

SECTION 'B' (Short-Answer Questions) (36)

NOTE: Answer any NINE part questions from this section. All questions carry equal marks. Draw diagrams where necessary.

2. i) Find the shortest and longest wavelength of emitted photons in hydrogen spectra in Paschen series.

ii) What is Wheatstone Bridge? Prove that for a balanced Wheatstone

$$\text{Bridge: } \frac{P}{Q} = \frac{R}{X}$$

(iii) X-rays of wavelength $2.64 \times 10^{-10} \text{ m}$ are used in Compton scattering process. Find the fractional change in wavelength for a scattering angle of 120° .

(iv) Derive an expression for the force experienced by a current carrying conductor in a uniform magnetic field.

(v) The half-life of ${}_{104}\text{Po}^{210}$ is 140 days. By what percent does its activity will decrease per week?

(vi) Calculate the temperature at which the root mean square speed of nitrogen molecule is 3300 ms^{-1} .

(vii) What is meant by Rectification? How does a semiconductor diode work as a half wave rectifier?

(viii) Give the construction and working of Geiger Counter.

(ix) A particle of charge $3.2 \times 10^{-19} \text{ C}$ and mass $2.48 \times 10^{-27} \text{ kg}$ is held motionless between two horizontal parallel plates separated by 5 cm . Find the potential difference between the plates.

(x) Define Electric Flux. Derive the expression for the electric flux due to a point charge.

(xi) What is thermostat? Describe the working of bimetallic thermostat.

(xii) Find the speed at which mass of particle will be doubled.

(xiii) Three resistances each of 6Ω can be connected in four different ways. What is equivalent resistance of each combination?

(xiv) An iron core solenoid with 400 turns has a cross-section area of 4.0 cm^2 . A current of 2.0 ampere passing through it produces $B = 0.2 \text{ weber/m}^2$. What emf is produced in it if the current is turned off in 0.1 sec? What is its self-inductance?

SECTION "C" (Detailed Answer Questions)(32)

NOTE: Attempt any TWO questions from this section. All questions carry equal marks. Draw diagrams where necessary.

3. a) What Photoelectric Effect? Explain its important results. Derive Einstein's photoelectric equation.

b) Explain capacitance of a capacitor and give its SI unit. Derive the expressions for the capacitance of a parallel plate capacitor when space between the plates contains:

i) Free space ii) A dielectric

4. a) Define Radioactivity. Explain the law of radioactive decay. Write the equations of the change in the parent nuclei α , β and γ decay.

b) State the first law of thermodynamics and explain following on its basis:

i) Isobaric Process ii) Isochoric Process
iii) Isothermal Process iv) Adiabatic Process

5. a) Derive the expression for the following when $r_n = n^2 \left(\frac{4\pi\epsilon_0 h^2}{me^2} \right)$

i) the energy of an electron in the n th orbit of hydrogen atom.

ii) The wavelength of photons emitted in the hydrogen spectrum.

b) What is Transformer? On what principle it works? With the help of diagram give its construction and working. Derive expressions for its efficiency and turns ratio.