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A3) A band gap is the energy range in a solid where no electronic states can exist. It is given usually by the energy difference between the top of the Valence Band & the bottom of the Conduction Band in eV.

→ Resistivity of Ge : 0.5 ohm-m (room temp.)
Resistivity of Cu : $1.68 \times 10^{-8}$ ohm-m

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A4) A collinear equidistant four-probe method is appropriate for the measurement of resistivity of specimen having wide variety of shapes. It uses pressure contacts instead of soldered contacts; & hence eliminates & overcomes issues like - error due to contact resistance of measuring leads; injection of impurities into the intrinsic material .etc.

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A5) $I = I_0 e^{-\lambda t}$

Averaging over the three, we get :

(c) 0.2284 $cm^2/mg$

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A7) According to Malus' Law, $I = I_0 \cos^2\theta$

∴ Intensity of light passing the second filter is -

→ $I \cos^2 60° = \boxed{I/4}$

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A8) N.A. of optical fibre $= \sqrt{n_{core}^2 - n_{clad}^2}$ (2)

$\therefore$ N.A. $= \sqrt{1.425^2 - 1.417^2} = \sqrt{0.022736} = 1.5078$

$\therefore$ **N.A. = 1.5078**

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A9) Lande g-factor : $g = 1 + \frac{J(J+1) + S(S+1) - L(L+1)}{2J(J+1)}$

$L = 1$, $J = 1$, $S = 2$

$\therefore g = 1 + \frac{1(2) + 2(3) - 1(2)}{2 \cdot 1(2)}$

$\therefore g = 1 + \frac{6}{4} = \frac{5}{2}$

$\therefore$ **$g = \frac{5}{2}$** ← Lande g-factor

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A12) $\chi = \frac{2(\rho - \rho_a) g h}{\mu_0 H^2} \Rightarrow h = \frac{\mu_0 H^2 \chi}{2(\rho - \rho_a) g}$

$\chi = 0.678 \times 10^{-5}$, $\rho = 1.764$ g/cc

$H = 1500$ Gauss, $\rho_a = 1.225 \times 10^{-3}$ g/cc, $g = 980$ cm/s$^2$

$\mu_0 = 1$

$\therefore h = \frac{1 \times 1500^2 \times 0.678 \times 10^{-5}}{2(1.761775)9800} = 0.0044$ cm

$\therefore$ Rise in height is 0.0044 cm

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A12) $E = h\nu = \frac{hc}{\lambda}$

$\therefore \lambda = \frac{hc}{E} = \frac{1.23984193 \text{ eV-}\mu\text{m}}{11 \text{ eV}}$

$\therefore \boxed{\lambda = 112.713 \text{ nm}}$ (wavelength of emitted radiation)

→ We use the position of two successive peaks of the anode current for the calculation of excitation energy of Argon. (voltage difference). Because of peaks, we get the points where electrons collide with gas molecules; hence we get accurate values.

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A13) Magnetoresistance $f = \frac{\Delta\rho}{\rho_0} \propto H^2$

∴ If we double the magnetic field, magneto-resistance will be 4f.

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A14) According to the circuit, increasing retarding voltage VG2A will decrease the anode current IA; due to less no. of electrons falling on the anode.

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A15) $\omega = g\left[e/2mc\right] H_0 \quad g = 2, \; H_0 = 9 \text{ Gauss}$

∴ frequency : 5.3 kHz