Reg. No ..... Name **23U131**

B. Sc. DEGREE END SEMESTER EXAMINATION : NOVEMBER 2023

SEMESTER 1 : CHEMISTRY

COURSE : **19U1CRCHE1 : THEORETICAL AND INORGANIC CHEMISTRY I**

(For Regular 2023 Admission and Improvement/Supplementary 2022/2021/2020/2019 Admissions)

Time : Three Hours Max. Marks: 60

PART A

Answer All (1 mark each)

1. What is meant by a scientific theory?
2. The oxidation state of Mn in KMnO4 is ----
3. Which substances are called secondary standards in titrimetry?
4. Which indicator can be used in the titration of strong base vs weak acid.
5. The minimum frequency required for a light to cause ejection of photoelectrons from the surface of a metal is called ……
6. The phenomenon of photoelectric effect establishes the ……nature of light.
7. The number of 3d electrons in Cu^{2+} is .....
8. A wavefunction ψ satisfying the condition $\psi\psi^* d\tau = 1$ is said to be.....

(1 x 8 = 8)

PART B

Answer any 6 (2 marks each)

9. How does a scientific hypothesis differ from a scientific theory.
10. 3.75 g of a gas occupies 2.8L at 273K and 1.01325 bar. Calculate the molecular mass of the gas.
11. The true value for the determination of the NaOH in a given aqueous solution of it is 4.012 gL^{-1}. The result reported by an experimentalist is found to be 3.982 gL^{-1}. Calculate the absolute and relative percentage error.
12. Discuss Davisson - Germer experiment on electron diffraction.
13. Give the main points of difference between classical mechanics and quantum mechanics.
14. Derive de Broglie relation.
15. Represent the energy levels and eigen functions for the first two energy levels of a particle-in one-dimensional box.
16. Give the orthogonality condition with regard to two wavefunctions.

(2 x 6 = 12)

PART C

Answer any 4 (5 marks each)

17. Write a note on the essential steps involved in chemical research.
18. Calculate (a) molality (b) molarity and (c) mole fraction of KI if the density of 20% (mass/mass) aqueous solution KI is 1.202 gmL^{-1}.
19. Explain how a redox indicator works.
20. Why does the uncertainty principle contradict Bohr's theory of hydrogen atom? Among concept of orbit and orbital, to which concept uncertainty principle is closely related? Justify your answer.Calculate the uncertainty in the velocity of an electron if the uncertainty in its position is 100 pm.

21. What are quantum numbers? Discuss the significance of each quantum number.
22. β-carotene is a linear polyene in which 10 single and 11 double bonds are in conjugation along a chain with 22 π electrons. If we take each C-C bond length to be about 140 pm, then the length of the molecular box in β-carotene is 2.94 nm. Estimate the wavelength of light absorbed by this molecule from its ground state to next higher excited state.

(5 x 4 = 20)

PART D
Answer any 2 (10 marks each)

23. Discuss the theory and procedure of redox titrations?
24. Give a brief account on acid-base titrations.
25. Derive expressions for the radius of the nth electron orbit in a hydrogen atom amd for the velocity and energy of an electron revolving in it.
26. Derive the wave equation for a particle in a three-dimensional box applying the varaibles method.

(10 x 2 = 20)