

2000

CHEMISTRY
(THEORY)
1 Marks - 70

Pass Marks - 21

Time . Three Hours

Special instructions

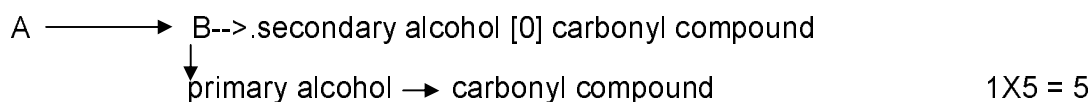
- (i) There are 36 questions in all.
 - (ii) All questions are compulsory.
 - (iii) Questions from 1 to 12 are the very short answer type of 1 mark each.
 - (iv) Questions from 13 to 17 are the objective type of 1 mark each. There are FOUR choices in each question out of which only ONE is correct Choose the correct answer and REWRITE it in the answer script.
 - (v) Questions from 18 to 21 are the short answer type of 2 marks each.
 - (vi) Questions from 22 to 33 are the short answer type of 3 marks each.
 - (vii) Questions from 34 to 36 are the long answer type of 5 marks each.
 - (viii) Marks are indicated at the right side margin of each question.
 - (ix) Use of log table, if necessary, is allowed.
1. What are the quantum numbers of the valence electrons in the ground state of a sodium atom? 1
 2. What is F-centre in ionic crystals?
 3. How is the rate constant of a reaction related to its activation energy?
 4. Give the IUPAC name of $\begin{array}{ccccccc} & & \text{COOH} & & & & \\ & & | & & & & \\ \text{CH}_3 & - & \text{CH} & - & \text{CH} & - & \text{CH}_3 \\ & & & & | & & \\ & & & & \text{NH}_2 & & \end{array}$
 5. What is a double salt ? 1
 6. Give the formula of an organometallic π -complex formed by Fe^{+2} and cyclopentadienyl anion. 1
 7. 100 g of C^{14} decays to 50 g of it 5770 years. What will be the time required to decay 25 g out of the rest 50 g of the given sample ?
 8. What is catalysis ?

9. A repeat unit is formed by reaction between terephthalic acid and ethylene glycol. Ten of this unit condense to form a polymer. What is the formula of the polymer? 1
10. Give an example of a monosaccharide of five carbon atoms.
11. Name *one* plant growth hormone.
12. Why is the use of DDT for crop protection being discouraged now-a-days? 1
13. Which of the following molecules /ions is associated with sp^3 - hybridisation of the central atom?
- A) BCl_3
 B) PCl_3
 C) CO_3^{2-}
 D) NO_3^- .
14. Second law of thermodynamics states that
- A) Energy can neither be created nor destroyed.
 B) For any action there is an equal and opposite reaction
 C) Entropy of the universe remains always the same
 D) Entropy of the universe always increases. 1
15. In qualitative analysis, an orange red precipitate of a compound with 2, 4-dinitrophenyl hydrazine is a diagnostic test for
- A) alcohols
 B) ethers
 C) aldehydes and ketones
 D) phenols.
16. Which one of the following will respond to the tests of Fe^{+3} - ion in solution?
- A) $[Fe(CN)_6]Cl_3$
 B) $Fe_2(SO_4)_3$
 C) $FeCl_3 \cdot 3NH_3$
 D) $FeSO_4 \cdot (NH_4)_2SO_4 \cdot 6H_2O$. 1
17. The number beta particles emitted when Ra^{226}_{88} decays to Pb^{206}_{82} is
- A) 4
 B) 3
 C) 6
 D) 5 1
18. Calculate the density of NaCl crystal at ordinary pressure from the following given data:
 Avogadro's number = $6.02 \times 10^{23} \text{ mol}^{-1}$ Distance between Na^+ and Cl^- in NaCl crystal = 281 pm. 2

19. The standard reduction electrode potentials of Zn/Zn⁺⁺ and Ni/Ni⁺² are respectively - 0.76 V and 0.25 V. An electrochemical cell is constructed by coupling the two electrodes and current is drawn out of it spontaneously. Identify the anode and write the electrode reaction of it. 2
20. Draw a neat and properly labelled diagram of a saturated calomel electrode. 2
21. What are diazonium salts ? Give the structure of benzene diazonium chloride. 2
22. Give reasons :
 (a) Transition metal ions like Cu⁺ and Ag⁺ are colourless.
 (b) Transition metals are good catalysts. 2
22. What is radioactivity ? Give one example of naturally occurring radioelement. 2
24. By taking a suitable example. draw the structure of a spherical micelle. 2
25. Write the name (s) and structure (s) of the monomer (s) of an addition polymer. State *one* use of the polymer. 2
26. Give two points each of the differences between
 (a) nucleoside and nucleotide and
 (b) DNA and RNA. 2
27. What is digestion ? Summarise digestion of proteins. 2
28. What do you understand by a molecular orbital ? How m-any molecular orbitals of H₂ originate from the 1s atomic orbitals of two hydrogen atoms. Give the electronic configuration of O₂ in its molecular orbitals. 3
29. The enthalpy change for the reaction
- $$2\text{NH}_3(\text{g}) \rightarrow \text{N}_2(\text{g}) + 3\text{H}_2(\text{g})$$
- at 298K is + 92.4 kJ. The reaction proceeds almost to the end. Compute,
 (a) sign of ΔS and
 (b) internal energy change of the reaction at the given conditions. 3
30. What is meant by a reaction being zero order ? Derive the integrated rate law of a first order reaction. 3
31. Give reasons of the following :

- a) acetaldehyde gives aldol condensation but formaldehyde does not.
 b) acetic acid is a weaker acid than chloroacetic acid.
 c) acyl chlorides have lower boiling points than the corresponding acids. 3
32. How are the following conversions carried out? Give equations only :
 a) methane nitrile to ethanamine
 b) benzene to nitrobenzene
 c) aniline to phenylcarbylamine. 1X3=3
33. Describe the preparation of crystalline $KMnO_4$ from pyrolusite. 3
34. What are colligative properties? Name any *two* of such properties of solutions. Describe the effect on the boiling point of a solvent for the presence of a non-volatile solute in it. Give the mathematical relation between the quantity of solute and solvent in the concentration of the solution and the boiling point of the solvent.
 1+1+2+1=5
35. Starting from a suitable haloalkane, say A, perform the reactions as directed in the following scheme.

alcoholic KOH



36. What is the trend of metallic character in the elements of group 15 of periodic table? Based on the electronic configuration.

explain

- a) the variable valence of nitrogen and phosphorus.

and

- b) the formation of pentachloride by phosphorus but not by nitrogen.

1+2+2 = 5

CHEMISTRY

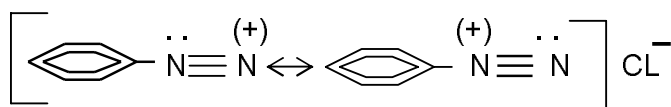
Scoring Key /Outline Answer And

Marking Scheme

- | | |
|---|---|
| 1. $n=3, l=0, m=0, s=(+) \text{ or } (-) \frac{1}{2}$ | 1 |
| 2. Anion deficient centre/coloured centre. | 1 |
| 3. $k=A.e^{-Ea/RT}$ | 1 |

4. -amine-3-methyl butanoic acid. 1
5. Any correct definition/statement. 1
6. $(\text{CH}_3)_2\text{Fe}$ 1
7. 5770 yrs. 1
8. Any correct definition/statement. 1
9. 1
- $$\text{H}-(\text{OCH}_2-\text{CH}_2-\text{O}-\overset{\text{O}}{\parallel}{\text{C}}-\text{C}_6\text{H}_4-\overset{\text{O}}{\parallel}{\text{C}}-\text{C})_{10}-\text{OH}$$
10. Any example, may be ribose, deoxyribose etc. 1
11. Any one, say indole-3-acetic acid or indole-3-propionic acid etc. 1
12. It is a contact insecticide. Because of its extreme chemical stability it is potentially dangerous towards living beings in general.
13. (B) pCl_3 1
14. (D) Entropy of the universe always increases. 1
15. (C) aldehydes and ketones 1
16. (B) $\text{Fe}_2(\text{SO}_4)_3$ 1
17. (a) 4 1
18.
$$d = \frac{4 \times (M/N_A)}{a^3}$$

$$= \frac{4 \times 58.5}{6.02 \times 10^{23} \times (281)^3} = 2.16 \text{ g cm}^{-3}$$
 1
19. Zn/Zn^{++} i.e. Zn immersed in Zn^{++} Soln. is the anode. 1
- $$\text{Zn} \rightleftharpoons \text{Zn}^{++} + 2\text{e}^-$$
20. Outline 1
Labelling 1
21. Diazonium salts : Definition/statement 1



22. [a] Absence of unpaired electrons in their electronic configurations. 1
[b] Properties of good catalysts like active sites for adsorption on the surface are possessed by them. 1

23. Definition of radioactivity. 1

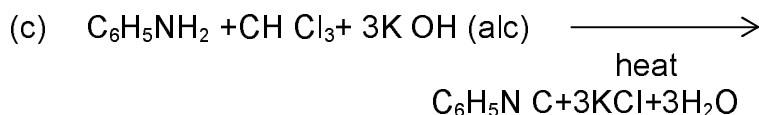
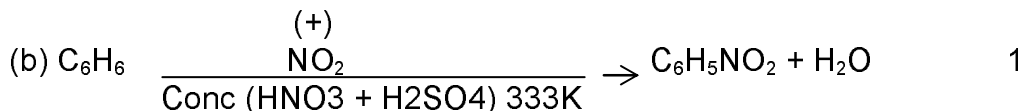
Any example.



O = COO end
 ~~~~~ = Long Chain Hydrocarbon

|                                                                                                                                                                                                           |     |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| Outline diagram of the spherical micelle.                                                                                                                                                                 | 1   |
| Labelling with the name of the example.                                                                                                                                                                   | 1   |
| 25. Name and structure of the monomer <u>of an addition</u> polymer.                                                                                                                                      | ½+½ |
| One use of the Polymer.                                                                                                                                                                                   | 1   |
| 26. [a] Any two Points of difference.                                                                                                                                                                     | ½+½ |
| [b]            -do-                                                                                                                                                                                       | ½+½ |
| 27. Digestion: Statement/definition                                                                                                                                                                       | 1   |
| Summary                                                                                                                                                                                                   | 1   |
| 28. Molecular orbital: Statement/definition                                                                                                                                                               | 1   |
| $\infty$ $\infty$<br>viz 1 S & 1 S*                                                                                                                                                                       | 1   |
| $\infty^2$ $\infty^*2$ $\infty^2$ $\infty^2^*$ $\infty^2$ $\pi^2$ $\pi^2$ $\pi^1$ $\pi^*1$<br>1s     1s     2x     2s     2p <sub>x</sub> 2p <sub>y</sub> 2p <sub>z</sub> 2p <sub>x</sub> 2p <sub>z</sub> |     |
| 29. (a) $\Delta s$ is +ve.                                                                                                                                                                                | 1   |
| (b) $\Delta H = \Delta E + \Delta nRT$                                                                                                                                                                    | 1   |
| (c) $\Delta = 87.44$ kJ                                                                                                                                                                                   | 1   |
| 30. Zero order reaction : Definition/statement.                                                                                                                                                           | 1   |
| Derivation of the equation.                                                                                                                                                                               | 2   |
| $k = \frac{2.303}{t} \log \frac{a}{a-x}$                                                                                                                                                                  |     |
| 31. (a) Acetaldehyde has $\alpha$ -hydrogen whereas formaldehyde does not have it.                                                                                                                        | 1   |
| (b) The presence of electron withdrawing substituent Cl in chloroacetic acid weakens the O-H bond and hence renders more acidity.                                                                         |     |
| (c) Due to the presence of intermolecular hydrogen bond carboxylic acids have higher b.p. than the corresponding acyl chlorides.                                                                          |     |

32. (a) Methane nitrile should be replaced by ethanenitrile. Full marks will be awarded to all. 1



33. (i) Conversion of pyrolusite to  $\text{K}_2\text{MnO}_4$

(ii) Oxidation of  $\text{K}_2\text{MnO}_4$  to  $\text{KMnO}_4$

(iii) Crystallisation of  $\text{KMnO}_4$  from the solution 1

34. (i) Colligative properties : Definition/statement 1

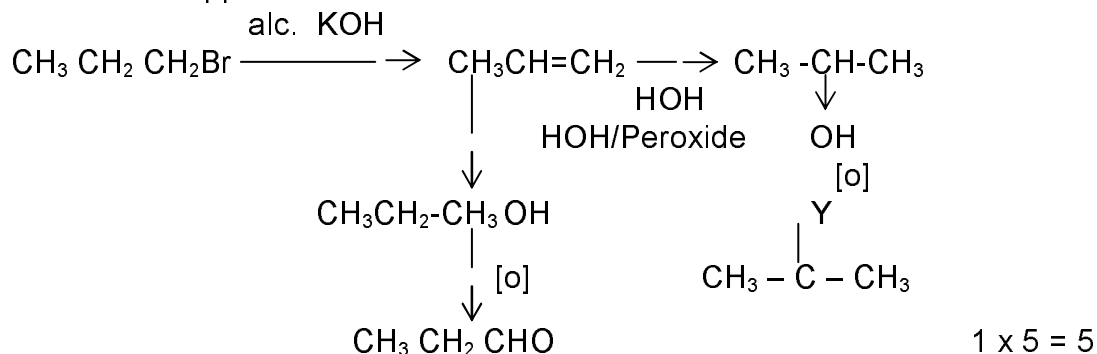
(ii) Naming of any two colligative properties of soln.  $\frac{1}{2} + \frac{1}{2} = 1$

(iii) Describing of the effect of presence of non-volatile solute on the b.p. of the solvent. 2

(iv) 
$$T_b - T_o = K_b \frac{W_B \times 1000}{W_A \times M_B}$$

Where, W=mass, A&B=solvent and solute,  
M=molar mass,  $T_b$  = b.p. of solution  
 $T_o$  = b.p. of solvent.

35. A is supposed  $\text{CH}_3\text{CH}_2\text{CH}_2\text{Br}$ . The scheme is



36. [i] Metallic character increases gradually down the group. 1

[ii] (a) Explanation of variable valency of N & P based on their electronic configuration. 2

(b) P contain vacant 3d orbitals whereas N does not

have any d-orbital in the valency shells.

2

*HEAD EXAMINER*  
*Chemistry*