

BACHELOR OF SCIENCE EXAMINATION, 2018

(2st Year, 2nd Semester)

PHYSICS (Subsidiary)

Paper-SO7

Time: Two hours

Full Marks: 50

The figures in the margin indicate full marks.

Answer any **four** questions

1. (a) Write the properties of Cathode Rays.
(b) Explain with proper diagram Thomson experiment for determining charge to mass ratio of cathode rays. Also obtain the expression of the ratio in terms of experimental parameters used.
(c) Why it is difficult to obtain the ratio with such experiment for positive rays?
3.5+6+3
2. (a) Discuss briefly the wave nature of matter and outline de Broglie theory of matter waves.
(b) Describe briefly Davisson-Germer experiment to demonstrate the wave nature of electrons.
(c) Calculate the de Broglie Wavelength of an electron whose Kinetic energy is 50 eV.
4+6+2.5
3. (a) Explain the origin of characteristic X-rays.
(b) An X-ray tube is operated at 30 Kilovolts. Find out the short wavelength limit of Continuous Spectra.
(c) Define half -life of a radioactive substance. What is the half-life of a radioactive sample if only 6.25% is left undecayed after a period of 16 days?
6+2.5+4

4. (a) For an alpha-scattering experiment define (i) impact parameter, (ii) distance of closest approach and (iii) angle of scattering.
(b) Obtain the relation between these parameters.
(c) Write the Rydberg formula for hydrogen spectrum for Lyman, Balmer and Paschen series. In which electromagnetic range these series lie?
(d) Using Ritz combination principle show that from two lines of Balmer series one can get a line of Paschen series.

4.5+3+3+2

5. (a) What is Compton shift? Derive an expression of Compton shift.
(b) A photon is found to have its wavelength doubled on being scattered by a free electron through 90° . Find the wavelength of incident photon.

10+2.5

6. (a) What are the drawbacks of classical wave theory to explain photoelectric effect?
(b) What is meant by stopping potential and what does it signify? Plot stopping potential versus frequency. Mention what is obtained from slope and intercept?
(c) Obtain the energy density of black-body radiation in the range of λ and $\lambda+d\lambda$ using Planck's theory.
(d) Show that it gives rise to Rayleigh-Jeans equation for larger wavelength.

2.5+(2+1+1)+4+2