QP CODE: 22103392

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Reg No : .....

Name : .....

B.Sc DEGREE (CBCS) REGULAR / REAPPEARANCE EXAMINATIONS, NOVEMBER 2022

Fifth Semester

CORE COURSE - CH5CRT08 - PHYSICAL CHEMISTRY - II

Common for B.Sc Chemistry Model I, B.Sc Chemistry Model II Industrial Chemistry & B.Sc Chemistry Model III Petrochemicals

2017 Admission Onwards

3C3B1881

Time: 3 Hours Max. Marks : 60

Part A

*Answer any **ten** questions.*

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

1. State the uncertainty principle.
2. What is meant by a linear operator?
3. Show that the Schrodinger wave equation is an Eigenvalue equation.
4. List the quantum numbers that needed to specify an atomic orbital.
5. What is meant by the LCAO-MO?
6. Express a wavelength of 400 nm as a wavenumber.
7. Specify the type of molecular excitations occur when a molecule absorbs an electromagnetic radiation of wavelength 1000 nm.
8. In terms of vibrational spectroscopy, define the zero point energy.
9. What is a polarisability ellipsoid?
10. What technological advance enabled the routine use of the Raman Spetroscopy?
11. Predict the number of signals in the low resolution PMR spectrum of toluene.
12. What is meant by the term 'spin flipping'?

(10×1=10)

Part B

*Answer any **six** questions.*

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

13. A sodium lamp emits yellow light (550 nm). How many photons does emit each second if its power is (a) 1.0 W, (b) 100 W?

14. X-rays of wavelength 10 pm are scattered from a target. (a) Find the wavelength of the X-rays scattered through 450. (b) Find the maximum wavelength present in the scattered X-rays. (c) Find the maximum kinetic energy of the recoil electrons.

15. What do you mean by the quantum mechanical zero point energy of an electron confined within a one-dimensional box, and find the zero point energy of an electron confined in a one-dimensional box of length 1.0 nm.

16. Explain the Born-Oppenheimer approximation, and discuss how it simplifies the problem of solving the Schrodinger wave equation for hydrogen molecule-ion.

17. In vibrational spectroscopy, how does an overtone differ from the fundamental?

18. What is the finger print region? Discuss its significance in the spectral study of organic compounds.

19. Discuss the different types of electronic transitions.

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

21. Explain the origin of hyperfine structure in the ESR absorptions. Give the ESR spectrum of methyl radical.

(6×5=30)

Part C

*Answer any **two** questions.*
*Each question carries **10** marks.*

22. Elaborate on the significance of various quantum numbers to specify the internal state of a hydrogenic atom.

23. Discuss the important features of MO theory and LCAO method. Illustrate the formation of the σ, σ^*, π and π^* – MO's.

24. (a) Discuss the principle of microwave spectroscopy.
(b) The pure rotational spectrum of gaseous HCl consists of a series of equally spaced lines separated by 20.80 cm^{-1}. Calculate the bond length of HCl. (The atomic mass of Hydrogen = 1.008 g $mol^{-1}$and that of Chlorine = 35.5 $gmol^{-1}$)

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)