BACHELOR OF SCIENCE EXAMINATION, 2019

(2nd Year, 2nd Semester, Old Syllabus)

PHYSICS (SUBSIDIARY)

Paper : SO-7

Time : Two hours   Full Marks : 50

The figures in the margin indicate full marks.

Answer any *four* questions.

1. (a) What are positive rays and write down their properties.

   (b) Describe Bainbridge mass spectrograph and explain how atomic masses are determined using it. Mention two uses of mass spectrograph.

   (c) In a Tompson positive ray experiment, singly and doubly ionised particles from identical parabolas for the same electric field, when the magnetic flux densities are 0.8 weber/m^2 and 1.2 weber/m^2 respectively. Compare the masses of the particles.

   $3+6+3\frac{1}{2}=12\frac{1}{2}$

2. (a) State and explain Planck's law of radiation.

   (b) Give an account of Einstein's explanation of photoelectric effect on the basis of quantum theory. Also explain theoretical overview of Millikan's experiment to verify the Einstein's photoelectric equation.

(Turn Over)

(c) The photoelectric threshold for a metal is $3000\,\text{Å}$. Find the kinetic energy of an electron ejected from it by radiation of wavelength of $1200\,\text{Å}$.

$$3+(3+4)+2\tfrac{1}{2}=12\tfrac{1}{2}$$

3. (a) The energy of the electron in the nth orbit in hydrogen atom is negative. Explain.

(b) Calculate the closest distance of approach of the α-particle of energy 5MeV while shooting a gold nucleus.

(c) The wavelength of 2nd line of Balmer series in the hydrogen spectrum is $4861\ \text{Å}$. Calculate the wavelength of first line.

(d) Explain why in the absorption spectrum of hydrogen, absorption lines of only Lyman series appear. $\qquad 3+3+3+3\tfrac{1}{2}=12\tfrac{1}{2}$

4. (a) The potential difference across an X-ray tube is 50000 Volt and the current through it 2.5 mA. Calculate (i) the number of electrons striking the anode per second, (ii) the speed with which they strike it and (iii) the approximate rate of production of heat in the anode.

(b) Sate and deduce Bragg's law of X-ray diffraction.

(c) What is Moseley's law and discuss its Importance.

(d) Explain why Compton effect is an incoherent scattering.

(e) How do you explain the absorption of X-rays by matter ? $\qquad 3+3+3+2+1\tfrac{1}{2}=12\tfrac{1}{2}$

5. (a) Explain the concept of de Broglie's matter wave.

(b) Deduce an expression for the wavelength of de Broglie matter wave.

(c) Calculate the de Broglie wavelength of an electron accelerated through a potential of 150 volts.

(d) Explain the wave velocity and group velocity for de Broglie matter wave. $\qquad 2+5+3+2\tfrac{1}{2}=12\tfrac{1}{2}$

6. (a) Show that the mean life of a radioactive substance is the reciprocal of the decay constant.

(b) Explain the law of radioactive disintegration. 1 gm of radium is reduced by 2.1 mg in 5 years by α-decay. Calculate the half-life period of radium.

(c) What do you mean by activity of a radioactive substance and mention its unit in SI system.

(d) Explain the secular and transient equilibrium for radioactive decay. $\qquad 5+3+2+2\tfrac{1}{2}=12\tfrac{1}{2}$

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