

2020

CHEMISTRY**(Theory)***Full Marks : 70**Time : 3 hours**General Instructions :*

- (i) All questions are compulsory.
- (ii) Question No. **1** to **5** are multiple choice questions carrying 1 mark each.
- (iii) Question No. **6** to **10** are very short answer questions carrying 1 mark each.
- (iv) Question No. **11** to **17** are short answer questions carrying 2 marks each.
- (v) Question No. **18** to **26** are long answer questions carrying 3 marks each.
- (vi) Question No. **27** is a value based answer question carrying 4 marks.
- (vii) Question No. **28 to 30** are very long answer questions carrying 5 marks each.
- (viii) Use simple calculator and log table if necessary.

Choose the correct answer:

- | | |
|---|---|
| 1. The anion O^- is isoelectronic with | 1 |
| (a) N^{2-} | |
| (b) F^- | |
| (c) N^{3-} | |
| (d) Ne | |
|
2. Beryllium exhibits diagonal relationship with | 1 |
| (a) Boron | |
| (b) Aluminium | |
| (c) Magnesium | |
| (d) Silicon | |
|
3. Magnesium is present in | 1 |
| (a) Haemoglobin | |
| (b) Chlorophyll | |
| (c) Vitamin B_{12} | |
| (d) Ascorbic Acid | |

(3)

4. Homolytic fission of a covalent bond leads to the formation of 1
- (a) Electrophile
- (b) Nucleophile
- (c) Free radical
- (d) Carbocation
5. A person living in Shimla observed that cooking food without using pressure cooker takes more time. The reason for this observation is that, at high altitude: 1
- (a) Pressure increases
- (b) Temperature decreases
- (c) Pressure decreases
- (d) Temperature increases

PART — II

6. Define molality of a solution. 1
7. Give the electronic configuration of Cu (Z=29) and Cr (Z=24). 1
8. Define critical temperature. 1

(4)

9. What is dry ice? 1
10. What is electromeric effect? 1

PART — III

11. The molecular mass of an organic compound is 78 and its percentage composition is 92.4% C and 7.6% H. Determine the molecular formula of the compound. 2
12. Calculate the uncertainty in the position of an electron if the uncertainty in its velocity is $5.7 \times 10^5 \text{ ms}^{-1}$ ($h = 6.6 \times 10^{-34} \text{ Js}$ and mass of electron is $9.1 \times 10^{-31} \text{ kg}$). 2
13. Give the principle involved in solvay process for the manufacture of sodium carbonate. 2

Either

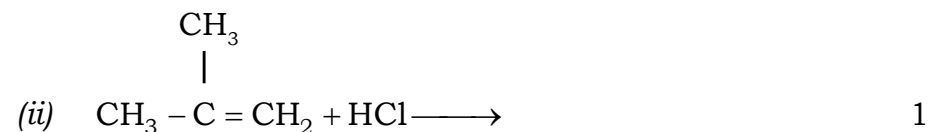
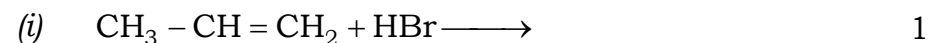
14. (a) Define and explain Law of Multiple Proportion with suitable example. 2

Or

- (b) Calculate the molarity of NaOH in the solution prepared by dissolving its 4.0g in enough water to form 250ml of the solution. 2

(5)

15. Using Markovnikov's rule, find the product of the following reactions.



16. Derive the Ideal Gas Equation. 2

Either

17. (a) Define hybridisation and explain taking BCl_3 molecule as an example. 2

Or

(b) What is Hydrogen bonding? What are the conditions necessary for the formation of hydrogen bonding? 2

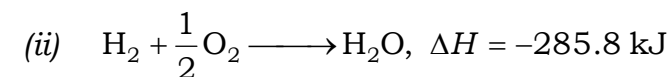
PART — IV

18. (a) What is enthalpy of formation? 1

(b) Calculate the enthalpy of formation of C_2H_6 from the following data: 2



(6)



19. (a) Oxygen is more electronegative than nitrogen but nitrogen has higher Ionisation Energy than oxygen. Why? 1

(b) Explain why second ionisation energy of Mg is less than that of Na? 1

(c) Define electron gain enthalpy. 1

20. (a) Give the relation between Gibb's Free energy change and the Equilibrium constant of a reaction. 1

(b) What is common ion effect? 1

(c) State Le Chatelier Principle. 1

Either

21. (a) What are hydrides? What are the different types of hydrides? 2

(b) Give one chemical reaction of H_2O_2 showing its oxidising action in acidic medium. 1

(7)

Or

- (c) Give one method of preparation of H_2O_2 with equation. 2
- (d) Write one method to remove temporary hardness of water. 1

Either

22. (a) Explain on the basis of Molecular Orbital Theory why O_2^- is paramagnetic but O_2^{2-} is not. 3

Or

- (b) Discuss the shapes of the following molecules on the basis of VSEPR theory. 3
- (i) NH_3
- (ii) H_2O
- (iii) CO_3

23. (a) A microscope using suitable photons is employed to locate an electron in an atom within a distance of 0.1\AA . What is the uncertainty, involved in the measurement of its velocity? 2
- (b) State Pauli's exclusion principle. 1

24. (a) A balloon is filled with hydrogen at room temperature. It will burst if pressure exceeds 0.25 bar. If at 1 bar pressure the gas occupies 2.40 L volume, upto what volume can the balloon be expanded? 2
- (b) What is an adiabatic process? 1

(8)

25. (a) State the Second Law of Thermodynamics. 1

- (b) For the reaction, 2

$2\text{NOCl (g)} \rightleftharpoons 2\text{NO (g)} + \text{Cl}_2 \text{ (g)}$, the value of the equilibrium constant K_c is 3.75×10^{-6} at 1069 K. Calculate K_p for the reaction at this temperature.

($R=0.0831 \text{ L bar K}^{-1} \text{ mol}^{-1}$)

26. (a) Give the general electronic configuration of alkaline earth metals. 1

- (b) Define oxidation number. Find the oxidation number of Fe in $\text{K}_4[\text{Fe}(\text{CN})_6]$. $1 + 1 = 2$

PART – V

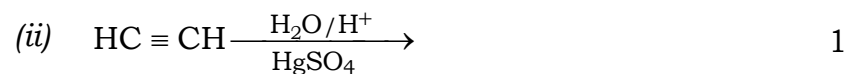
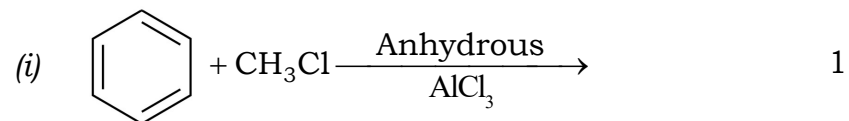
27. Recently, different state governments are imposing a ban on use of any kind of polythene bags. But polythene bags are of great use to us for packing different types of materials. Can you avoid its use? How do you agree or disagree with the government's decision? 4

Either

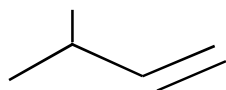
28. (a) Successive nitration in benzene takes place in meta position. Explain why? 2

(9)

(b) Complete the following reactions:



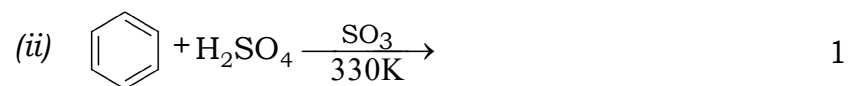
(c) Give the IUPAC name of 1



Or

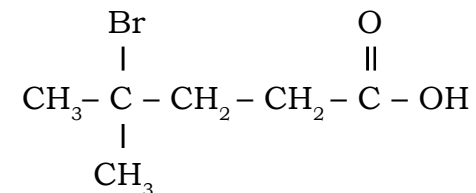
(d) What is resonance? Draw the resonating structure of nitrobenzene. 2

(e) Complete the following reactions:



(10)

(f) Convert the following into bond-line structure 1



Either

29. (a) CCl₄ cannot be hydrolysed while SiCl₄ can be easily hydrolysed. Explain why? 2

(b) Complete the following reactions.



(c) What is the general electronic configuration of the outer most shell in group 13 elements? 1

Or

(d) Write two general characteristics of *p*-block elements. 1

(e) Write the general electronic configuration of group 14 elements. How does diamond and graphite differ in terms of electrical conductivity and hardness? 1 + 1 = 2

(f) Give one method of preparation of boric acid with chemical equation. 2

30. (a) What are isomers? 1

(b) Give appropriate examples of the following types of structural isomers:

(i) Functional isomers 1

(ii) Position isomers 1

(c) What is a carbocation? 1

(d) Give one example each of an electrophile and a nucleophile. 1

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