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(FOR THE CANDIDATES ADMITTED DURING THE ACADEMIC YEAR 2021 ONLY) **21 PCY 206**

REG.NO. :

N.G.M.COLLEGE (AUTONOMOUS): POLLACHI

END-OF-SEMESTER EXAMINATIONS: JULY 2022

M.Sc.-CHEMISTRY **MAXIMUM MARKS: 70**

II SEMESTER **TIME : 3 HOURS**

PHYSICAL CHEMISTRY –II - QUANTUM AND ELECTROCHEMISTRY

SECTION - A (10 X 1 = 10 MARKS)

ANSWER THE FOLLOWING QUESTIONS.

MULTIPLE CHOICE QUESTIONS. **(K1)**

1. In photoelectric effect, the limiting frequency below which no electrons are emitted is called _____.
   (a) limiting frequency (b) zero frequency
   (c) eddy frequency (d) threshold frequency
2. Which of the following approximations assumes the separation of electronic and nuclear motions ?
   a) The Born-Oppenheimer approximation
   b) The Hund's rule.
   c) Heisenberg's uncertainty principle
   d) The Hartree-Fock approximation.
3. The total π bonding energy on formation of the ethylene molecule is _____.
   a) 2β b) 2α c) 2β – 2α d) 2β + 2α
4. According to D-H theory, λ is related to _____.
   a) C b) $C^{1/2}$ c) $C^{3/2}$ d) C^{n}
5. According to Helmholtz model, the variation of potential of the double layer with distance into the solution is _____.
   a) linear b) downward curved c) upward curved d) parabola

ANSWER THE FOLLOWING IN ONE (OR) TWO SENTENCES. **(K2)**

6. Write Compton effect.
7. What are quantum numbers?
8. What is Slater determinant?
9. Write any two applications of Debye Huckel limiting law.
10. What is fuel cell?

SECTION – B (5 X 4 = 20 MARKS)

ANSWER EITHER (a) OR (b) IN EACH OF THE FOLLOWING QUESTIONS. (K3)

11. a) Apply quantum mechanics to explain black body radiation.

(OR)

b) Explain the failure of classical mechanics and origin of quantum mechanics using photo electric effect.

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12. a) Describe approximation methods and their need in quantum mechanics.

(OR)

b) Apply single perturbation method to calculate energy of helium atom in ground state.

13. a) Based on quantum mechanical calculations explain the hybridisation of ethylene.

(OR)

b) Calculate π-Bond Order in Butadiene molecule.

14. a) Describe electrochemical cells and their types.

(OR)

b) Calculate ionic strength, mean ionic activity coefficient $\gamma\pm$, and the mean ionic molality $m\pm$ for a 0.02 molal aqueous solution of zinc chloride, $ZnCl_2$.

15. a) Examine the Stern model of electrical double layer

(OR)

b) Derive Butler Volmer equation and give its uses.

SECTION - C (4 X 10 = 40 MARKS)

ANSWER ANY FOUR OUT OF SIX QUESTIONS. (K4 (Or) K5)
(16th QUESTION IS COMPULSORY AND ANSWER ANY THREE QUESTIONS (FROM Qn. No : 17 to 21)

16. Determine the energy and wave function of a particle in one-dimensional box quantum mechanically.

17. Derive Schrodinger's time dependent and time-independent equation.

18. Derive the expressions for energy of a Rigid rotor using classical mechanics as well as quantum mechanics. What is the significance of the results?

19. Investigate the importance of HMO to benzene and give your findings.

20. Explain the Debye Huckel Onsager theory for strong electrolytes. Give its advantages and disadvantages.

21. Summarize the corrosion types and its prevention

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