



ANANDALAYA
PERIODIC TEST – 2
Class: XII

Subject: Chemistry (043)
Date : 21-09-2024

MM: 70
Time: 3 hours

General Instructions:

Read the following instructions carefully.

- (a) There are 33 questions in this question paper with internal choice.
- (b) SECTION A consists of 16 multiple-choice questions carrying 1 mark each.
- (c) SECTION B consists of 5 short answer questions carrying 2 marks each.
- (d) SECTION C consists of 7 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.

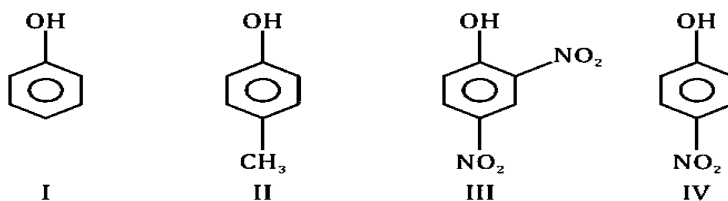
SECTION A

1. What are the followings called? (1)

A = Same molecular formula but different structures, B = non-superimposable mirror images

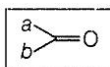
- (A) A = Isomers, B = Stereo-isomers (B) A = Enantiomers, B = Isomers
(C) A = Racemic mixture, B = Enantiomers (D) A = Isomers, B = Enantiomers

2. Which of the following will show the highest acidic strength? (1)

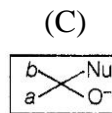
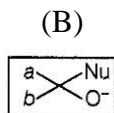
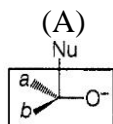


- (A) I (B) II (C) III (D) IV

3. Which of the following is the correct representation for intermediate of nucleophilic addition reaction to the given carbonyl compound (A)? (1)



(A)



(D)
(B) and (C) both

4. Propanone + NH₂NH₂ + KOH $\xrightarrow[\Delta]{\text{Ethylene glycol}}$ A. Identify A. (1)

- (A) propanal (B) propanoic acid (C) propane (D) propene

5. Propanal and Propanone are _____. (1)

- (A) functional group isomers (B) position isomers (C) geometrical isomers (D) metamers

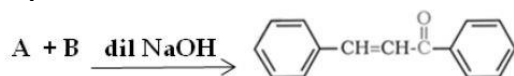
6. What happens to the value of K_H as the solubility of N₂ gas increases? (Henry's Law) (1)

- (A) Remains the same (B) Increases linearly
(C) Decreases linearly (D) First increases and then decreases

7. Given that $E^0_{\text{Ag}^+/\text{Ag}} = 0.80 \text{ V}$, $E^0_{\text{Mg}^{2+}/\text{Mg}} = -2.37 \text{ V}$, $E^0_{\text{Cu}^{2+}/\text{Cu}} = +0.34 \text{ V}$ (1)
Which of the following statements is/are correct?
(i) AgNO_3 can be stored in a copper vessel
(ii) $\text{Mg}(\text{NO}_3)_2$ can be stored in a copper vessel
(iii) CuCl_2 can be stored in silver vessel
(A) II and III (B) I and II (C) III only (D) I, II, III
8. The Van't Hoff's factor of 0.1 M $\text{Ba}(\text{NO}_3)_2$ in the solution is 2.74. The degree of association (1)
is _____.
(A) 91.3% (B) 87% (C) 100% (D) 74%
9. 234.2 gm of sugar solution contains 34.2 gm of sugar. What is the molal concentration of the (1)
solution?
(A) 0.1 (B) 0.5 (C) 5.5 (D) 55
10. The standard electrode potentials for the following reactions are: (1)
 $\text{Zn} \rightarrow \text{Zn}^{+2} + 2\text{e}^-$, $E^0 = +0.76 \text{ V}$, $\text{Fe} \rightarrow \text{Fe}^{+2} + 2\text{e}^-$, $E^0 = +0.41 \text{ V}$
What will be the e.m.f. of the cell in which the overall cell reaction is as follows?
 $\text{Fe}^{+2} + \text{Zn} \rightarrow \text{Fe} + \text{Zn}^{+2}$
(A) -0.35 V (B) +0.35 V (C) -1.17 V (D) +1.17 V
11. Which of the following is non-electrolyte? (1)
(A) NaCl (B) CaCl_2 (C) $\text{C}_{12}\text{H}_{22}\text{O}_{11}$ (D) CH_3COOH
12. For an exothermic reaction, the energy of activation of the reactants is _____. (1)
(A) equal to the energy of activation of products.
(B) less than the energy of activation of products.
(C) greater than the energy of activation of products.
(D) sometimes greater and sometimes less than that of the products.
- Q. 13 to Q. 16 are Assertion (A) and Reason (R) type questions. 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.
13. (A): Formaldehyde is a trigonal planar molecule. (1)
(R): It contains sp^2 hybridized carbon atom.
14. (A): Lowering of vapour pressure is directly proportional to osmotic pressure of the solution. (1)
(R): Osmotic pressure is a colligative property.
15. (A): The order of a reaction can be fractional. (1)
(R): The order of a reaction cannot be written from the balanced chemical equation of a reaction.
16. (A): Ketones are more easily oxidised than aldehydes. (1)
(R): C-C bond of ketones is stronger than C-H bond of aldehydes.

SECTION B

17. (a) Draw the structural formula of 4-Methylpent-3-en-2-one. (2)
 (b) Give the IUPAC name of $\text{CH}_3\text{CH}(\text{CH}_3)\text{CH}_2\text{CH}_2\text{CHO}$.
18. (a) Arrange the following in the increasing order of their boiling points. (2)
 Acetaldehyde, propane, propanone, acetic acid, and ethyl alcohol
 (b) The following reaction represents the cross-aldol condensation. Identify A and B.



19. Observe the following reaction and compare: (2)
 (i) The acidic property of water and alcohol
 (ii) Basic strength of alkoxide and hydroxide anion



20. An organic compound with the molecular formula $\text{C}_9\text{H}_{10}\text{O}$ forms 2, 4-DNP derivative, reduces Tollens' reagent and undergoes Cannizzaro reaction. On vigorous oxidation, it gives 1, 2-benzenedicarboxylic acid. Identify the compound. (2)

OR

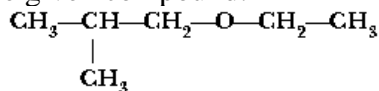
An aromatic compound 'A' (molecular formula $\text{C}_8\text{H}_8\text{O}$) gives positive 2, 4-DNP test. It gives a yellow precipitate of compound 'B' on treatment with iodine and sodium hydroxide solution. Compound 'A' does not give Tollen's or Fehling's test. On drastic oxidation with potassium permanganate, it forms a carboxylic acid 'C' (molecular formula $\text{C}_7\text{H}_6\text{O}_2$) reaction. Identify A and write all the reactions involved.

21. (a) What is the unit of molal depression constant? (2)
 (b) Why does the solubility of gases decrease with increase in temperature?

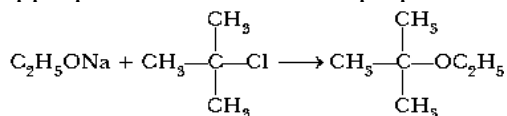
SECTION C

This section contains 7 questions with internal choice in one question. The following questions are short answer type and carry 3 marks each.

22. (a) Write the IUPAC name of the given compound: (3)



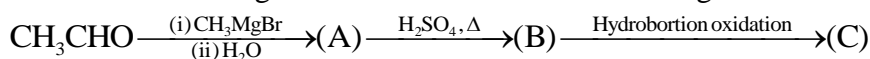
- (b) The following is not an appropriate reaction for the preparation of t-butyl ethyl ether.



Write a suitable reaction for the preparation of t-butyl ethyl ether.

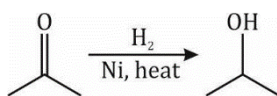
- (c) Define: Collision frequency

23. (a) Deduce the isomerism existing between A and C in the following reaction. (3)



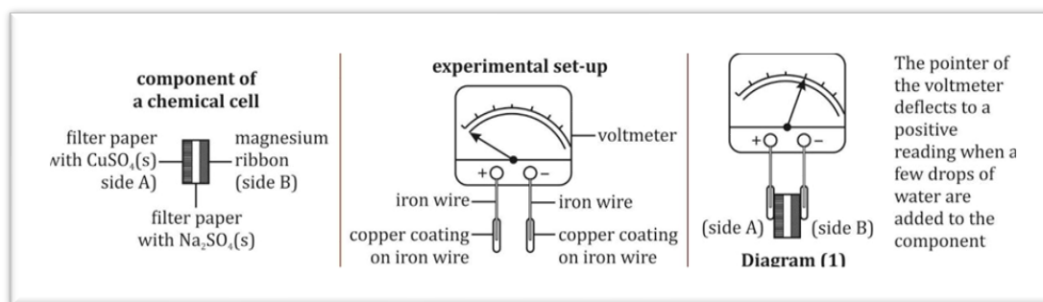
- (b) Which one, Phenol or methanol has lesser value of dipole moment and why?

24. Nickel catalyses the conversion of propanone to propan-2-ol as follows. (3)



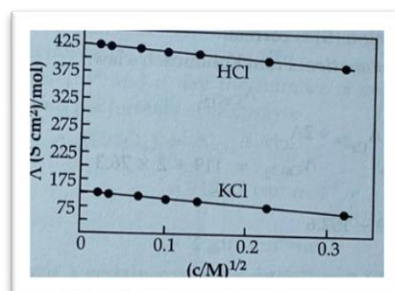
- (a) Outline how a catalyst increases the rate of reaction.
 (b) Explain why an increase in temperature increases the rate of reaction?
 (c) Discuss, referring to intermolecular forces present, the relative volatility of propanone and propan-2-ol.

25. (a) The diagrams below show the component of a chemical cell, an experimental set-up and how the pointer of the voltmeter deflects when the set-up is connected to the component. (3)



Why does the pointer of the voltmeter deflect as shown when few drops of water are added to the component?

- (b) The molar conductivity of CH_3COOH at infinite dilution is $390 \text{ S cm}^2/\text{mol}$. Using the graph and given information, find out the molar conductivity of CH_3COOK .



26. (a) For a reaction $\text{A} + \text{B} \rightarrow \text{P}$, the rate is given by $\text{Rate} = k[\text{A}][\text{B}]^2$. (3)
- (i) How is rate reaction affected if the concentration of 'B' is doubled.
- (ii) What is overall order of reaction if 'A' is present in large excess?
- (b) Consider the reaction: $3\text{A} \rightarrow 2\text{B}$. Express the rate of production of product B in terms of the rate of reduction of reactant A.
27. (a) Show that the time required for 99% completion is double of the time required for the completion of 90% reaction. (3)
- (b) For a gaseous the reaction $\text{A}_{(\text{g})} \rightarrow \text{B}_{(\text{g})} + \text{C}_{(\text{g})}$, write the integrated rate equation in terms of total pressure P_t at time 't' and initial pressure of A at time $t = 0$ sec.
28. (a) Which of the following has the highest dipole moment? (3)
- CH_2Cl_2 , CHCl_3 , CCl_4
- (b) Why is chloroform stored in dark coloured bottles?
- (c) Explain Wurtz reaction using iso-propylbromide.

SECTION D

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

29. Comparing SN^1 and SN^2 Reactions (4)

In nucleophilic substitution reactions, a bond between carbon and a leaving group (C-LG) is broken, and a new bond between carbon and a nucleophile (C-Nu) is formed.

Nucleophilic substitution reactions of alkyl halides occur through two main pathways. The key difference lies in the timing of the bond-forming and bond-breaking steps.

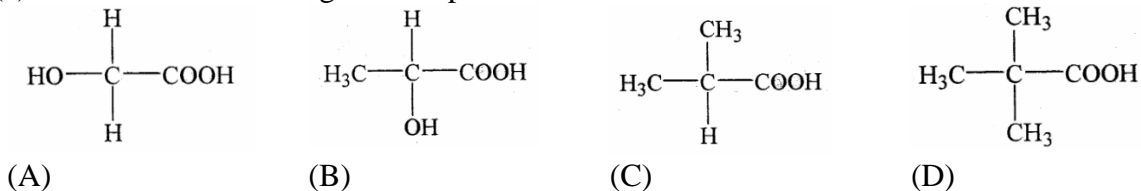
The SN^1 mechanism (Substitution, Nucleophilic, Unimolecular rate determining step) generally passes through two steps; first, a (slow, rate-determining) breaking of the C-LG bond on the substrate to form an intermediate carbocation, followed by (fast) addition of a nucleophile to the carbocation (form C-Nu) to give the substitution product (there is often a

third acid-base step which follows the substitution reaction when neutral nucleophiles like H₂O or R-OH are used).

The S_N² mechanism (Substitution, Nucleophilic, Bimolecular rate determining step) occurs in a single, concerted step: attack of the nucleophile on the backside of the C–LG bond, passing through a transient five-membered transition state route to a tetrahedral product where configuration at the carbon has been inverted.

Answer the following questions:

(a) Which of the following shows optical isomerism?

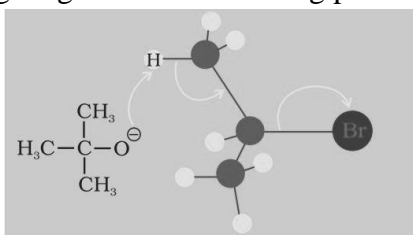


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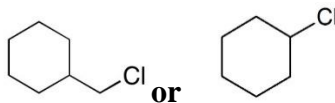
(a) Which one of the following readily follows S_N¹ mechanism?

(A) Vinyl chloride (B) Allylchloride (C) Benzylchloride (D) iso-butylchloride

(b) Predict the role of attacking reagent in the following picture.



(c) Which one in the following pair of substances undergoes S_N² substitution reaction faster and why?

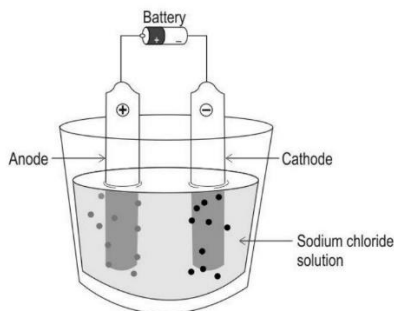


30. Hydrogen Production: Electrolysis

(4)

Electrolysis is a promising option for carbon-free hydrogen production from renewable and nuclear resources. Electrolysis is the process of using electricity to split water into hydrogen and oxygen. This reaction takes place in a unit called an electrolyser. Electrolysers can range in size from small, appliance-size equipment that is well-suited for small-scale distributed hydrogen production to large-scale, central production facilities that could be tied directly to renewable or other non-greenhouse-gas-emitting forms of electricity production.

One such electrolysis process is shown here.



Answer the following questions:

(a) What is the product formed at cathode as well as anode for the given setup?

OR

(a) Write the electrode reactions if the electrolyte is changed to molten sodium chloride.

(b) What is the nature and function of the electrodes seen here, inert or active?

(c) What factors did you consider to determine the products of electrolysis in the cell given above?

SECTION E

31. (a) In a cold winter, the temperature suddenly drops down to -2°C . If the water in a car's radiator would freeze down, the engine will not function properly after some time. To avoid the freezing of water, a certain amount of ethylene glycol should be used to lower the freezing point of water in the radiator. If the capacity of a car's radiator to hold water is 1 kg, how many grams of ethylene glycol must be added to lower the freezing point of water from 0° to -2°C ? (Molecular weight of ethylene glycol = 62 g/mol) (5)
- (b) Suggest the most important intermolecular interaction in the following pairs:
(i) Acetonitrile (CH_3CN) and acetone ($\text{C}_3\text{H}_6\text{O}$) (ii) I_2 and CCl_4
32. (a) What is the E° cell for the reaction: $\text{Cu}^{+2}(\text{aq.}) + \text{Sn}^{+2}(\text{aq.}) \rightarrow \text{Cu}(\text{s}) + \text{Sn}^{+4}(\text{aq.})$ at 25°C if equilibrium constant for the reaction is 1×10^6 ? (5)
- (b) Represent Nernst equation for the following overall cell reaction.
$$\text{Cr}_2\text{O}_7^{2-}(\text{aq.}) + 14 \text{H}^+(\text{aq.}) + 6\text{e}^- \rightarrow 2\text{Cr}^{3+}(\text{aq.}) + 7\text{H}_2\text{O}(\text{l})$$
- (c) How conductivity and molar conductivity change with change in temperature?

OR

- (a) The measured resistance of conductivity cell was 100 ohms. If 7.45 g of KCl is dissolved per litre of solution. Calculate (i) specific conductance (ii) molar conductance. ($l/A = 1.25 \text{ cm}^{-1}$, Molar mass of KCl is 74.5 g mol^{-1})
- (b) What are the factors which affect corrosion? CO_2 is always present in natural water. Explain its effect on rusting of iron.
33. (a) What happens when Benzaldehyde and Acetophenone are treated in the presence of alkali? (5)
- (b) Arrange the following in decreasing order of their acidic strength.
 $\text{CH}_3\text{CH}_2\text{OH}$, CH_3COOH , ClCH_2COOH , FCH_2COOH , $\text{C}_6\text{H}_5\text{CH}_2\text{COOH}$
- (c) Distinguish between Ethanal and Acetone. (Write the name of the test and the positive observation of the test)
- (d) Write the chemical reaction of cyclohexanecarbaldehyde with Semicarbazide and weak acid.

OR

- (a) Write a chemical reaction of 'Clemenson reduction'.
- (b) Arrange the following in the increasing order of their pK_a values.
 HCOOH , $\text{C}_6\text{H}_5\text{COOH}$, CH_3COOH
- (c) Justify: There are two $-\text{NH}_2$ groups in semicarbazide. However, only one is involved in the formation of semicarbazones.
- (d) Distinguish between Benzoic acid and Phenol. (Write the name of the test and the positive observation of the test)