

BACHELOR OF SCIENCE (CBCS-2018 COURSE)
T. Y. B. Sc. Sem-VI :SUMMER- 2022
SUBJECT : PHYSICS : ATOMIC & MOLECULAR PHYSICS

Day : Tuesday
Date : 5/7/2022

S-18463-2022

Time : 11:00 AM-02:00 PM
Max. Marks : 60

N. B.

- 1) All questions are **compulsory**.
- 2) Figures to the right indicate full **marks**.
- 3) Draw the neat **diagram** wherever necessary.

Q 1. Attempt any **Two** of the following. **(12)**

- (a) Explain sodium doublet in sodium spectra.
- (b) Write a note on origin of characteristics X ray spectra.
- (c) Write a note on four quantum numbers.

Q 2. Attempt any **Two** of the following. **(12)**

- (a) Show that the vibrational energy level of the diatomic molecule is given by

$$E_v = \frac{\left(v + \frac{1}{2}\right) h \sqrt{k}}{2\pi \sqrt{\mu}}$$

- (b) Explain Raman effect on the basis of quantum theory. Draw the necessary energy level diagram.
- (c) Write a note on Frank and Hertz experiment. What conclusions are drawn from the experiment.

Q 3. Attempt any **Two** of the following. **(12)**

- (a) What is electronic spectra of molecule and hence discuss fluorescence and phosphorescence.
- (b) Explain vector atom model in detail.
- (c) With neat diagram, explain the experimental set up to produce and observe Zeeman effect.

Q 4. Attempt any **Three** of the following. **(12)**

- (a) Find the minimum magnetic field needed for the Zeeman effect to observe in spectral line of 200 nm wavelength, when a resolution of a spectrometer is 0.010 nm.
- (b) Write the electronic configuration of fluorine and neon.
- (c) Compare between X ray spectra and optical spectra.
- (d) Determine the ground state of the aluminum atom ($Z=13$) and represent it in the spectral notation.

Q 5. Attempt any **Four** of the following. **(12)**

- (a) Write a note on Bohr's postulates.
- (b) Find the orbital angular momentum of d electron.
- (c) The frequency of strong yellow line in spectrum of sodium is $5.09 \times 10^{14} \text{ sec}^{-1}$. Calculate the wavelength of the light in nanometers.
- (d) The spacing between vibrational level of CO molecule is 0.08 eV. Calculate the value of force constant. Take mass of carbon atom =12 a.m.u. and that of oxygen 16 a.m.u., Mass of proton = $1.67 \times 10^{-27} \text{ kg}$.
- (e) In an experiment of Raman effect using mercury green radiation of $\lambda = 546.1 \text{ nm}$, a Stoke's line of wavelength 554.3 nm was observed. Find Raman shift and wavelength corresponding to anti-Stoke's line.
- (f) Explain in short Rutherford's model of an atom.

* * * *