Sample Paper 20

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. Consider the following reaction :

$C_6H_5NO_2 \xrightarrow{Sn/HCl} X \xrightarrow{C_6H_5COCl} Y + CHl$

What is Y in the above reaction ?

(a) Acetanilide (b) Benzanilide

(c) Azobenzene (d) Hydrazobenzene

2. An industrial method of preparation of methanol is :

(a) catalytic reduction of carbon monoxide in presence of $ZnO - Cr_2O_3$

(b) by reacting methane with steam at $900^\circ C$ with a nickel catalyst

(c) by reducing formaldehyde with lithium aluminium hydride

(d) by reacting formaldehyde with aqueous sodium hydroxide solution

3. Which does not react with I_2 and NaOH.

(a) Ethyl Alcohol (b) Acetaldehyde

(c) Acetone (d) Propanol

4. The preparation of ethyl acetoacetate involves.

(a) Witting reaction (b) Cannizzaro's reaction

(c) Reformatsky reaction (d) Claisen condensation

5. An aqueous solution is 1.00 molal in KI. Which change will cause the vapour pressure of the solution to increase ?

(a) Addition of NaCl
(b) Addition of Na_2SO_4
(c) Addition of 1.00 molal KI
(d) Addition of water

6. Which of the following will show paramagnetism corresponding to 2 unpaired electrons ? (Atomic numbers : Ni=28, Fe=26)

(a) $[FeF_6]^{3-}$
(b) $[NiCl_4]^{2-}$
(c) $[Fe(CN)_6]^{3-}$
(d) $[Ni(CN)_4]^{2-}$

7. The fuel used in the cell used in Apollo mission was.

(a) H_2
(b) $H_2 - O_2$
(c) CH_4
(d) O_2

8. For the reaction :

$[N_2O_5(g) \longrightarrow 2NO_2(g) + \frac{1}{2}O_2(g)]$ the value of rate of disappearance of N_2O_5 is given as $6.25 \times 10^{-3} mol\, L^{-1}s^{-1}$. The rate of formation of NO_2 and O_2 is given respectively as

(a) 6.25×10^{-3} mol $L^{-1}s^{-1}$ and 6.25×10^{-3} mol $L^{-1}s^{-1}$
(b) 1.25×10^{-2} mol $L^{-1}s^{-1}$ and 3.125×10^{-3} mol $L^{-1}s^{-1}$
(c) 6.25×10^{-3} mol $L^{-1}s^{-1}$ and 3.125×10^{-3} mol $L^{-1}s^{-1}$
(d) 1.25×10^{-2} mol $L^{-1}s^{-1}$ and 6.25×10^{-3} mol $L^{-1}s^{-1}$

9. General electronic configuration of lanthanides is :

(a) $(n-2)f^{1-14}(n-1)s^2p^6d^{10}ns^2$
(b) $(n-2)f^{10-14}(n-1)d^{0-1}ns^2$
(c) $(n-2)f^{0-14}(n-1)d^{10}ns^2$
(d) $(n-2)d^{0-1}(n-1)f^{1-14}ns^2$

10. Kohlrausch's law states that at :

(a) finite dilution, each ion makes definite contribution to equivalent conductance of an electrolyte, whatever be the nature of the other ion of the electrolyte.
(b) infinite dilution each ion makes definite contribution to equivalent conductance of an electrolyte depending on the nature of the other ion of the electrolyte.
(c) infinite dilution, each ion makes definite contribution to conductance of an electrolyte whatever be the nature of the other ion of the electrolyte.
(d) infinite dilution, each ion makes definite contribution to equivalent conductance of an electrolyte, whatever be the nature of the other ion of the electrolyte.

11. The change in optical rotation (with time) of freshly prepared solutions of sugar is known as :

(a) Specific rotation
(b) Inversion
(c) Rotatory motion
(d) Mutarotation

12. When a biochemical reaction is carried out in laboratory in the absence of enzyme then rate of reaction obtained 10^{-6} times, then activation energy of reaction in the presence of enzyme is :

(a) $\frac{6}{RT}$ (b) different from E_a obtained in laboratory

(c) P is required (d) can't say anything

Directions (Q. No. 13-16) : Each of the following questions consists of two statements, one is Assertion and the other is Reason. Give answer :

13. **Assertion :** The pK_a of acetic acid is lower than that of phenol.
Reason : Phenoxide ion is more resonance stabilised.

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

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

(c) Assertion is correct but Reason is incorrect.

(d) Both the Assertion and Reason are incorrect.

14. **Assertion :** The acetate ion is resonance stabilized.
Reason : Acetate ion is more basic than the methoxide ion.

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

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

(c) Assertion is correct but Reason is incorrect.

(d) Both the Assertion and Reason are incorrect.

15. **Assertion :** Aromatic aldehydes and formaldehyde undergo Cannizzaro reaction.
Reason : These aldehydes which have α-H atom undergo Cannizzaro reaction.

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

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

(c) Assertion is correct but Reason is incorrect.

(d) Both the Assertion and Reason are incorrect.

16. **Assertion :** In acidic medium, $K_2Cr_2O_7$ exists as $Cr_2O_7^{2-}$ (orange) while in basic medium it is converted to CrO_4^{2-} (yellow).
Reason : $K_2Cr_2O_7$ is hygroscopic in nature and changes colour on reaction with water.

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

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

(c) Assertion is correct but Reason is incorrect.

(d) Both the Assertion and Reason are incorrect.

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. Which out of molarity or molality will change in temperature why ?

18. Suggest some chemical reagents for the chemical reduction of carbonyl compounds ($\equiv$ aldehydes and ketones).

19. Write the Nernst equation for the EMF of the cell
$Ni_{(s)} \mid Ni^{2+}_{(aq)} \parallel Ag^{2+}_{(aq)} \mid Ag$

20. Write the reaction of formaldehyde with ammonia.

or

How will you convert ?

1. $CH_3COOH \longrightarrow CH_3 - CH_3$
2. $CH_3COOH \longrightarrow CH_3 - CH_2 - OH$
3. $C_6H_5COOH - C_6H_4 - Br - COOH$

21. Write the cell reaction for which $E_{cell} = E^0_{cell} - \frac{RT}{2F} \ln \frac{[Mg^{2+}]}{[Ag^+]^2}$

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. Complete the following reactions :

1. $CH_3 - O - C_2H_5 + HI \xrightarrow{373\,K}$
2. $C_6H_5ONa + CH_3Br \xrightarrow{\Delta}$
3. $CH_3 - O - CH_2CH_3 + HBr \xrightarrow{373\,K}$

23. How is standard Gibbs energy of a reaction is related to its equilibrium constant ?

24. What is a racemic mixture ? Give one example.

25. Discuss the following terms :

(a) Coordination Number.

(b) Effective Atomic Number.

26. Which would undergo S_N1 reaction faster in the following pair and why ?

$$CH_3-CH_2-Br \text{ and } H_3C-\underset{\displaystyle Br}{\overset{\displaystyle CH_3}{\overset{|}{\underset{|}{C}}}}-CH_3$$

27. How substituents effect the acidity of carboxylic acids ?

28. How can one reduce carboxylic acid to alcohol?

or

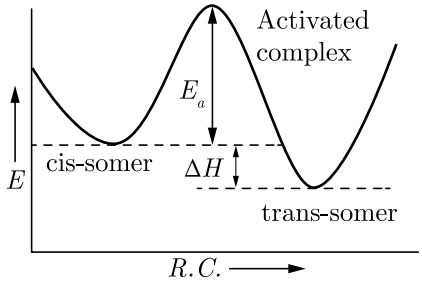
How carboxylic acids are commercially converted into alcohols ?

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. A reaction is said to be unimolecular if, on the microscopic level, rearrangement of the structure of a single molecule produces the appropriate product molecules. An example of a unimolecular process is conversion of cis-2-butene to trans-2-butene (in the absence of any catalyst).

All that is required for this reaction to occur is a twist or rotation around the double bond interchanging the methyl group with the hydrogen atom on the right-hand side. Only one cis-2-butene molecule need to be involved as a reactant in this process. Rotating part of a molecule about a double bond is not easy, because it involves a distortion of the electron clouds forming the double bond. A considerable increase in energy is required to twist one end of cis-2-butene around the other. This is shown in figure.



The minimum quantity of energy required to surmount an energy barrier during a chemical reaction is called the activation energy, E_a and the molecular species at the top of the barrier is called the activated complex or transition state.

In the sample of gaseous cls-2-butene at room temperature, only a tiny fraction of molecules have enough energy to surmount the activation energy barrier. Not only do few molecules have enough energy to overcome the activation energy barrier, but fewer still have that energy concentrated so that it can cause the atomic movements needed for the reaction to occur. For a uni-molecular process, the reaction rate must always be directly proportional to the concentration of the reacting species. For a general uni-molecular process, $A \rightarrow$ products, the rate equation is, Rate $= k[A]$, where $[A]$ =concentration of A.

Read the above passage and answer the following questions:

(a) With the help of diagram, explain the physical significance of energy of activation (E_a) in chemical reactions.

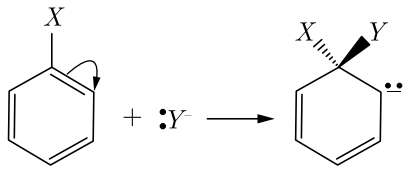
(b) Can molecularity of a reaction be zero ?

(c) Over a given period of time only a very small fraction of cis-2-butene molecule will be converted to trans-2-bttene. Give reason.

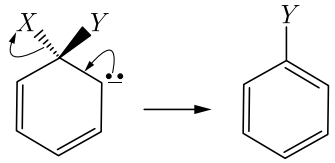
or

(d) How is the rate of reaction affected if the concentration of cis-2-butene is doubled ?

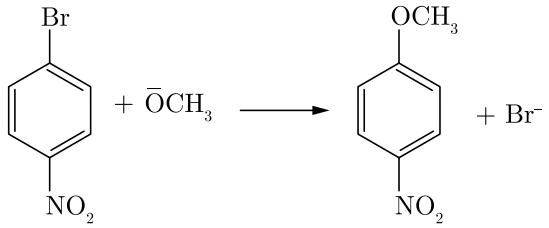
30. The simple aryl halides generally are resistant to attack by nucleophiles in either S_N1 or S_N2 reactions. However, this low reactivity can be changed dramatically by changes in the reaction conditions and the structure of the aryl halide. In fact, nuclephilic displacement becomes quite rapid.(i) when the aryl halide is activated by substitution with strongly electron attracting groups such as NO_2 and (ii) when very strongly basic nucleophilic reagents are used. The generally accepted mechanism of nucleophilic aromatic substitution of aryl halides carrying activating groups involve two steps. The first step involves attack of the nucleophile Y at the carbon bearing halogen substitutent to form an intermediate carbanion. The aromatic system is destroyed on forming the anion and the carbon at the reaction site changes from planar (sp^2 bonds) to tetrahedral (sp^3 bonds).

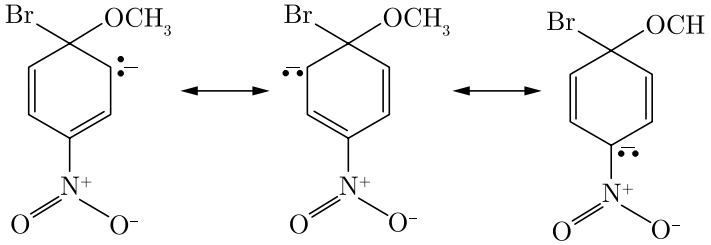


In the second step, loss of an anion, X^- or Y^-, regenerated an aromatic system and if X^- is lost, the overall reaction is nucleophilic displacement of X by Y



When strongly electron attracting groups are located on the ring at the ortho-parapositions, the intermediate anion is stabilised by the delocalization of the electrons from the ring carbons to more favourable locations on the substituent groups.





Read the above passage carefully and answer the following questions :

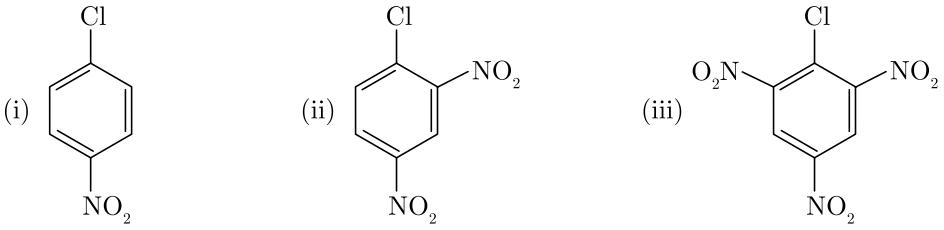
(a) Chlorobenzene is extremely less reactive towards a nucleophilic substitution reaction. Give two reasons for the same.

(b) Write the product formed when *p*-nitrochlorobenzene is heated with aqueous NaOH at 443 K followed by acidification.

(c) Why NO_2, group shows its effect only at ortho and para-positions and not at meta-position?

or

(d) Aryl halides are extremely less reactive towards nucleophilic substitution. Predict and explain the order of reactivity of the following compounds towards nucleophilic substitution :



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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. Derive the Arrhenius equation.

or

Briefly explain the effect of adding catalyst on the rate of reaction.

32. (a) In the titration of $FeSO_4$ with $KMnO_4$ in the acidic medium, why is dil. H_2SO_4 used instead of dil. HCl ?

(b) Give reason :

1. Among transition metals, the highest oxidation states is exhibited on oxo-anions of a metal.
2. Ce^+ is used as an oxidising agent in volumetric analysis.
3. Transition metals form a number of interstitial compounds.
4. Zn^{2+} salts are white while Cu^{2+} salts are blue.

or

(a) A blackish brown coloured solid 'A' when fused with alkali metal hydroxides in presence of air produces a dark green coloured compound 'B' which an electrolytic oxidation in alkaline medium gives a dark purple coloured compound 'C'. Identify A, B and C and write the reactions involved.

(b) What happens when an acidic solution of the green compound (B) is allowed to stand for sometime ? Give the equation involved. What is this type of reaction called ?

33. Amino acids may be acidic, alkaline or neutral. How does this happen ?

□□□□□□□