CoF_6]^{3-}$  and  $[Co(C_2O_4)_3]^{3-}$ , which one complex is –

- (i) Diamagnetic                      (iii) Outer orbital complex  
(ii) More stable                      (iv) Low spin complex

23. Write the mechanism of the following reaction –



OR

- (a) Nucleophilic substitution of chlorobenzene becomes easier when  $-NO_2$  group is attached at ortho- or para-positions. Explain giving resonating structures.
- (b) Out of chlorobenzene and cyclohexyl chloride which one has higher dipole moment and why?
24. Give example of the formation of (i) an Oxime and (ii) a Cyanohydrin from either Ethanal.
25. What happens when D- glucose is oxidized with (i)  $Br_2$  water & (ii) conc.  $HNO_3$ ? Write chemical equations.

OR

- (a) Give evidence for each of the followings (giving chemical equations) –

- (i) Glucose has six carbon chains in its molecule.  
(ii) Glucose reduces Tollen's as well as Fehling's solutions.

## SECTION – C

**This section contains 5 questions carrying three marks each with internal choice in one question.**

26. (a) State Henry's law.  
(b) The vapour pressure of pure liquids **A** and **B** are 450 and 700 mm Hg respectively. Find out the composition of the liquid mixture if total vapour pressure is 600 mm Hg.
27. Using valence bond theory explain the complex  $[NiCl_4]^{2-}$  is tetrahedral and paramagnetic whereas the complex  $[Ni(CN)_4]^{2-}$  is square planer and diamagnetic.
28. (a) Identify the major product formed when 1-chloro-1-methylcyclohexane is dehydrohalogenated with alcoholic KOH.  
(b) Out of following pairs which will be more reactive towards Nucleophilic substitution reactions? Give reason in short.  
(i) Chloroethane and chlorobenzene  
(ii) Vinyl chloride and allyl chloride

OR

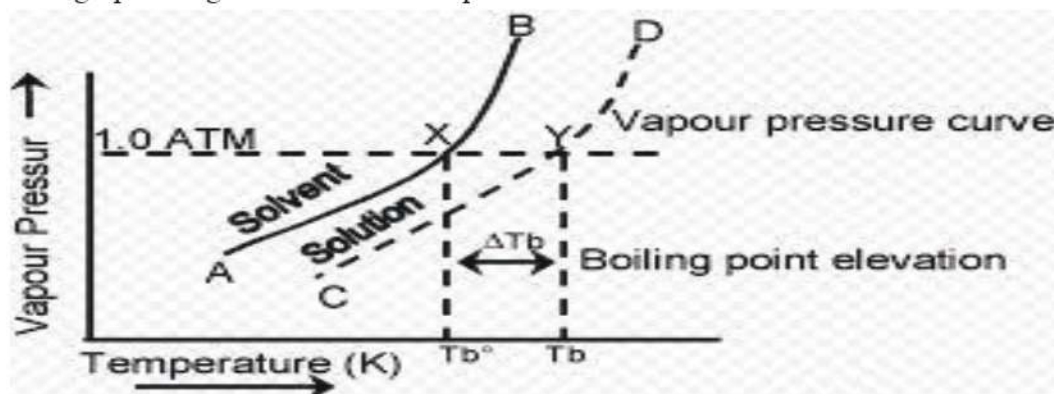
- (a) What is the product when an alkyl halide reacts with  $AgNO_2$ ? Write the chemical equation.  
(b) Out of  $CH_3-CH_2-Br$  and  $(CH_3)_3C-Br$ , which will give  $S_N^2$  reaction faster and why?
29. (a) What happens when salicylic acid is acetylated?  
(b) Ortho nitrophenol is steam volatile whereas para isomer does not. Why?  
(c) How will you convert phenol into 2-hydroxy benzenecarbaldehyde?
30. (a) Give a chemical test to distinguish between ethanamine and N-methylethanamine.

- (b) Arrange them in decreasing order of their  $pK_b$  value-  $C_2H_5-NH_2$ ,  $(C_2H_5)_2NH$  &  $(C_2H_5)_3N$ .  
 (c) Aniline gives appropriate yield of Meta nitro benzene upon nitration along with ortho & para isomers. Why?

### SECTION – D

The following questions are case based questions. Each question has three questions of 1+1+2 = 4 marks.

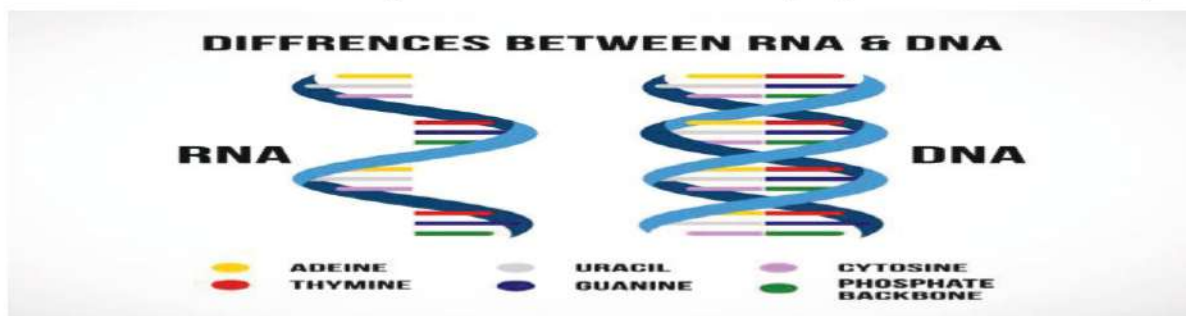
31. Observe the graph and give the answers of questions followed.



- (a) Boiling point of which solution is lower, 1M glucose solution OR 1M NaCl solution?  
 (b) If a solution of a salt has observed boiling point nearly doubled to its calculated boiling point. It's Observed molar mass would be either twice of its calculated molar mass OR half of its calculated molar mass. Justify.  
 (c) 1 Molal solution has boiling point 374.15 K. What would be the boiling point of the same salt solution if its molality becomes 2.5 times? (boiling point of pure solvent = 373.15 K)
- OR
- (c) Compare the boiling point of NaCl solution (1 molal) assuming that NaCl is (i) 100% ionized and (ii) 0% ionized. ( $K_b$  for water = 0.52 K. Kg mol<sup>-1</sup>. (boiling point of pure solvent = 373.15 K)

32. Read the following paragraphs and give the answers of the questions followed.

1. Nucleic acids are of two types – DNA & RNA. Both are having nitrogenous bases as Adenine, Guanine, Cytosine, Thymine and Uracil. Out of these Thymine is not found in RNA. Intermolecular H – bonds are present in between A-T and G-C pair. More number of H- bonding is present in between G-C pair.



2. Proteins are the polymers of alpha amino acids. The simplest amino acid is 2-aminoethanoic acid called Glycine. Nature of amino acid solutions depends upon relative numbers of  $-NH_2$  &  $-COOH$  groups.
- (a) A sample of DNA has higher boiling point as compared to another sample. Which pair of nitrogenous pair would you expect more in this sample?  
 (b) How is a nucleoside different from a nucleotide?



- (c) What would you infer from the following observations?
- A nucleic acid sample has unequal % composition of Purine and Pyrimidine. Is it DNA single strand or double strand?
  - A nucleic acid sample has uracil as one of the nitrogenous base. Identify the nucleic acid.

OR

- (c) How is RNA structurally different from DNA? Give any two points.

### SECTION – E

**This section contains 3 questions carrying five marks each with internal choice in two questions.**

33. (a) The electrolyte solution used in a lead storage battery is essentially changing in a regular interval of time. What is the reason behind it?
- (b) Write the reaction taking place at the electrodes and the product of electrolysis of aqueous solution of NaCl.
- (c) Write the Nernst equation and find the EMF of the cell at 298K.  
 $\text{Mg(s)} / \text{Mg}^{2+} (0.001\text{M}) // \text{Cu}^{2+} (0.001\text{M}) / \text{Cu(s)}$ , (given is  $\text{EMF}^0_{\text{cell}}$  is 2.71V)

OR

- (a) Suggest a formula to find the limiting molar conductivity of water.
- (b) A solution of  $\text{AgNO}_3$  is electrolyzed for 10 minutes with a current of 2 amperes. What mass of Ag is deposited at the cathode? (atomic mass of Ag = 108u)
- (c) Calculate the  $\Delta G^0$  for the following reaction. State whether the reaction becomes spontaneous or not?  
 $\text{Cu(s)} + \text{Zn}^{2+}(\text{aq}) \rightarrow \text{Cu}^{2+}(\text{aq}) + \text{Zn(s)}$ ,  $E^0_{\text{Cu}^{2+}/\text{Cu}} = 0.34\text{V}$  &  $E^0_{\text{Zn}^{2+}/\text{Zn}} = -0.76\text{V}$
34. Answer the following questions – (any five)
- Silver atom has  $4d^{10} 5s^1$  electronic configuration in its ground state. Can you consider it as a transition element?
  - Cr has higher  $\Delta_t H^0$  (II) than Mn. Why?
  - Why is  $\text{Cr}^{2+}$  reducing in nature whereas  $\text{Mn}^{3+}$  is oxidizing when both are having  $3d^4$  configuration?
  - The chemistry of actinoids is more complex. Why?
  - What is the effect of pH change on dichromate ion?
35. (a) An alkene **A** ( $\text{C}_3\text{H}_6$ ) on ozonolysis gives two compounds **B** & **C**. **B** gives  $\alpha$ ,  $\beta$ -unsaturated aldehyde when reacting with dilute NaOH whereas **C** gives self-oxidation and reduction when treated with conc. NaOH. Identify **A**, **B** & **C** and write the name reactions involved.
- (b) Comment upon the reactivity of Ethanal, propanone and benzene carbaldehyde.

OR

- (a) A Grignard's reagent **R-Mg-X** when reacts with  $\text{CO}_2$  gives a carboxylic acid **X** of molecular formula ( $\text{C}_3\text{H}_6\text{O}_2$ ). **X** has less acidic strength than acetic acid. On decarboxylation **X** gives ethane. Identify **X** and the Grignard's reagent and write the chemical reactions involved.
- (b) Write a chemical test to distinguish between the following pairs of compounds.
- Phenol and Benzoic acid
  - Acetophenone and benzophenone.