QP CODE: 20100033

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Reg No : .....

Name : .....

BSc DEGREE (CBCS) EXAMINATION, FEBRUARY 2020

Fifth Semester

Core Course - CH5CRT08 - PHYSICAL CHEMISTRY - II

B.Sc Chemistry Model I ,B.Sc Chemistry Model II Industrial Chemistry ,B.Sc Chemistry Model III Petrochemicals

2017 Admission Onwards

9C79536C

Time: 3 Hours | Maximum Marks :60

Part A

*Answer any **ten** questions.*

*Each question carries **1** mark.*

1. Specify the value of the Compton wavelength.
2. Give the significance of linear operators in quantum mechanics.
3. Specify the condition for orthonormality of wavefunctions?
4. How many nodes (spherical and angular) does a *4p* orbital possess?
5. What are bonding and anti-bonding MO's?
6. *Express a wavelength of 400 nm as a wavenumber.*
7. *Name the region of electromagnetic radiation used for electronic transitions.*
8. *Give the selection rules governing the transition between vibrational energy levels.*
9. *What is the Raman effect?*
10. *Distinguish between hyperchromic and hypochromic shift.*
11. *Tuning of energy levels is a unique characteristic of NMR spectroscopy. Validate the statement.*
12. *Give the expression for the seperation between spin energy levels of an electron.*

(10×1=10)

Part B

*Answer any **six** questions.*

*Each question carries **5** marks.*

13. Find the energy per photon and the energy per mole of photons of radiation of wavelength (a) 600 nm (red) (b) 550 nm (yellow) (c) 400 nm (blue).

14. Explain (a) the de Broglie hypothesis (b) Heisenberg's uncertainty principle.

15. A hydrogen atom, treated as a point mass, is confined to a one-dimensional square well of length 1.0 nm. How much energy does it have to give up to fall from the first excited state to the ground state?

16. Outline the basic principle of the LCAO method, and illustrate the formation of MO's by the combination of AO's.

17. In the context of vibrational spectroscopy, what do mean by overtones and hot bands?

18. Sketch the fundamental vibrational modes of H2O indicating their activity in IR region.

19. State and explain the rule of mutual exclusion.

20. Explain the term Larmour Precession. What is its significance in the NMR spectroscopy?

21. Explain the nuclear shielding and the deshielding as applied to the NMR spectroscopy.

(6×5=30)

Part C

*Answer any **two** questions.*

*Each question carries **10** marks.*

22. Starting from the Schrodinger equation in cartesian coordinates, obtain the expressions for the wavefunction in spherical coordinates for hydrogenic species.

23. Discuss the solution of the Schrodinger wave equation for the hydrogen molecule-ion. And pictorially represent the MO wavefunctions and the probability density. Discuss the potential energy curves of bonding and anti-bonding MO's.

24. *(a) Arrive at expressions for (a) moment of inertia and (b) rotational energy of a rigid diatomic molecule.*

(b) Evaluate the rotational constant of ^2HCl (masses of 2H and Cl are 2.0141 m_u and 34.969 m_u, respectively)

25. (a) Discuss the origin of the Frank-Condon principle and how it leads to the appearance of vibrational structure in an electronic transition.

(b) Explain how dissociation of a diatomic molecule can occur through absorption of radiation.

(2×10=20)