Sample Paper 4

Class XII 2023-24

Chemistry

Time: 3 Hours **Max. Marks: 70**

General Instructions:

1. There are 33 questions in this question paper with internal choice.
2. SECTION A consists of 16 multiple-choice questions carrying 1 mark each.
3. SECTION B consists of 5 very short answer questions carrying 2 marks each.
4. SECTION C consists of 7 short answer questions carrying 3 marks each.
5. SECTION D consists of 2 case-based questions carrying 4 marks each.
6. SECTION E consists of 3 long answer questions carrying 5 marks each.
7. All questions are compulsory.
8. Use of log tables and calculators is not allowed.

SECTION-A

Directions (Q. Nos. 1-16) : 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. The half-life for a first order reaction is 4 minutes. The time after which 99.9% reaction gets completed is:

(a) 32 minutes (b) 40 minutes

(c) 16 minutes (d) 8 minutes

2. In the following reaction:

$CH_3 - CH = CH - CH_2OH \xrightarrow{PCC}$ .....

The product formed is:

(a) $CH_3 - CH = CH - CHO$ (b) $CH_3 - CH_2 - CH_2 - CHO$

(c) $CH_3 - CHO$ and CH_3CH_2OH (d) $CH_3 - CH = CH - COOH$

3. In the nitration of benzene using a mixture of conc. H_2SO_4 and conc. HNO_3, the species which initiate the reaction is_____.

(a) NO^+ (b) NO_2

(c) NO_2^- (d) NO_2^+

4. The reagent with which acetaldehyde and acetone both react easily is:

(a) Grignard reagent (b) Schiff's reagent

(c) Tollen's reagent (d) Fehling solution

5. o-hydroxy benzyl alcohol when reacted with PCl_3 gives the product as (IUPAC name):

(a) o- hydroxy-benzyl chloride

(b) o-chloromethylchlorobenzene

(c) 4-hydroxymethylphenol

(d) 2- chloromethylphenol

6. The relationship between rate constant and half-life period for a first order reaction is:

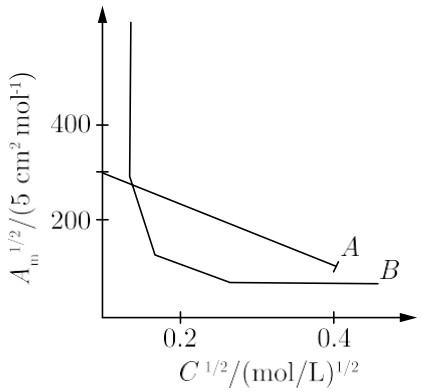
(a) $t_{1/2} = 0.693k$

(b) $t_{1/2} = k/0.693$

(c) $t_{1/2} = \frac{0.693}{k}$

(d) $k = \frac{t_{1/2}}{0.693}$

7. The following curve is obtained when molar conductivity λ_m (y-axis) is plotted against the square root of concentration $C^{1/2}$ (x-axis) for two electrolytes A and B.



What can you infer about the nature of the two electrolytes A and B?

(a) A is weak electrolyte and B is strong electrolyte

(b) A is strong electrolyte and B is weak electrolyte

(c) A and B both are strong electrolytes

(d) A and B both are weak electrolytes

8. $KMnO_4$ acts as an oxidising agent in alkaline medium. When alkaline $KMnO_4$ is treated with KI, iodide ion is oxidised to:

(a) IO^-

(b) I_2

(c) IO_4^-

(d) IO_3^-

9. The magnitude of CFSE (crystal field splitting energy, T_0) can be related to the configuration of d-orbital in a coordination entity as:

(a) if $T_0 < P$, the configuration is $t_{2g}^3 e_g^1$ = week field ligand and high spin complex

(b) if $T_0 > P$, the configuration is $t_{2g}^4 e_g^0$ = strong field ligand and high spin complex

(c) if $T_0 > P$, the configuration is $t_{2g}^3 e_g^1$ = strong field ligand and low spin complex

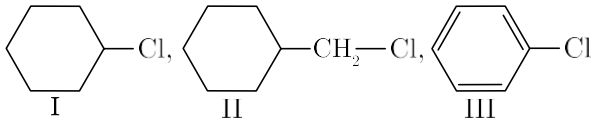
(d) if $T_0 = P$, the configuration is $t_{2g}^4 e_g^1$ = strong field ligand and high spin complex

10. Benzene diazonium chloride reacts with phenol in weakly alkaline medium to give:

(a) *p*-hydroxyphenol (b) Chlorobenzene

(c) Biphenyl ether (d) Benzene

11. Consider the following given compounds :

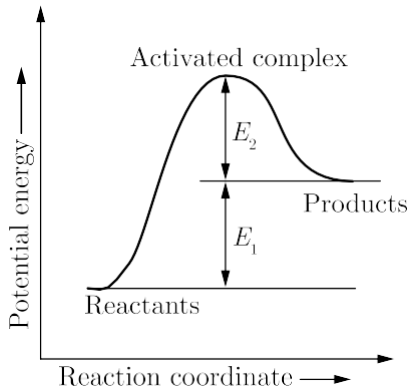


Which of the following is the correct order of reactivity towards S_N2 reaction?

(a) I > III > II (b) II > I > III

(c) II > III > I (d) III > I > II

12. Consider the given figure and mark the correct option.



(a) Activation energy of both forward and backward reaction is $E_1 + E_2$ and reactant is more stable than product.

(b) Activation energy of forward reaction is $E_1 + E_2$ and product is less stable than reactant.

(c) Activation energy of forward reaction is $E_1 + E_2$ and product is more stable than reactant.

(d) Activation energy of backward reaction is E_1 and product is more stable than reactant.

Directions (Q. Nos. 13-16) : Each of the following questions consists of two statements, one is Assertion and the other is Reason. Give answer :

13. **Assertion :** Aliphatic amines are weaker bases than ammonia and aromatic amines are stronger bases than ammonia.

Reason : +/ − effect of alkyl groups on aliphatic amines increase the electron density on nitrogen atom. Aromatic amines are weaker due to electron withdrawing nature of the aryl group.

(a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

(b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.

(c) Assertion is false but Reason is true.

(d) Assertion is true but Reason is false.

14. **Assertion :** Only *a*-amino acids are obtained on hydrolysis of proteins.
Reason : In zwitter ionic form, amino acids show amphoteric behaviour.

(a) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.

(b) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

(c) Assertion is true but Reason is false.

(d) Assertion is false but Reason is true.

15. **Assertion :** Actinoids form relatively less stable complexes as compared to lanthanides.
Reason : Actinoids can utilise their 5*f* orbitals along with 6*d* orbitals in bonding, but lanthanoids do not use their 4*f* orbital for bonding.

(a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

(b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.

(c) Assertion is false but Reason is true.

(d) Assertion is true but Reason is false.

16. **Assertion :** Ethers have specific dipole moment values.
Reason : The C – O bond is polar in nature.

(a) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.

(b) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

(c) Assertion is true but Reason is false.

(d) Assertion is false but Reason is true.

SECTION-B

Directions (Q. Nos. 17-21) : This section contains 5 questions with internal choice in one question. The following questions are very short answer type and carry 2 marks each.

17. Is the following reaction possible? Explain with reason.

$Fe(s) + H_2SO_4(aq) \not\rightarrow FeSO_4 + H_2 -$

18. A compound (A) on oxidation gives B $(C_2H_4O_2)$, (A) reacts with dil. NaOH and on subsequent heating forms (C). The compound (C) on catalytic hydrogenation gives (D). Identify A, B, C, D and write down the reaction involved.

19. Write the order of following reactions with reason:

(i) $N_2 + 3H_2 \underset{Mo}{\overset{Fe}{\rightleftharpoons}} 2NH_3^-$

(ii) $CH_3COOC_2H_5 + NaOH \longrightarrow CH_3COONa$

20. Give the plausible explanation for the following:
(i) Glucose doesn't 2, 4-DNP test.
(ii) The two strands in DNA are not identical but are complementary.

OR

What happens when D-glucose is treated with the following? Give equation to support your answer.
(i) HI (ii) HNO_3

21. Write all the geometrical isomers of $[Pt(NH_3)(Br)(Cl)(Py)]$ and how many of these will exhibit optical isomers?

SECTION-C

Directions (Q. Nos. 22-28) : This section contains 7 questions with internal choice in one question. The following questions are short answer type and carry 3 marks each.

22. How will you distinguish between the following pairs of compounds ?
(i) Chloroform and carbon tetrachloride
(ii) Benzyl chloride and chlorobenzene.

23. Show that for a first order reaction, time required for completion of 99% of reaction is twice the time required for completion of 90% of reaction.

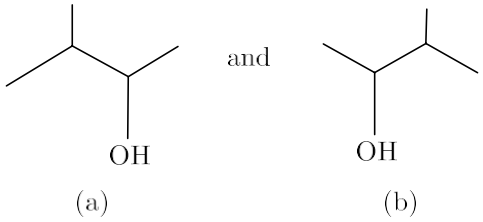
24. Give reasons for the following: (Any three)
(i) Aniline cannot be prepared by the ammonolysis of chlorobenzene under normal conditions.
(ii) N-ethylethanamine boils at 329.3K and butanamine boils at 350.8K. although both are isomeric in nature.
(iii) Acylation of aniline is carried out in the presence of pyridine.
(iv) Acetylation of aniline reduces its activation effect.

25. (i) Write the IUPAC name of the following complex : $K_2[PdCl_4]$
(ii) Using crystal field theory, write the electronic configuration of d^5 ion, if $\Delta_o > P$.
(iii) What are homoleptic complexes?

26. How are following conversions carried out?
(i) Ethyl cyanide to ethanoic acid
(ii) Butan-1-ol to butanoic acid
(iii) Benzoic acid to *m*-bromobenzoic acid.

27. The boiling point of solution obtained by dissolving 6 g urea (NH_2CONH_2) in 200 g water, is 100.28C. What will be the freezing point of this solution? For water molal elevation constant and molal depression constant are respectively 0.52°C $molal^{-1}$ and 1.86°C $molal^{-1}$.

28. (i) Identify the chiral molecule in the following pair:



(ii) Write the structure of the product when chlorobenzene is treated with methyl chloride in the presence of sodium metal and dry ether.

(iii) Write the structure of the alkene formed by dehydrohalogenation of 1-bromo-1-methylcyclohexane with alcoholic KOH.

SECTION-D

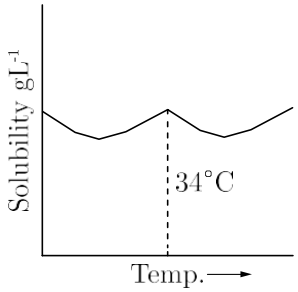
Directions (Q. Nos. 29-30) : The following questions are case-based questions. Each question has an internal choice and carries 4 marks each. Read the passage carefully and answer the questions that follow.

29. Solubility in Binary Solutions

Binary solutions can be of nine different types depending upon the nature of the solute and solvent whether solid, liquid or gas. They may be further classified as solid, liquid and gaseous solutions based on the component which acts as the solvent. However, the liquid solutions are the most important. Both solids and gases dissolve in liquids resulting in homogeneous mixtures, i.e. solutions. The solubility is governed by number of factors such as nature of solute and solvent, temperature, pressure etc. The concentrations of the solutions can be expressed in different ways such as normality, molarity, molality, mole fraction etc. Out of these, molality and mole fraction are better as they do not change with the change in temperature.

Based on the above passage, answer the .following questions:

(i) Solubility curve of $Na_2SO_4 \$ 10H_2O$ in water with temperature is given as:



What do you infer about the temperature variation of curve with solubility process?

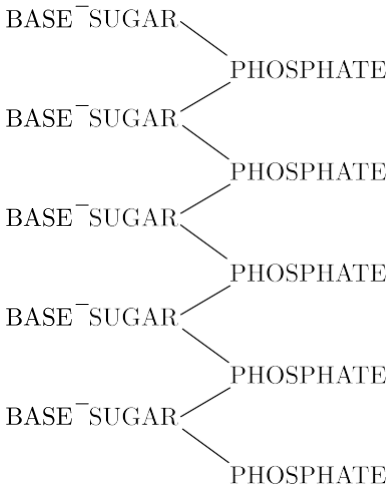
(ii) On what factor does the maximum amount of a solid solute that can be dissolved in a specified amount of a given liquid solvent not depend upon?

(iii) What is the molality of a sulphuric acid solution in which mole fraction of water is 0.85?

OR

How much amount of salt is contained in 1000 g of a 4% solution of salt?

30. The basic chemical formula of DNA is now well established. As shown in figure, it consists of a very long chain, the backbone of which is made up of alternate sugar and phosphate groups, joined together in regular 3151 phosphate di-ester linkages. To each sugar is attached a nitrogenous base, only four different kinds of which are commonly found in DNA.



Two of these–adenine and guanine are purines, and the other two thymine and cytosine are pyrimidines. A fifth base, 5-methyl cytosine, occurs in smaller amounts in certain organisms, and a sixth, 5-hydroxy-methyl-cytosine, is found instead of cytosine in the T even phages. It should be noted that the chain is unbranched, a consequence of the regular intemucleotide linkage. On the other hand the sequence of the different nucleotides is, as far as can be ascertained, completely irregular. Thus, DNA has some features which are regular, and some which are irregular. A similar conception of the DNA molecule as a long thin fibre is obtained from physicochemical analysis involving sedimentation, diffusion, light scattering, and viscosity measurements. These techniques indicated that DNA is a very asymmetrical structure approximately 20. A wide and many thousands of angstorms long. Estimates of its molecular weight currently center between $5 \# 10^6$ and 10^7 (approximately $3 \# 10^4$ nucleotides). Surprisingly each of these measurements tend to suggest that the DNA is relatively rigid, a puzzling finding in view of the large number of single bonds (5 per nucleotide) in the phosphate-sugar back bone. Recently these indirect inferences have been confirmed by electron microscopy.

Based on the above passage answer the following questions:

(i) A nitorgenous based is attached to each sugar and only four of its kinds are commonly found in DNA. Name the purines present in DNA.

(ii) Which of the four kinds of nitrogenous bases commonly found in DNA has been replaced in some organisms?

(iii) As shown in figure, DNA has a long chain. What is the backbone of DNA made up of and how is it joined?

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As given, DNA has some regular and some irregular features. Which features of DNA are regular and which are irregular? Which analysis provide the same concept of DNA?

SECTION-E

Directions (Q. Nos. 31-33) : The following questions are long answer type and carry 5 marks each. Two questions have an internal choice.

31. Explain the following observations:
(i) *d*-block elements exhibit more oxidation states as compared to elements of *f*-block.
(ii) Cu^{+} salts are colourless, whereas Cu^{2+} salts are coloured. (Atomic number of Cu = 29).
(iii) Mn^{2+} ion is more stable than Mn^{3+} ion.
(iv) Transition elements form several complex compounds.
(v) Zn^{2+} salts are white whereas Cu^{2+} salts are blue.

32. *A*, *B* and *C* are three non-cyclic functional isomers of a carbonyl compound with molecular formula C_4H_8O. Isomers *A* and *C* give positive Tollen's test whereas isomer *B* does not give Tollen's test but gives positive lodoform test. Isomers *A* and *B* on reduction with Zn (Hg)/ Conc. HCl give the same product *D*.
(i) Write the structure of *A*, *B*, *C* and *D*.
(ii) Out of *A*, *B* and *C* isomers, which one is least reactive towards addition of HCN?

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An alkene 'A' (Mol. formula C_5H_{10}) on ozonolysis gives a mixture of two compounds 'B' and 'C'. Compound 'B' gives positive Fehling's test and also forms iodoform on treatment with I_2 and NaOH. Compound 'C' does not give Fehling's test but forms iodoform.
(i) Identify the compounds A, B and C.
(ii) Write the reaction for ozonolysis and formation of iodoform from B and C.

33. (i) Write the cell reaction and calculate the emf of the following cell at 298 K :

$$Sn(s)\ y\ Sn^{2+}(0.004\ M)\ z\ H^{+}(0.020\ M)\ y\ H_2(g)(1\ bar)\ y\ Pt(s)$$

(Given: $E^{\circ}_{Sn^{2+}/Sn} = -0.14\ V$)
(ii) Give reasons :
(a) On the basis of E° values, O_2 gas should be liberated at anode but it is Cl_2 gas which is liberated in the electrolysis of aqueous NaCl.
(b) Conductivity of CH_3COOH decreases on dilution.

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(i) Out of the following pairs, predict with reason which pair will allow greater conduction of electricity:
(a) Silver wire at 30°C or silver wire at 60°C.
(b) 0.1 M CH_3COOH solution or 1 M CH_3COOH solution.
(c) KCl solution at 20°C or KCl solution at 50°C.
(ii) Give two points of differences between electrochemical and electrolytic cells.