विद्या सर्वार्थि साधिका

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PERIODIC TEST -2

Class: XII

Subject: Chemistry (043) MM: 70

Date : 16-09-2025 Time:3 hours

General Instructions:

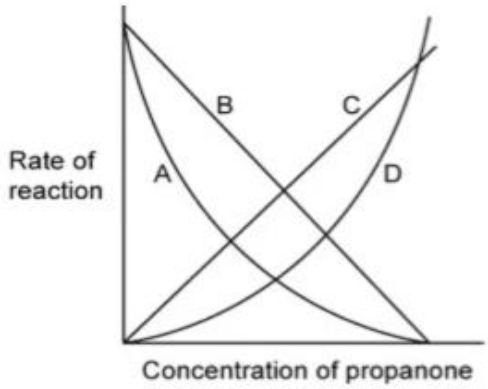
(a) There are 33 questions in this question paper with internal choice.
(b) SECTION A consists of 16 multiple choice questions carrying 1 mark each.
(c) SECTION B consists of 5 short answer questions carrying 2 marks each.
(d) SECTION C consists of 7 short answer questions carrying 3 marks each.
(e) 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 The molecular weight of benzoic acid in benzene is determined by depression in freezing point method corresponds to _____. (1)

(A) ionization of benzoic acid
(B) dimerization of benzoic acid
(C) trimerization of benzoic acid
(D) solvation of benzoic acid

2. The reaction between iodine and propanone can be catalyzed by sulfuric acid. The rate equation shows that this reaction is first order with respect to propanone: (1)
Rate = k $[H^+]$ $[C_3H_6O]$. Identify the plot which corresponds to this equation.



3. Which of the following pair shows a positive deviation from Raoult's law? (1)

(A) Water-nitric acid
(B) Benzene-methanol
(C) Water-hydrochloric acid
(D) Acetone-chloroform

4. The table below shows the K_H values for some gasses at 293 K and at the same pressure. (1)

K_H values (kbar)	144.97	69.16	76.48	34.86
Gas	Helium	Hydrogen	Nitrogen	Oxygen

Arrange the given gases in decreasing order of their solubility

(A) Helium > Nitrogen > Hydrogen > Oxygen.
(B) Hydrogen > Helium > Nitrogen > Oxygen.
(C) Nitrogen > Hydrogen > Oxygen > Helium
(D) Oxygen > Hydrogen > Nitrogen > Helium

5. Substances A and B react in solution according to the equation. (1)

$$A + 2B \rightarrow C + 2D$$

The results of an investigation of the reaction between A and B are shown in this table.
Calculate the Initial rate/ mol $L^{-}s^{-1}$.

Experiment	Initial [A] /mol L^{-1}	Initial [B]/ mol L^{-1}	Initial rate/ mol $L^{-1}s^{-1}$
1	0.5	0.25	3.5×10^{-4}
2	0.5	0.50	To be calculated

(A) 1.4×10^{-3} mol L^{-1} s^{-1} (B) 7.0×10^{-4} mol L^{-1} s^{-1}
(C) 3.5×10^{-4} mol L^{-1} s^{-1} (C) 1.75×10^{-4} mol L^{-1} s^{-1}

6. What happens to the hydrogen in a hydrogen-oxygen fuel cell? (1)
(A) It is oxidised at the cathode. (B) It is reduced at the cathode.
(C) It is oxidised at the anode (D) It is reduced at the anode.

7. The following electrochemical cell has an electromotive force of +2.46 V. (1)
Al (s) | Al^{+3} (aq) || Ag^{+} (aq) | Ag (s)
Which statement about the operation of the cell is not correct?
(A) The mass of the silver electrode increases during the cell's operation
(B) The silver electrode has a positive polarity
(C) The aluminium electrode is reduced by Ag^{+} ions
(D) Electrons flow from the aluminium electrode to the silver electrode via an external circuit

8. The charge required for the oxidation of one mole of Mn_2O_4 to MnO_4^{2-} _____. (1)
(A) 5 x 96500 C (B) 96500 C (C) 10 x 96500 C (D) 2 x 96500 C

9. Four compounds, CH_3Cl, CH_3Br, C_2H_5Br and C_3H_7I are represented by the letters M, N, O and P in the table below (in random order). The boiling points are also given in the table. Which compound does 'O' represent? (1)

Boiling points	-24.2°C	38°C	3.56° C	101.6°C
Compound	M	N	O	P

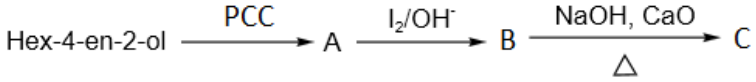
(A) CH_3Cl (B) CH_3Br (C) C_2H_5Br (D) C_3H_7I

10. Which of the following alkyl iodide cannot be produced by the reaction of HI with an appropriate ether? (1)
(A) $(CH_3)_3C - CH_2 - I$ (B) $(CH_3)_2CH - I$ (C) $C_6H_5CH_2 - I$ (D) $C_6H_5 - I$

11. Arrange the acids from left to right, in the increasing order of their acidity: (1)
2, 4, 6 - Trinitrophenol, acetic acid, phenol, benzoic acid.

(A) 2, 4, 6 - Trinitrophenol, acetic acid, benzoic acid, phenol
(B) phenol, acetic acid, benzoic acid, 2, 4, 6 - Trinitrophenol
(C) 2, 4, 6 - Trinitrophenol, benzoic acid, acetic acid, phenol
(D) phenol, benzoic acid, acetic acid, 2, 4, 6 – Trinitrophenol

12. Identify the major product 'C' in a given reaction sequence. (1)



(A) But-2-ene (B) But-1-ene (C) Pent-2-ene (D) Isobutene

In the following questions (Q13-16) choose the correct answer out of the following choices.
(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: Phenol on treatment with Br_2 in CS_2 gives ortho and para bromophenol. (1)
R: Carbon disulphide is a solvent of low polarity, hence leads to monobromination of phenols

14. A: 2-Methoxy-2-methyl propane reacts with hydrogen iodide to form methyl alcohol and 2- Iodo-2-methylpropane. (1)
R: The reaction given in (A) follows SN_2 mechanism.

15. A: Reaction of >C=O group with ammonia derivatives is an example of nucleophilic addition reaction. (1)
R: The reaction is very fast when the solution contains high concentration of [H+].

16. A: Aldehydes and ketones, both react with Tollen's reagent to form silver mirror. (1)
R: Both, aldehydes and ketones contain a carbonyl group

SECTION B

17. Carboxylic acids are stronger acids than phenols though both possess resonance stabilization of respective anions. Why? (2)

18. (a) Preparation of ethers by dehydration of alcohols is not suitable for the using of secondary and tertiary alcohol. Give reason. (2)
(b) Arrange the following compounds in increasing order of their boiling points?
CH_3 -CH_2-OH, CH_3-CHO, CH_3 -O-CH_3, CH_3 -CH_2-CH_3,

19. When 2-chlorobutane reacts with hot ethanolic potassium hydroxide, two structural isomers are formed. One of these structural isomers also displays stereoisomerism. Draw the structures of the two stereoisomers formed in this reaction and state their IUPAC names. (2)

20. Give simple chemical tests to distinguish between the following pairs of compounds. (2)
(i) Acetophenone and Benzophenone (ii) Phenol and Benzoic acid

21. A 5% solution of $Na_2SO_4.10H_2O$ (MW = 322) is isotonic with 2% solution of non- electrolytic, non-volatile substance X. Find out the molecular weight of X. (2)

SECTION C

22. A rechargeable nickel–cadmium cell is an alternative to a lithium-ion cell. (3)
The half-equations for this cell are given below:
$Cd(OH)_2$ (s) + $2e^-$ → Cd (s) + $2OH^-$ (aq) E = -0.88
NiO(OH) (s) + H O (I) + e → Ni (OH) (s) + OH^- (aq) E = +0.52
i) Deduce the oxidation state of the cadmium in this cell after recharging is complete.
ii) Write an equation for the overall reaction that occurs when the cell is recharged.

OR

Table given shows some standard electrode potential data.

Electrode half-equation	E^0/V
Ag (aq) + e- ⇌ Ag (s)	+0.80 V
Al^{3+} (aq) + 3e- ⇌ Al (s)	-1.66
Cl_2 (g) + 2e- ⇌ 2Cl (aq)	+1.36
ClO^- (aq) + e- ⇌ ClO (aq)	+0.95
Cu^{2+} (aq) + 2e- ⇌ Cu (s)	+0.34
Pb^{2+} (aq) + 2e- ⇌ Pb (aq)	+1.67

Use data from Table to deduce the species that most readily loses electrons. Justify your answer
(a) Write the conventional representation (cell diagram), including state symbols, for the feasible reaction of Ag+/ Ag and Al^{3+} / Al.
(b) Explain why the salt bridge connecting the silver and aluminium electrodes cannot be made with potassium chloride solution.

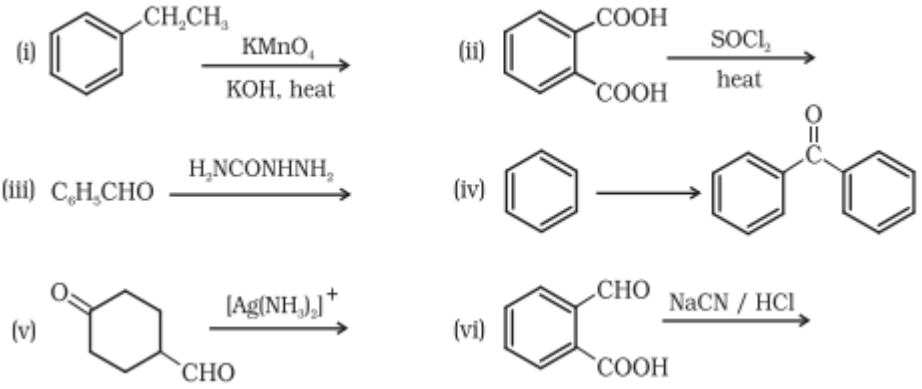
23. The results of three experiments carried out at a temperature, T, to investigate the rate of the reaction between compounds A and B are shown in Table below. Use the data to deduce the rate equation for the reactions between A and B (3)

	Experiment 1	Experiment 2	Experiment 3
Initial concentration of A/mol L^{-1}	0.12	0.27	0.12
Initial concentration of A/mol L^{-1}	0.80	0.80	1.16
Initial rate / mol $L^{-1}s^{-1}$	2.842×10^{-5}	6.394×10^{-5}	5.974×10^{-5}

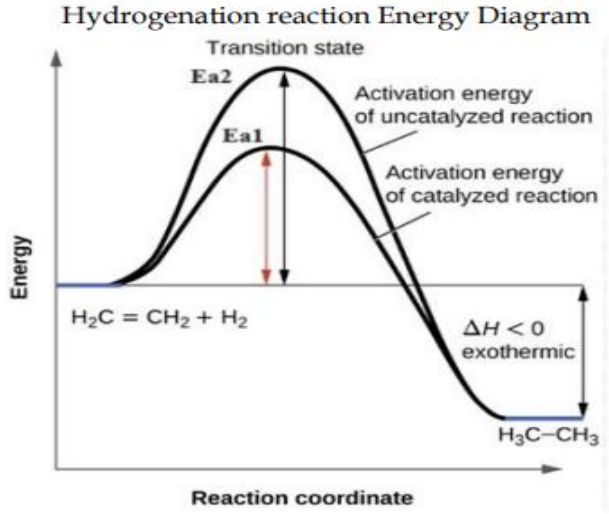
Use the data from the table given to deduce the rate equation for the reactions between A and B.

24. Explain the following with an example. (i) Kolbe's reaction (ii) Reimer-Tiemann reaction (iii) Williamson ether synthesis. (3)

25. Complete each synthesis by giving missing starting material, reagent or products (3)



26. Observe the potential energy diagram for the hydrogenation of ethene to give ethane. (3)



(a) For the same process, predict why there is a difference in Ea1 and Ea2?
(b) Assuming both the reaction are reversible then in which case the backward reaction will be faster?
(c) Will the ΔG value of this reaction be different in the above two paths? Explain.

27. Give reasons for the following: (3)
(i) Although chlorine is an electron-withdrawing group, it is *ortho*, *para*-directing in electrophilic aromatic substitution reactions. Explain.
(ii) When 2-bromopropane is reacted with alcoholic KOH, propene is the major product, while with aqueous KOH, propan-2-ol is the major product. Explain.
(iii) Why are aryl halides less reactive towards nucleophilic substitution reactions than haloalkanes?

28. Write the mechanism of conversion of ethanol to ether. (3)

SECTION D

29. Read the passage and answer the questions given: (4)

The products of electrolysis, the process of using electricity to decompose chemical compounds, depend on the electrolyte (the substance being decomposed) and the type of electrodes used. Common products include hydrogen and oxygen gas (from water electrolysis), chlorine gas and sodium hydroxide (from brine electrolysis), and various metals and non-metals from molten salts. Here's a more detailed breakdown:

Electrolysis of Water:

- Electrolyte: Water (H_2O).
- Electrodes: Usually inert electrodes like platinum.
- Products: Hydrogen gas (H_2) at the cathode (negative electrode) and oxygen gas (O_2) at the anode (positive electrode).

Electrolysis of Molten Salts:

- Electrolyte: A molten salt, like sodium chloride (NaCl).
- Electrodes: Typically, inert electrodes.
- Products**:** A metal (e.g., sodium) at the cathode and a non-metal (e.g., chlorine) at the anode.

The products of electrolytes also depend on the nature of electrodes, concentration of the electrolyte and temperature.

A solution of sodium chloride (NaCl) is electrolyzed using inert electrodes (like platinum or graphite).

(a) How does the concentration of NaCl affect the products formed at the anode?

(b) At very high concentrations, what is the primary product at the anode? Why?

(c) (i) At very low concentrations, what is the primary product at the anode**?** Why?

OR

(c) (ii) How would the products change if the electrodes were made of reactive metals like copper instead of inert ones?

30. Read the following passage and answer the following questions: (4)

Saytzeff's Rule (also known as Zaitsev's Rule) predicts that the major product formed during an elimination reaction will be the most substituted and therefore the most stable alkene. This means the alkene with the greater number of alkyl groups attached to the double bond carbons will be the predominant product. Carbocation rearrangements, such as hydride or alkyl shifts, can occur during reactions involving carbocations to achieve a more stable intermediate

(a) When 3-bromo-2,2-dimethylbutane is treated with alcoholic KOH (potassium hydroxide), identify the major product(s) formed and explain the mechanism involved, including any relevant rearrangement

(b) Predict the major product(s) of the acid-catalysed dehydration of 3,3-dimethyl-2-butanol and outline the reaction mechanism, detailing any carbocation rearrangement

(c) (i) Consider the reaction of 2-bromopentane with a strong, non-bulky base like sodium ethoxide (NaOEt). Predict the major product and explain the reasons for its formation, considering both E^2 and SN^2 reaction pathways and Saytzeff's rule

OR

(c) (ii) Consider the reaction of 1-bromo-2-phenylpropane with a strong base. What are the possible elimination products in this reaction? Identify the major product. Would Saytzeff's rule directly predict the major product here? Why or why not?

SECTION E

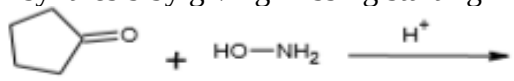
31. How will you bring about the following conversions in not more than two steps? (5)

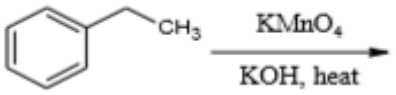
(i) Propanone to Propene (ii) Benzoic acid to Benzaldehyde (iii) Ethanol to 3-Hydroxybutanal

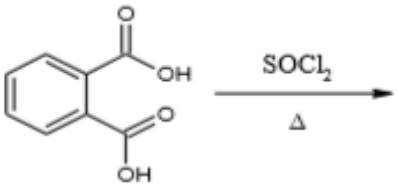
(iv) Benzene to m-Nitroacetophenone (v) Benzaldehyde to Benzophenone

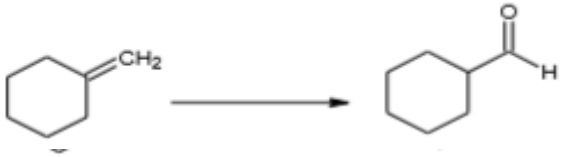
OR

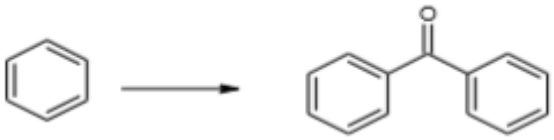
Complete each synthesis by giving missing starting material, reagent or products:

(a) 

(b) 

(c) 

(d) 

(e) 

32. (a) Define the following terms: (5)
    (i) Ideal solution
    (ii) Azeotrope
    (iii) Osmotic pressure

    (b) A solution of glucose ($C_6H_{12}O_6$) in water is labelled as 10% by weight. What would be the molality of the solution? (Molar mass of glucose = 180 g mol^{-1})

OR

A solution of glucose in water is labelled as 10% w/w, what would be the molality and mole fraction of each component in the solution? If the density of solution is 1.2 g mL-1 , then what shall be the molarity of the solution?

33. (a) State Faraday's First Law of Electrolysis and mathematically express it. (5)

    (b) Electrolysis of dilute aqueous NaCl solution was carried out by passing 10 milliampere current. What is the time required to liberate 0.01 mol of H_2 gas at the cathode is?

OR

(a) Define conductivity and molar conductivity for the solution of an electrolyte. Discuss their variation with concentration.