C 22106

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Name...

Reg. No.......................................

FOURTH SEMESTER M.Sc. DEGREE EXAMINATION, JUNE 2017

(CUCSS)

Physics

PHY 4C 12—ATOMIC AND MOLECULAR SPECTROSCOPY

(2012 Admissions)

Time : Three Hours

Maximum : 36 Weightage

Section-A

Answer all questions.
Each question carries a weightage of 1.

1. Illustrate the fine structure transitions of sodium atom.

2. Distinguish between Zeeman effect and Paschen back effect.

3. Why nitrogen molecules do not show IR absorption or emission ?

4. A homo nuclear diatomic molecule does not respond to microwave radiation, why ?

5. Why a micro wave source and techniques are applied to observe ESR.

6. Explain Fronde-Condon principle.

7. What is isomer shift ? What information it gives ?

8. Explain hyper Raman effect.

9. Deduce the condition for NMR.

10. Give the decay schemes of ^{57}Co and ^{119}Sn.

11. Explain Morse curve.

12. What are P,Q and R branches ?

(12 × 1 = 12 weightage)

Section - B

Answer any two questions.
Each question carries a weightage of 6.

13. What are equivalent and nonequivalent electrons ? Using jj coupling scheme obtain the term symbols of a ps configuration.

14. (A) With necessary theory obtained the energy levels of a rigid rotator.

    (B) Explain the effect of nonrigidity and isotope substitutions on these levels.

15. Discuss the rotational fine structure of electronic vibrational transitions, what is Fortrat parabola.

16. Give an account of Mossbauer effect. Discuss isomer shift with example.

(2 × 6 = 12 weightage)

Turn over

Section - C

*Answer any **four** questions.*
Each carries a weightage of 3.

17. Evaluate the Lande 'g' factors and the splitting factors 'mg' for the doublet terms $^2P_{1/2}$ and $^2P_{3/2}$.

18. The micro wave spectra of CN radical shows a series of lines spaced by a constant amount of 3.8 cm^{-1}. What is the bond length of CN ?

19. A Raman line is observed at 4768.5 Å, when acetylene was irradiated by 4358.3 Å radiation, Calculate the equilibrium vibrational frequency that causes the shift.

20. The fundamental band for HCl centred at a 2886 cm^{-1} assume that the inter nuclear distance is 1.276 Å. Calculate the wave number of the first two lines of each of the P and R branches of HCl.

21. Given that the bond dissociation energy of oxygen is 6eV and its vibrational frequency is 1580cm^{-1} estimate the maximum vibrational quantum number possible for Oxygen.

22. Obtain the resonance frequency and the number of hyperfine components of the ESR spectrum for the free radical CH_3 in a magnetic field of 0.34 T (given g=2.0023).

$(4 \times 3 = 12$ weightage)