I–TERM EXAMINATION : 2021–22

CLASS : XII (CBSE) E/M

Time : 3 hrs. **Chemistry (Theory)** M.M.: 70

General Instructions :

Read the following Instructions very carefully and strictly follow them:

(i) **All questions are compulsory.**

(ii) **There are 33 questions in this question paper.**

(iii) **Section A - Questions no. 1 to 2 are case based questions having four MCQ or reason Assertion type based on given passage each carrying 1 mark.**

(iv) **Section A - Questions no. 3 to 16 are MCQ and assertion reason type questions carrying 1 mark each.**

(v) **Section B - Question no. 17 to 25 are short answer questions and carry 2 marks each.**

(vi) **Section C -Questions no. 26 to 30 are short answer questions and carry 3 marks each.**

(vii) **Section D - Questions no. 31 to 33 are Long answer type Questions, carrying 5 marks each.**

(viii) **There is no over all choice in the question paper. However, an internal choice have been provided**

(ix) **Use of calculater and log tables is not permitted.**

SECTION 'A'

Q.1. Read the passage given below and answer the following, questions. [1x4= 4]

Alkyl halides are prepared by the free radical halogenation of alkanes, addition of halogen acid to alkenes, replacement of -OH group of alcohols with halogens using phosphorus halides, thionyl chloride or halogen acids. Aryl halides are prepared by electrophilic substitution to arenes. Fluoride and iodides are best prepared by halogen exchange method. These compounds find wide applications in industry as well as in day to day life. These compounds are generally used as solvents and as starting material for the synthesis of a large number of organic compounds. The following questions are multiple choice questions choose the most appropriate answer.

(i) Which of the following undergoes nucleophilic substitution exclusively by SN^1 mechanism ?

(a) Benzyl chloride (b) Ethyl chloride

(c) Chlorobenzene (d) Isopropyl chloride

(ii) A Grignard reagent may be made by reacting magnesium with :

(a) Methyl amine (b) Diethyl ether

(c) Ethyl iodide (d) Ethyl alcohol

OR

C-Cl bond of chlorobenzene in comparison to C-Cl bond in methyl chloride is :

(a) Longer and weaker (b) Shorter and weaker

(c) Shorter and stronger (d) Longer and stronger

(iii) Phosgene is commonly known as:

(a) thionyl chloride (b) carbonyl chloride

(c) carbondioxide and phosphine (d) phosphoryl chloride

(iv) Which of the following is most reactive towards SN^1 reaction ?

(a) $C_6H_5C(CH_3)C_6H_5Br$ (b) $C_8H_5CH_2Br$

(c) $C_6H_5CH(C_6H_5)Br$ (d) $C_6H_5CH(CH_3)Br$

Q.2. **Read the passage given below and answer the following questions.** [1x4=4]

Both alcohol and phenol contain a hydroxyl group but phenols are more acidic than alcohols. Whereas acidic strength of aliphatic alcohols mainly depends upon the inductive effects. The acid strength of phenols depends upon combination of both inductive ad resonance effect of the substituent and its position on benzene ring.

In the following questions a statement of assertion followed by a statement of reason is given. Choose the answer out of the following choices.

(a) Assertion and reason both are correct statement and reason is correct explanation for assertion.

(b) Assertion and reason both are correct statement and reason is not correct explanation for assertion.

(c) Assertion is correct statement but reason is wrong.

(d) Assertion is wrong statement but reason is correct.

(i) Assertion (A) : Equimolar mixture of conc. HCℓ and $ZnC\ell_2$ is known as Lucas reagent.
Reason (R) : Lucas reagent can be used to distinguish between methanol and ethanol.

(ii) Assertion (A) : Alcohols show intramolecular hydrogen bonding
Reason (R) : Alcohols have higher boiling points than ether of comparable molecular masses

OR

Assertion (A) : C_2H_5OH is a weak base than phenol but is a stronger nucleophile than phenol.
Reason (R) : In phenol the lone pair of electrons on oxygen is withdrawn towards the ring due to resonance

(iii) Assertion (A) : O-Nitrophenol is less soluble in H_2O than m and p-isomers.
Reason (R) : m-and p-Nitrophenols exist as associated molecule.

(iv) Assertion (A) : Picric acid does not contain COOH group
Reason (R) : Picric acid is 2, 4,6-trinitrophenol.

Following question (No. 3-11) are multiple choice questions carrying 1 mark each.

Q.3. A Primary alkyl halide would prefer to undergo: [1]

(a) SN^1 reaction (b) SN^2 reaction
(c) α-Elimination (d) racimisation

Q.4. Toluene react with a halogen in the presence of iron (III) chloride giving ortho and parahalo compounds. The reaction is : [1]

(a) Electrophilic Elimination reaction
(b) Electrophilic substitution reaction
(c) Free radical addition reaction
(d) Nucleophilic substitution reaction

OR

If the initial concentration of reaction is doubled $t_{1/2}$ is also doubled. The order of reaction is :

(a) Zero (b) 1 (c) 2 (d) 3

Q.5. If 18 g of glucose is present in 1000 g of solvent the solution is said to be : [1]

(a) 1 molar (b) 0.1 molal
(c) 0.1 molar (d) 0.5 molal

OR

The number of moles of solute per kg of a solvent is called :

(a) Molarity (b) Normality (c) Molality (d) Mole fraction

Q.6. The rate of chemical reaction : [1]

(a) increase as the reaction proceeds
(b) decrease as the reaction proceeds
(c) may increase or decrease during the reaction
(d) remain constant as the reaction proceeds

Q.7. The rate of reaction, $A + B \rightarrow$ products, is given by the equation, r=k[A] [B]. If B is taken in large excess, the order ofreaction would be : [1]

(a) 2 (b) 1 (c) zero (d) unpredictable

OR

Which of the following oxidation state is common for all lanthanoids :

(a) +2 (b) +3 (c) +4 (d) +5

Q.8. Electronic configuration of a transition element X in +3 oxidation state is (Ar)$3d^5$. What is its atomic number ? [1]

(a) 25 (b) 26 (c) 27 (d) 24

Q.9. Which is the correct formula of freon-12 ? [1]

(a) $CC\ell_2F_2$ (b) $CF_3C\ell$ (c) $CHC\ell_2F$ (d) $CC\ell_3F$

Q.10. Tartaric acid molecule contain two asymmetric carbon atoms. The number of optical isomers of tartaric acid is : [1]

(a) 2 (b) 3 (c) 4 (d) 5

Q.11. Primary, Secondary and tertiary alcohols are distinguished by : [1]

(a) Oxidation method (b) Lucas test

(c) Victor Meyer's method (d) all of these

In the following questions (Q. No. 12- 16) a statement of assertion followed by a statement of reason is given choose the correct answer out of the following choices:

(a) Both Assertion (A) and reason (R) are correct statement and reason (R) is the correct explanation of the Assertion (A)

(b) Both Assertion (A) and reason (R) are correct but reason(R) is not the correct explanation of the Assertion (A)

(c) Assertion (A) is correct but Reason (R) is wrong statement.

(d) Assertion (A) is wrong but reason (R) is correct statement.

Q.12. Assertion (A): Acidic character of alcohols follows the order. Primary > secondary >tertiary. [1]

Reason (R) : Acidic character of alcohols is due to the presence of polar -OH group.

Q.13. Assertion (A): SN^2 reaction take place in a single step. [1]

Reason (R) : SN^2 reaction involves transition state intermediate.

OR

Assertion (A): Nucleophilic substitution of iodoethane is easier than chloroethane.

Reason (R) : Bond energy of C-I bond is less than that of C-Cl bond.

Q.14. Assertion (A): $KMnO_4$ is a coloured compound. [1]

Reason (R) : Colour of $KMnO_4$ is due to charge transfer.

Q.15. Assertion (A): Fe^{2+} act as a reducing agent. [1]

Reason (R) : Fe^{3+} state is stable due to $3d^5$ configuration.

Q.16. Assertion (A) : The sum of mole fraction of all the component of a solution is unity. [1]

Reason (R) : Mole fraction is a temperature independent mode of concentration.

SECTION-B

In the following Questions (Q. No. 17-25) are short answer type and carry 2 marks each.

Q.17. A glucose solution which boils at 101.04 °C at 1 atm what will be relative lowering of vapour pressure of an aqueous solution of urea which is equimolal to given glucose solution? (Given K_b for water is 0.52 k kg mol^{-1}) [2]

OR

A solution containing 15 g urea (molar mass = 60 g mol^{-1}) Per litre of solution in water has the same osmotic pressure (isotonic) as a solution of glucose (molar mass 180g mol^{-1}) in water. Calculate the mass of glucose present in one litre of its solution.

Q.18. Show that in a first order reaction time required for completion of 99.9% is 10 times that of half life $\left(t_{1/2}\right)$ of the reaction. [2]

OR

The rate constant for a first order reaction is 60 s^{-1} how much time will it take to reduce the initial concentration of the reactant to $^1/_{10}$ th of its initial value ?

Q.19. How do you convert the following : [2]

(i) Propan-1-ol to propan-2-ol

(ii) Benzene to diphenyl

Q.20. Although chlorine is an electron withdrawing group yet it is ortho-para directing in electrophilic aromatic substitution reaction why? [2]

Q.21. The elements of 3d transition series are given as : [2]

Sc, Ti, V, Cr, Mn, Fe, Co, Ni, Cu Zn

Answer the following :

(i) Which element has the highest m.p. and why?

(ii) Which element is a strong oxidising agent in +3 oxidation state and why ?

Q.22. Write the mechanism of acid dehydration of ethanol to yield ethene. [2]

OR

Explain the following with an example :

(i) Reimer Tiemann reaction

(ii) Williamson Ether Synthesis

Q.23. Explain why is orthonitrophenol more acidic than ortho methoxyphenol ? [2]

Q.24. Give reasons : [2]

(i) Transition metals form coloured compounds.

(ii) In transition series, with an increase in atomic number, the atomic radius does not change very much.

Q.25. For a reaction : [2]

$$2NH_3(g) \xrightarrow{Pt} N_2(g) + 3H_2(g)$$

Rate = k

(i) Write the order and molecularity of this reaction

(ii) Write the unit of k.

SECTION 'C'

Q. No. 26-30 are short answer type II carrying 3 marks each.

Q.26. What happens when: [3]

(a) $(CH_3)_3$-C-O-CH_3 is treated with HI

(b) Anisole is treated with CH_3COCl / Anhydrous $AlCl_3$

(c) Phenol is treated with Br_2 / Cs_2

OR

Define following term :

(a) Optical isomerism (b) Chirality (c) enantiomers

Q.27. Give reasons for the following : [3]

(a) Ethyl iodide undergoes SN^2 reaction faster than ethyl bromide.

(b) C-X bond length in halobenzene is smaller than C-X bond length of CH_3-X.

(c) Racemic mixture is optically inactive.

OR

For a reaction $A + B \rightarrow P$ the rate is given by Rate=k[A] $[B]^2$

(a) How is the rate of reaction affected if the concentration of B is doubled ?

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

Q.28. Calculate the freezing point of a solution containing 0.5 g KCl (molar mass=74.5gmol^{-1}) dissolved in 100g water assuming KCl to be 92% Ionised. [3]

(K_f for water = 1.86 K kg mol^{-1})

Q.29. Account for the following : [3]

(a) Manganese shows maximum number of oxidation states in 3d series.

(b) E^o value for Mn^{3+}/Mn^{2+} couple is much more positive that for Cr^{3+}/Cr^{2+}

(c) Ti^{4+} is colourless whereas V^{4+} is coloured in an aqueous solution.

OR

(a) Arrange the compounds in order of increasing boiling points.
Bromomethane, Bromoform, Chloromethane, Dibromomethane

(b) Give the difference between SN^1 and SN^2 reaction.

Q.30. Explain following term : [3]

(a) Henry's law (b) Raoult's law

(c) Mole fraction

SECTION 'D'

Q. No. (31 to 33) are long answer type questions carrying 5 marks each.

Q.31. (a) Following compounds are given to you : [5]

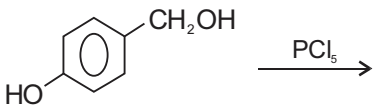
2-bromopentane, 2-bromo 2-methyl butane, 1-bromo pentane :

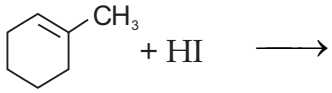
(i) Write the compound which is most reactive towards SN^2 reaction.

(ii) Write the compound which is optically active.

(iii) Write the compound which is most reactive towards -Elimination reaction.

(b) Write the major product in the following reactions :

(i) 

(ii) 

OR

(a) What happen when :

(i) Ethyl chloride is treated with aqueous KOH

(ii) Methyl chloride is treated with KCN

(iii) n-butyl chloride is treated with alcoholic KOH.

(b) Explain why:

(i) The dipole moment of chlorobenzene is lower than that of cyclohexyl chloride.

(ii) Grignard reagents should be prepared under anhydrous conditions.

Q.32. (a) Write two difference between 'order of reaction' and 'molecularity of reaction'. [5]

(b) A first order reaction is 75% completed in 40 minutes. Calculate its $t_{1/2}$.

OR

Consider the reaction $R \xrightarrow{K} P$. The change in concentration of $\ell_n[R]$ with time (t) is shown in the following plot :

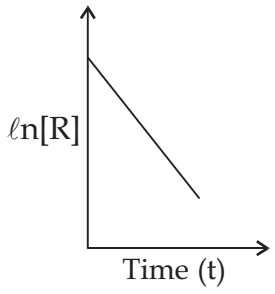
(i) Predict the order of reaction

(ii) What is the unit of rate constant

(iii) Give the relationship between K and $t_{1/2}$

(iv) What is the slope of the curve

(v) Draw the plot log $\frac{[Ro]}{R}$ vs time (t)



Q.33. (a) (i) Copper (I) compounds are white where as copper (II) compounds are coloured. [5]

(ii) Zn, Cd, Hg are considered as d-block elements but not as transition elements.

(iii) How is the variability in oxidation states of transition metals different from that of the p-block elements ?

(b) What is Lanthanoid contraction ? Write its two consequences.

OR

(a) Give one chemical test to distinguish between the following:

(i) Phenol and 1-propanol

(ii) Ethanol and dimethyl ether

(b) How can you obtain :

(i) Phenol from chlorobenzene

(ii) Chlorobenzene from benzene diazonium chloride

(iii) Picric acid from phenol

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