COMMON PRE-BOARD EXAMINATION 2022-23

Subject: (Chemistry - 043)

Date:

Time Allowed: 3 hours

Class: XII

Max. Marks : 70

General Instructions:

Read the following instructions carefully.

a) There are **35** questions in this question paper with internal choice.
b) SECTION A consists of 18 multiple-choice questions carrying 1 mark each.
c) SECTION B consists of 7 very short answer questions carrying 2 marks each.
d) SECTION C consists of 5 short answer questions carrying 3 marks each.
e) SECTION D consists of 2 case- based questions carrying 4 marks each.
f) SECTION E consists of 3 long answer questions carrying 5 marks each.
g) All questions are compulsory.
h) Use of log tables and calculators is not allowed

SECTION A

The following questions are multiple-choice questions with one correct answer. Each question carries 1 mark. There is no internal choice in this section.

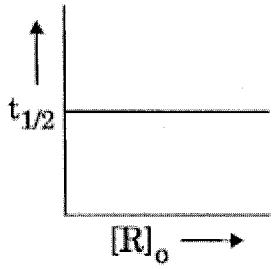
1. Limiting molar conductivities of K^+ and SO_4^{2-} are 73.5 Scm^2mol^{-1} and 160.0 Scm^2mol^{-1} respectively. What is the limiting molar conductivity (in Scm^2mol^{-1}) of potassium sulphate solution?

a. 86.5
b. 233.5
c. 307
d. 394

2. Units of rate constant of a zero-order reaction is

a. mol L^{-1} s^{-1}
b. s^{-1}
c. mol^{-1} L s^{-1}
d. mol^{-2} L^2 s^{-1}

3. A graph is plotted with half-life against initial concentration of reactant. Identify the order of reaction.



a. Zero order of reaction
b. First order of reaction
c. Second order of reaction
d. None of these

4. Identify the correct relationship for a first order reaction.

a. 2 $t_{½} = t_{99.9\ \%}$
b. 5 $t_{½} = t_{99.9\ \%}$
c. 10 $t_{½} = t_{99.9\ \%}$
d. 100 $t_{½} = t_{99.9\ \%}$

5. Which among the following has the highest melting point?

a. Cr
b. Mn
c. Zn
d. Fe

6. C_6H_5-CO-NH_2 on treatment with Br_2 in an aqueous solution of NaOH gives

a. C_6H_5-CH_2-NH_2
b. C_6H_5-NH_2
c. C_6H_5-CH_2- Br
d. C_6H_5-CH_2-OH

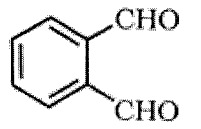
7. Out of the following, the strongest base in aqueous solution is

a. Methylamine
b. Dimethylamine
c. Trimethylamine
d. Aniline

8. Identify the compound which does not undergo aldol condensation.

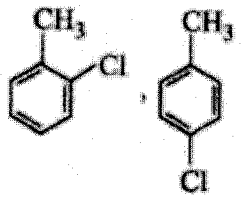
a. Ethanal
b. Propanal
c. Propanone
d. Methanal

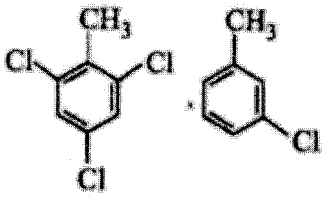
9. The IUPAC name of the given compound is

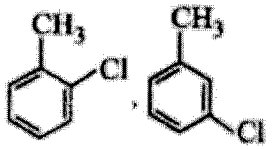


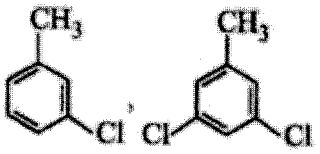
a. Benzene-1,2-dial
b. 2-Oxobenzaldehyde
c. Benzene-1,2-dicarbaldehyde
d. Benzene-1,2-diol

10. A compound X with molecular formula C_7H_8 is treated with Cl_2 in the presence of $FeCl_3$. Which of the following compounds are formed during the reaction?

a. 

b. 

c. 

d. 

11. Identify the products *(A)* and *(B)* in the following reactions.

$$RX + AgCN \longrightarrow \underline{\quad (A) \quad} + AgX$$
$$RX + KCN \longrightarrow \underline{\quad (B) \quad} + KX$$

a. *(A)*-RCN , *(B)*- RCN
b. *(A)*-RCN , *(B)*- RNC
c. *(A)*-RNC , *(B)*- RCN
d. *(A)*-RNC , *(B)*- RNC

12. The denticity of $EDTA^{4-}$ is

a. One

b. Two

c. Six

d. Three

13. Which of the following complexes does not show geometrical isomerism?

a. $[Pt(NH_3)_2Cl_2]$

b. $[Co(NH_3)_4Cl_2]$

c. $[CoCl_2(en)_2]$

d. $[Ni(CO)_4]$

14. Identify the compounds formed when Ethanol is heated with concentrated sulphuric acid at 413 K and at 443 K respectively.

a. Ethanal and Ethoxyethane

b. Ethene and Ethoxyethane

c. Ethoxyethane and Ethene

d. Ethanal and Ethanoic acid

15. Given below are two statements labelled as Assertion (A) and Reason (R)

Assertion (A): Glycine must be taken through diet.

Reason (R): It is a non-essential amino acid.

Select the most appropriate answer from the options given below:

a. Both A and R are true and R is the correct explanation of A

b. Both A and R are true but R is not the correct explanation of A.

c. A is true but R is false.

d. A is false but R is true.

16. Given below are two statements labelled as Assertion (A) and Reason (R)

Assertion (A): The carbon– oxygen bond length in phenol is slightly more than that in methanol.

Reason (R): C-O bond in phenol has partial double bond character due to resonance.

Select the most appropriate answer from the options given below:

a. Both A and R are true and R is the correct explanation of A

b. Both A and R are true but R is not the correct explanation of A.

c. A is true but R is false.

d. A is false but R is true.

17. Given below are two statements labelled as Assertion (A) and Reason (R)

Assertion (A): Aromatic primary amines cannot be prepared by Gabriel phthalimide synthesis.

Reason (R): Aromatic primary amines are less basic than aliphatic primary amines.

Select the most appropriate answer from the options given below:

a. Both A and R are true and R is the correct explanation of A

b. Both A and R are true but R is not the correct explanation of A.

c. A is true but R is false.

d. A is false but R is true.

18. Given below are two statements labelled as Assertion (A) and Reason (R).

Assertion (A): Cr^{2+} and Mn^{3+} are both reducing since they have d^4 configuration.

Reason (R): Cr^{2+} changes from d^4 to d^3, the latter having a half-filled t_2g level and Mn^{3+} changes from d^4 to half-filled d^5 configuration which has extra stability in solution.

Select the most appropriate answer from the options given below:

a. Both A and R are true and R is the correct explanation of A

b. Both A and R are true but R is not the correct explanation of A.

c. A is true but R is false.

d. A is false but R is true.

SECTION B

This section contains 7 questions with internal choice in two questions. The following questions are very short answer type and carry 2 marks each.

19. a) What type of a battery is Mercury cell?

b) Write the anode and cathode reactions and the overall reaction occurring in a Mercury cell.

20. For a reaction $A + B \rightarrow P$, the rate is given by:

$$\text{Rate} = k\,[A][B]^2$$

a) How is the rate of reaction affected if the concentration of both A and B are tripled?

b) What is the overall rate of reaction if A is present in large excess?

21. Give reasons:

a) Rate of a reaction increases with rise in temperature.

b) Molecularity greater than three is not observed.

22. Using the IUPAC norms, write the formulae for the following:

a) Potassium tetrachloridonickelate(II)

b) Tetraamminechloridonitrito-N-platinum(IV) sulphate

23. Which compound in each of the following pairs will react faster in S_N2 reaction with OH^- and why?

a) CH_3Br or CH_3I

b) $(CH_3)_3CCl$ or CH_3Cl

OR

Bring out the following conversions:

a) Chlorobenzene to 4-Chloroacetophenone

b) Chloroethane to Butane

24. What do you understand by the term glycosidic linkage?

OR

Define the following :
(i) Peptide linkage
(ii) Primary structure

25. Give equations of the following reactions:

a) Phenol is treated with bromine water.

b) Anisole is treated with bromine in Ethanoic acid.

SECTION C

This section contains 5 questions with internal choice in two questions. The following questions are short answer type and carry 3 marks each.

26. At 25^0 C, the saturated vapour pressure of water is 3.165 KPa. Find the saturated vapour pressure of a 5% aqueous solution of urea at the same temperature.
(Molar mass of urea = 60 $gmol^{-1}$)

27. Answer **any three** out of the following questions.

a) Predict A and B in the following reaction.

$$C_6H_5N_2Cl \xrightarrow{CuCN} A \xrightarrow{H_2O/H^+} B$$

b) Nitration of Aniline leads to ortho, para as well as meta products. Give reason.

c) Write a suitable chemical test to distinguish between the following:

Methanamine and N-Methylmethanamine.

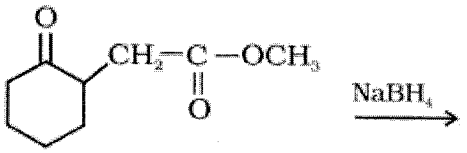
d) The boiling points of isomeric amines follow the given order. Explain.

Primary > Secondary > Tertiary

28. Predict the products of the following reactions:

a) $CH_3 - CH = CH_2 \xrightarrow[\text{ii) } 3\,H_2O_2/OH^-]{\text{i) } B_2H_6}$

b) $CH_3CH_2OH \xrightarrow{Cu/573\,K}$

c) 

29. For the complex $[NiCl_4]^{2-}$, write

a) the IUPAC name.

b) The hybridisation type

c) The shape of the complex

(Atomic number of Ni=28)

30. a) Account for the following.

(i) Electrophilic substitution reactions in haloarenes occur slowly.

(ii) Haloalkanes, though polar, are insoluble in water.

b) Give the chemical equation for the reaction of ethyl chloride with $AgNO_2$

OR

Following compounds are given to you:

2-Bromopentane, 2-Bromo-2-methylbutane, 1-Bromopentane

a) Identify the compound with highest boiling point. Give reason.

b) Write the compound which is optically active. Give reason.

c) Write the compound which is most reactive towards β-elimination reaction. Give reason for your choice.

SECTION D

The following questions are case-based questions. Each question has an internal choice and carries 4 (1+1+2) marks. Read the passage carefully and answer the questions that follow.

31. Denaturation has been variously supposed to be depolymerization, anhydride formation, or hydrolysis. It appears that the different theories do not refer to exactly the same phenomenon, but they can be reconciled if the difference between denaturation and coagulation is recognized. All the previous theories of denaturation are based mainly upon observations on heat denaturation and to some extent on denaturation by alcohol and by acids and alkalis. When a protein in its native form, is subjected to physical changes like change in temperature or chemical changes like change in pH, the hydrogen bonds are disturbed. Due to this, globules unfold and helix gets uncoiled and protein loses its biological activity.

This is called denaturation of protein. The denaturation causes change in secondary and tertiary structures but primary structures remain intact. Examples of denaturation of protein are coagulation of egg white on boiling, curdling of milk, and formation of cheese when an acid is added to milk. It has been emphasized that the theory proposed does not presuppose the absence in the protein molecule of linkages other than those at present known. Unless the protein molecule is a rigid system of rings formed entirely by primary valence linkages, the theory will not be invalidated by any new knowledge about the constitution of the protein molecule which organic chemistry may bring in the future.

(Extract from the Studies on Denaturation of Proteins XIII. A Theory of Denaturation; Advances in Protein Chemistry; Volume 46, 1995, Pages 6-26)

a) Define the term 'protein'.

b) The difference between denaturation and coagulation needs to be recognized. Comment on this statement.

c) During the manufacture of cheeses, cheese curds are milled and salted between pH 5.5 and 5.4, and the final pH of the cheese after manufacture can range from 5.3 to 4.9. What could you conclude from this case study?

OR

c) Two glasses of milk A and B were maintained at 82^0C and 99^0C respectively. In which glass, the curdling of milk occurs faster? Give a reason.

32. Boiling point elevation describes the phenomenon that boiling point of a liquid (a solvent) will be higher when another compound is added, which means a solution has higher boiling point than the pure solvent. This happens when a non-volatile solute such as a salt is added to pure solvent such as water. For example, the addition of 3 g of a substance to 100 g of CCl_4 ($M = 154\ gmol^{-1}$) raises the boiling point of CCl_4 by 0.6^0C.
$K_b\ (CCl_4) = 5.03\ Kkgmol^{-1}$.

a) Define Ebullioscopic constant (K_b)

b) How does the vapour pressure of a solvent change when a non-volatile solute is added to it?

c) Calculate the molality of the solution from the data given in the passage.

OR

c) Calculate the molar mass of the solute mentioned in the passage.

SECTION E

The following questions are long answer type and carry 5 marks each. Two questions have an internal choice.

33. a) Calculate ΔG^θ and log Kc for the following reaction at 298 K:
$2Al(s) + 3Cu^{2+}(aq) \rightarrow 2Al^{3+}(aq) + 3Cu(s)$. Given: $E^\theta_{cell} = 2.02\ V$

b) How long does it require to reduce 5 moles of Cu^{2+} to Cu^+ with 10 A current?
(Given: $1\ F = 96500\ C\ mol^{-1}$)

OR

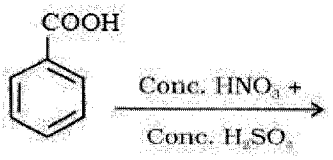
a) Conductivity of 0·02 M methanoic acid is $1.2126 \times 10^{-3}\ Scm^{-1}$. Calculate its molar conductivity and degree of dissociation if limiting molar conductivity for methanoic acid is $404.2\ Scm^2mol^{-1}$.

b) State the following laws:

(i) Faraday's first law of electrolysis

(ii) Kohlrausch's law of independent migration of ions.

34. a) Complete the following reactions.

(i) 

(ii) $CH_3CH_2CHO + NH_2CONHNH_2 \xrightarrow{H^+}$

(iii) $CH_3CH_2CH{=}CHCH_2CN \xrightarrow[2.\ H_2O]{1.\ DIBAL\text{-}H}$

b) Write short notes with the help of chemical reaction on:

(i) Rosenmund reduction

(ii) Hell-Volhard Zelinsky reaction

OR

a. Arrange the following in the increasing order of acidic character.
CH_3CH_2COOH, $CH_3CH(Br)COOH$, $CH_3C(Br_2)COOH$, $CH_3CH(CH_3)COOH$

b. How will you convert Propene to Propanone.

c. An alkene (A) with molecular formula C_5H_{10} on ozonolysis gives a mixture of two compounds, (B) and (C). Compound (B) gives positive Fehling test and also reacts with iodine and NaOH solution to form iodoform. Compound (C) does not give Fehling solution test but forms iodoform. Identify the compounds A, B and C and write their structures as well as IUPAC names.

35. a) Give reasons for the following statements.

(i) Transition metals and their compounds show catalytic activities.

(ii) Zr and Hf occur together in nature and its difficult to separate them.

b) Following are the transition metal ions of 3d series:

Ti^{4+}, V^{2+}, Cr^{3+}, Mn^{3+}

(Atomic numbers: Ti = 22, V = 23, Cr = 24, Mn = 25)

Identify the ion which

(i) is the most stable in an aqueous solution.

(ii) is colourless.

(iii) has the highest magnetic moment.

Give suitable reasons in each case.