

2021

CHEMISTRY
(Theory)

Full Marks : 70

Pass Marks : 21

Time : Three hours

All the Questions are compulsory.

The figures in the right margin indicate full marks for the questions.

Question Nos. 1–10 are Very short Answer (VSA) types of 1 mark each.

1. Which tropospheric pollutants are responsible for formation of cloud ? 1
2. Under what condition a system is said to be an isolated system. 1
3. State Gay-Lussac's law. 1
4. The value of equilibrium constant of a reversible reaction decreases with increase of temperature. Mention the reaction is either exothermic or endothermic. 1
5. What is the precision of measurement ? 1
6. What is the oxidation number of U in $\text{UO}_2(\text{NO}_3)_2$ 1

P.T.O.

7. Explain why He_2 molecule does not exist? 1
8. What is an oxidising agent? 1
9. Name the oxide of nitrogen which damage the leaves of plants and retards the rate of photosynthesis. 1
10. Write the relation between K_p / K_c of the reaction
 $4\text{O}_2(\text{g}) + \text{O}_2(\text{g}) \rightleftharpoons 2\text{N}_2\text{O}_5(\text{g})$. 1

Question Nos. 11–14 are Objective types carrying 1 mark each. Choose and rewrite the best answer out of the given alternatives.

11. In the change of NO^+ to NO the electron is added to 1
- A. σ orbital
 - B. σ^* orbital
 - C. π^* orbital
 - D. π orbital
12. Which of the following is NOT an extensive property? 1
- A. Free energy
 - B. Heat capacity
 - C. Entropy
 - D. Surface tension

13. Intra-molecular hydrogen bonding is observed in— 1
- A. water
 - B. hydrofluoric acid
 - C. ortho-nitrophenol
 - D. alcohol
14. Which of the following is achiral? 1
- A. A chair
 - B. A book
 - C. CH_3Cl
 - D. CHFCl

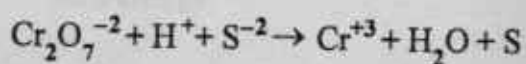
Question Nos. 15 – 24 are Short Answer (SA-II) types of 2 marks each.

15. What are the causes of deviations of real gases from ideal gases behaviour? 2
16. What are the structural features affecting the basicity of a molecule? 2
17. Write the difference between spin isomers of hydrogen. 2
18. Why is the hydride bridge in $(\text{BeH}_2)_n$ considered to be electron deficient but not the halide bridge in $(\text{BeCl}_2)_n$? 2
19. Giving a general formula of a solid salt, derive the relation between solubility and solubility product. 2
20. State and explain Hess's law of constant heat summation. 2

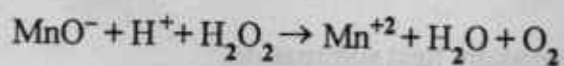
21. A certain mass of a gas occupies 250 mL at 750 mm pressure. What will be its volume if the pressure gas is changed to 540 mm at the same temperature? 2
22. Why C-H bonds in CH_4 are essentially non-polar? 2
23. The electron affinity of nitrogen is much lower than that of its neighbouring element oxygen. Give reason. 2
24. A solution of oxalic acid $(\text{COOH})_2 \cdot 2\text{H}_2\text{O}$ is prepared by dissolving 0.63g of the oxalic acid in 250 ml of the solution. Calculate the molarity of the solution. 2

Question Nos. 25 – 31 are Short Answer (SA-I) types of 3 marks each.

25. (i) Why the elements of group 1 are called alkali metals? 3
- (ii) Alkaline earth metals form more complexes as compared to the alkali metals. Give reason. 1+2=3
26. How can we reduce the rate of global warming? 3
27. Using VSEPR theory, predict the geometry of XeF_4 molecule and clearly indicate the position of lone pair of electrons and hybridization of the central atom. 3
28. Balance the following redox reaction by ion-electron method 3



OR

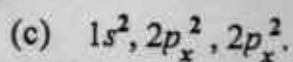
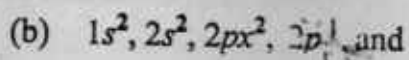
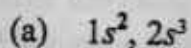


29. The methylene hydrogen atoms in $\text{CH}_3\text{CH}_2\text{NO}_2$ are more acidic than that in $\text{CH}_3\text{CH}_2\text{CH}_3$. Give reason. 3

OR

Explain why $(\text{CH}_3)_3\text{C}^+$ is more stable than CH_3CH_2^+ .

30. Write the name of the principles or rules violated in the following electronic configurations



OR

Show that the total number of orbitals associated with the principle quantum number $(n)=3$ is nine.

31. According to Le-Chatelier's principle, what are the favourable conditions for the manufacture of ammonia by the reaction process $\text{N}_2 + 3\text{H}_2 \rightleftharpoons 2\text{NH}_3 + \text{heat}$? 3

OR

Write the general characteristics of equilibrium constant.

Question Nos. 32 – 34 are Essay (E) types of 5 marks each.

32. (i) What are the properties responsible for the anomalous behaviour of carbon from the rest of the element in group 14?

OR

What are the properties responsible for the anomalous behaviour of boron from the rest of the element in group 13 ?

- (ii) Diamond and graphite are both allotropic forms of carbon, still only graphite is used as a lubricant. Why ?

OR

Explain why boron cannot expand its coordination number beyond four.

3+2=5

33. (a) Write the product obtained when

- (i) Propene is treated with HBr.
(ii) Propene is treated with HBr in presence of peroxide
(iii) Acetylene is treated with alkaline potassium permanganate.

OR

Write the product obtained when

- (i) Benzene is treated with acetyl chloride in presence of anhydrous AlCl_3 .
(ii) 1,2 di bromo ethane reacts with alcoholic potassium hydroxide followed by sodamide.
(iii) Vapours of phenol are passed over heated zinc dust.

- (b) A structural isomer of butene when subjected to ozonolysis followed by treatment with Zn / H_2O produces a single product. Identify the butane.

OR

According to Huckel's rule Naphthalene is an aromatic compound. Give reason. 3+2=5

34. Write the basic postulates of Bohr's theory of atomic hydrogen. Write merits and demerits of this theory. 5

OR

State Heisenberg's uncertainty principle. Show that this principle is significant only in microscopic sub-atomic particles. 5