SATISH SCIENCE ACADEMY

DHANORI PUNE-411015

CHEMISTRY

Class 12 - Chemistry

Time Allowed: 3 hours   **Maximum Marks: 70**
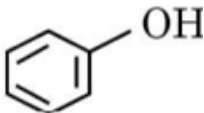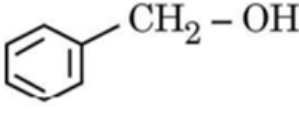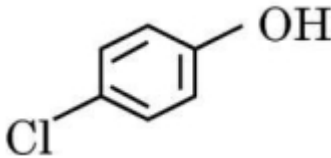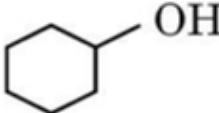
General Instructions:

Read the following instructions carefully.

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

1. To prepare alkanes containing odd number of carbon atoms, Wurtz reaction is not preferred because: **[1]**

    a) a lot of reaction mixture goes wasted.

    b) a mixture of three different alkyl halides has to be used.

    c) a mixture of four different alkyl halides has to be used.

    d) a mixture of two different alkyl halides has to be used.

2. The vitamin that cannot be stored in our body is   **[1]**

    a) vitamin E

    b) vitamin C

    c) vitamin K

    d) vitamin D

3. Which of the following is most acidic ?   **[1]**

    a)

    b)

    c)

    d)

4. Methyl ketones are usually characterized by: **[1]**

    a) Benedict's reagent

    b) Iodoform test

    c) Schiff's test

    d) Tollen's reagent

5. For a reaction $2A \rightarrow 3B$, rate of reaction $-\frac{d[A]}{dt}$ is equal to **[1]**

   a) $\frac{+3}{2}\frac{d[B]}{dt}$

   b) $+\frac{2\,d[B]}{dt}$

   c) $\frac{+1}{3}\frac{d[B]}{dt}$

   d) $\frac{+2}{3}\frac{d[B]}{dt}$

6. Match the items given in column I with that in column II. **[1]**

Column I	Column II
(a) Molarity	(i) $\frac{\text{Mass of solute}}{\text{Mass of solution}} \times 10^6$
(b) Molality	(ii) Number of gram moles of a solute per litre of solution
(c) Normality	(iii) Number of gram moles of a solute per kg of solvent
(d) ppm	(iv) Number of gram equivalent of a solute per litre of solution

   a) (a) - (ii), (b) - (iii), (c) - (iv), (d) - (i)

   b) (a) - (iv), (b) - (iii), (c) - (ii), (d) - (i)

   c) (a) - (iii), (b) - (ii), (c) - (i), (d) - (iv)

   d) (a) - (i), (b) - (ii), (c) - (iii), (d) - (iv)

7. Which of the following compounds on treatment with benzene sulphonyl choride forms an alkali-soluble **[1]** precipitate?

   a) $(CH_3)_3N$

   b) $CH_3CH_2NH_2$

   c) $(CH_3)_2NH$

   d) CH_3CONH_2

8. Which set of ions exhibit specific colours? (Atomic number of Sc = 21, Ti = 22, V = 23, Mn = 25, Fe = 26, Ni = **[1]** 28, Cu = 29 and Zn = 30)

   a) $Sc^{3+}, Zn^{2+}, Ni^{2+}$

   b) $Ti^{3+}, Ti^{4+}, Ni^{2+}$

   c) $Sc^{3+}, Ti^{4+}, Mn^{3+}$

   d) V^{3+}, V^{2+}, Fe^{3+}

9. For the reaction A $\rightarrow$ products, at $[A] = 0.4\,M, t_{1/2} = 24\,s$ and at $[A] = 0.2\,M, t_{1/2} = 12\,s$. The unit **[1]** for the rate constant is

   a) S^{-2}

   b) $mol\ L^{-1}s^{-1}$

   c) $L^2/mol^2/s$

   d) S^{-1}

10. For making a distinction between 2 – pentanone and 3 – pentanone the reagent to be employed is: **[1]**

   a) $K_2Cr_2O_7 / H_2SO_4$

   b) SeO_2

   c) Zn – Hg/HCl

   d) Iodine/NaOH

11. Lucas reagent is? **[1]**

   a) anhydrous $PdCl_2$ and conc.HCl.

   b) anhydrous $AlCl_3$ and conc.HCl.

   c) anhydrous CaC_2 and conc. HCl.

   d) anhydrous $ZnCl_2$ and conc. HCl.

12. Among the following, which is the strongest base? **[1]**

   a) $O_2N-\langle\text{ring}\rangle-NH_2$

   b) $\langle\text{ring}\rangle-NH_2$

   c) $\langle\text{ring}\rangle-CH_2-NH_2$

   d) $H_3C-\langle\text{ring}\rangle-NH_2$

13. **Assertion (A):** DNA has a double helix structure. **[1]**

    Reason (R): The two strands in a DNA molecule are exactly similar.

    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.

14. **Assertion:** Benzaldehyde is more reactive than propanal towards nucleophilic addition reactions. **[1]**

    Reason: Benzaledhyde is less sterically hindered.

    a) Both assertion and reason are Correct and reason is the Correct explanation of the assertion.

    b) Both assertion and reason are correct but, reason is not the correct explanation of the assertion.

    c) Assertion is Correct but, reason is incorrect.

    d) Both assertion and reason are incorrect.

15. **Assertion (A):** Benzyl bromide when kept in acetone-water, it produces benzyl alcohol. **[1]**

    Reason (R): The reaction follows S_N2 mechanism.

    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.

16. **Assertion (A):** Hydrolysis of ether $\diagup\diagdown O \mathrm{-\!-\!-}\diagdown\diagup$ with aq. HI is S_N1 reaction. **[1]**

    Reason (R): $I^{\ominus}$ is strong nucleophile so, it attacks from less hindered side.

    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.

Section B

17. Explain the following: $[Fe(CN)_6]^{4-}$ and $[Fe(H_2O)]^{2+}$ are of different colours in dilute solutions. **[2]**

18. Give reasons for the following: **[2]**

    i. Transition metals form alloys.

    ii. Mn_2O_3 is basic whereas Mn_2O_7 is acidic.

    iii. Eu^{2+} is a strong reducing agent.

19. **Answer the following:** **[2]**

    (a)　　a. The conversion of molecule A to B followed second order kinetics. If concentration of A increased to three times, how will it affect the rate of formation of B? **[1]**

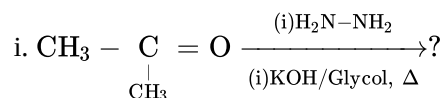   b. Define Pseudo first order reaction with an example.

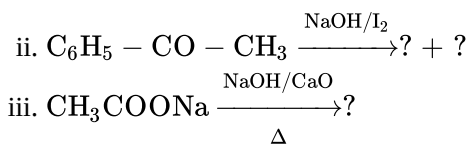   (b)　Why are chemical reactions irreversible? **[1]**

20. Define the terms: Van't Hoff factor **[2]**

OR

What are Hypertonic and Hypotonic solutions?

21. Predict the products of the following reactions: **[2]**

    i. $CH_3 - \underset{\underset{CH_3}{|}}{C} = O \xrightarrow[\text{(i)KOH/Glycol, }\Delta]{\text{(i)}H_2N-NH_2} ?$

ii. $C_6H_5 - CO - CH_3 \xrightarrow{NaOH/I_2} ? + ?$

iii. $CH_3COONa \xrightarrow[\Delta]{NaOH/CaO} ?$

Section C

22. One half-cell in a voltaic cell is constructed from a silver wire dipped in silver nitrate solution of unknown concentration. The other half-cell consists of a zinc electrode in 1.0 M solution of $Zn(NO_3)_2$. A voltage of 1.48 V is measured for this cell. Use this information to calculate the concentration of silver nitrate solution. **[3]**

   [Given, $E^\circ_{Zn^{2+}/Zn} = -0.763V$ and $E^\circ_{Ag^+/Ag} = +0.80V$].

23. The half-life for a first order reaction is 5×10^4 s. What percentage of the initial reactant will react in 2h? **[3]**

24. Name the reagents which are used in the following conversions: **[3]**

   i. A primary alcohol to an aldehyde

   ii. Butan-2-one to butan-2-ol

   iii. Phenol to 2, 4, 6-tribromophenol

   OR

   How the following conversions can be carried out?

   i. Propene to propan-1-ol

   ii. Ethanol to but-1-yne

   iii. 1-Bromopropane to 2-bromopropane

25. Arrange the following compounds in the increasing order of their property indicated: **[3]**

   i. Acetaldehyde, Benzaldehyde, Acetophenone, Acetone (Reactivity towards HCN)

   ii. $(CH_3)_2CHCOOH$, $CH_3CH_2CH(Br)COOH$, $CH_3CH(Br)CH_2COOH$ (Acidic strength)

   iii. CH_3CH_2OH, CH_3CHO, CH_3COOH (Boiling point)

26. Calculate the e.m.f. of the following cell at 298K: **[3]**

   $Fe(s) | Fe^{2+}$ (0.001 M) $|| H^+$ (0.01 M) $| H_2(g)$ (1 bar) $| Pt(s)$

   Given that $E^\circ_{cell} = +0.44V$

   [log 2 = 0.3010 log 3 = 0.4771 log 10 = 1]

27. Which compound in each of the following pairs will react faster in S_N2 reaction with OH^-? **[3]**

   i. CH_3Br or CH_3I

   ii. $(CH_3)_3CCl$ or CH_3Cl

28. i. Calculate the mass of Ag deposited at cathode when a current of 2A was passed through a solution of $AgNO_3$ for 15 min. **[3]**

   (Given: Molar mass of Ag = 108g mol^{-1}, 1 F = 96500 C mol^{-1}).

   ii. Define fuel cell.

Section D

29. **Read the following text carefully and answer the questions that follow:** **[4]**

   Transition metal oxides are generally formed by the reaction of metals with oxygen at high temperatures. The highest oxidation number in the oxides coincides with the group number. In vanadium, there is a gradual change from the basic V_2O_3 to less basic V_2O_4 and to amphoteric V_2O_5. V_2O_4 dissolves in acids to give VO^{2+} salts.

   Potassium dichromate is a very important chemical used in the leather industry and as an oxidant for the

preparation of many azo compounds. Dichromates are generally prepared from chromate. Sodium dichromate is more soluble than potassium dichromate. The latter is, therefore, prepared by treating the solution of sodium dichromate with potassium chloride. Sodium and potassium dichromates are strong oxidising agents; sodium salt has a greater solubility in water and is extensively used as an oxidising agent in organic chemistry. Potassium dichromate is used as a primary standard in volumetric analysis.

  i. Which of the 3d series of the transition metals exhibits the largest number of oxidation and why? (1)
 ii. A transition metal exhibits highest oxidation state ih oxides and fluorides. Give reason. (1)
iii. How would you account for the increasing oxidising power in the series: (2)

$VO_2^+ < Cr_2O_7^{2-} < MnO_4^-$?
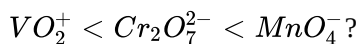
OR

MnO is basic whereas Mn_2O_7 is acidic in nature. Give reason. (2)

30. **Read the following text carefully and answer the questions that follow:** [4]

Vapour pressure of a liquid or a solution is the pressure exerted by the vapour in equilibrium with the liquid or solution at a particular temperature. It depends upon the nature of the liquid and temperature. The non-volatile solute in solution reduces the escaping tendency of the solvent molecules in the vapour phase because some of the solute particles occupy the positions of the solvent molecules on the liquid surface. The relative lowering of the vapour pressure of a solution containing a non-volatile solute is equal to the mole fraction of the solute in the solution. This is also known as Raoult's law. However, for solutions of volatile solutes, the vapour pressure of a component in a solution at a given temperature is equal to the mole fraction of that component in the solution multiplied by the vapour pressure of that pure component. The solutions in which each component obeys Raoult's law is called an ideal solution. For ideal solutions ΔH_{mixing} and ΔV_{mixing} are also zero. Practically no solution is ideal. A non-ideal solution is that solution in which solute and solvent molecules interact with one another with a different force than the forces of interaction between the molecules of the pure components. There are two types of non-ideal solutions, showing positive deviations and negative deviations from ideal behaviour. If for the two components A and B, the forces of interaction between A and B molecules are less than the A-A and B-B interactions, the non-ideal solutions have positive deviations. On the other hand, if the forces of interaction between A and B molecules are more than the A-A and B-B interactions, the non-ideal solutions have negative deviations.

  i. What is the mole fraction of A in solution obeying result's low if the vapour pressure of a pure liquid A is 40 mm of Hg at 300 K. The vapour pressure of this liquid in solution with liquid B is 32 mm of Hg? (1)
 ii. Vapour pressure of a solution of heptane & octane is given by the equation: (1)

P(sol.)(mm Hg) = 35 + 65x, where x is the mole fraction of heptane. Calculate the vapour pressure of pure octane. (2)

iii. What is the value of ΔV_{mixing} and ΔH_{mixing} for non-ideal solution showing negative deviation?

OR

Acetic acid + pyridine, the mixture is an example of which type of solution? (2)

Section E

31. **Attempt any five of the following:** [5]

   (a)   Write the products obtained after hydrolysis of lactose. **[1]**

   (b)   What are the hydrolysis products of sucrose? **[1]**

   (c)   Write the reactions showing the presence of following in the open structure of glucose: **[1]**

        i. a carbonyl group

ii. chain with six carbon atoms

(d) What is the basic structural difference between starch and cellulose ? **[1]**

(e) Name the vitamin whose deficiency causes convulsions. **[1]**

(f)   i. Name any two bases which are common to both DNA and RNA. **[1]**

  ii. Which vitamin deficiency causes:

    1. Bone deformities in children?

    2. Pernicious anaemia?

(g) Define denaturation of protein. What is the effect of denaturation on the structure of protein? **[1]**

32. Using Valence bond theory, explain the following in relation to the paramagnetic complex $[Mn(CN)_6]^{3-}$ **[5]**

  a. type of hybridisation

  b. magnetic moment value

  c. type of complex - inner, outer orbital complex

<div align="center">OR</div>

Give the oxidation state, d orbital occupation and coordination number of the central metal ion in the following complexes:

  a. $K_3[CO(C_2O_4)_3]$

  b. $(NH_4)_2[COF_4]$

  c. Cis $[Cr(en)_2Cl_2]Cl$

  d. $[Mn(H_2O)_6]SO_4$

33. Describe a method for the identification of primary, secondary and tertiary amines. Also write chemical equations of the reactions involved. **[5]**

<div align="center">OR</div>

Account for the following:

  i. Diazonium salts of aromatic amines are more stable than those of aliphatic amines.

  ii. Amines are more basic than alcohols of comparable molecular masses.