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Q1). A Slit of width α is illuminated by white light

A). For what value of α will the first minimum for red light of wave length $\lambda = 650$ nm appear at $\theta = 15°$?

Ans). At the first minimum, $m = 1$ in equation [$a \sin\theta = m\lambda$, for $m = 1, 2, 3....$] Solving for a, we then find

$a = m\lambda / \sin\theta$
$= (1)(650 nm)/(\sin 15°)$
$= 2511$ nm
$= 2.5 \mu m$.

Therefore, the value of a the first minimum for red light of $\lambda = 650$ nm be at $\theta = 15°$ would be $2.5 \mu m$. For the incident light to flare out that much ($\pm 15°$) the Slit has to be very fine indeed, amounting to about four times the wave length. Note that a fine human hair may be about 100 μm in diameter.

B). What is the wave length λ' of the light whose first side diffraction maximum is at $15°$, thus Coinciding with the first minimum for the red light?

(Q(2) part (a)))

(Q no - 2 (part) (A)

Reflection vs Refraction :

the phenomena of light beam rebounding after hitting a Surface is called reflection. To put it simply, the mirror images are what are called reflection. The light beam that hits the surface is called incident ray.

Refraction :-

When the light changes direction or bend's as it passes through the boundry between these two media. the images that witnessed these two media. the image that are witness- through glass see through objects are result of refraction.

Q:

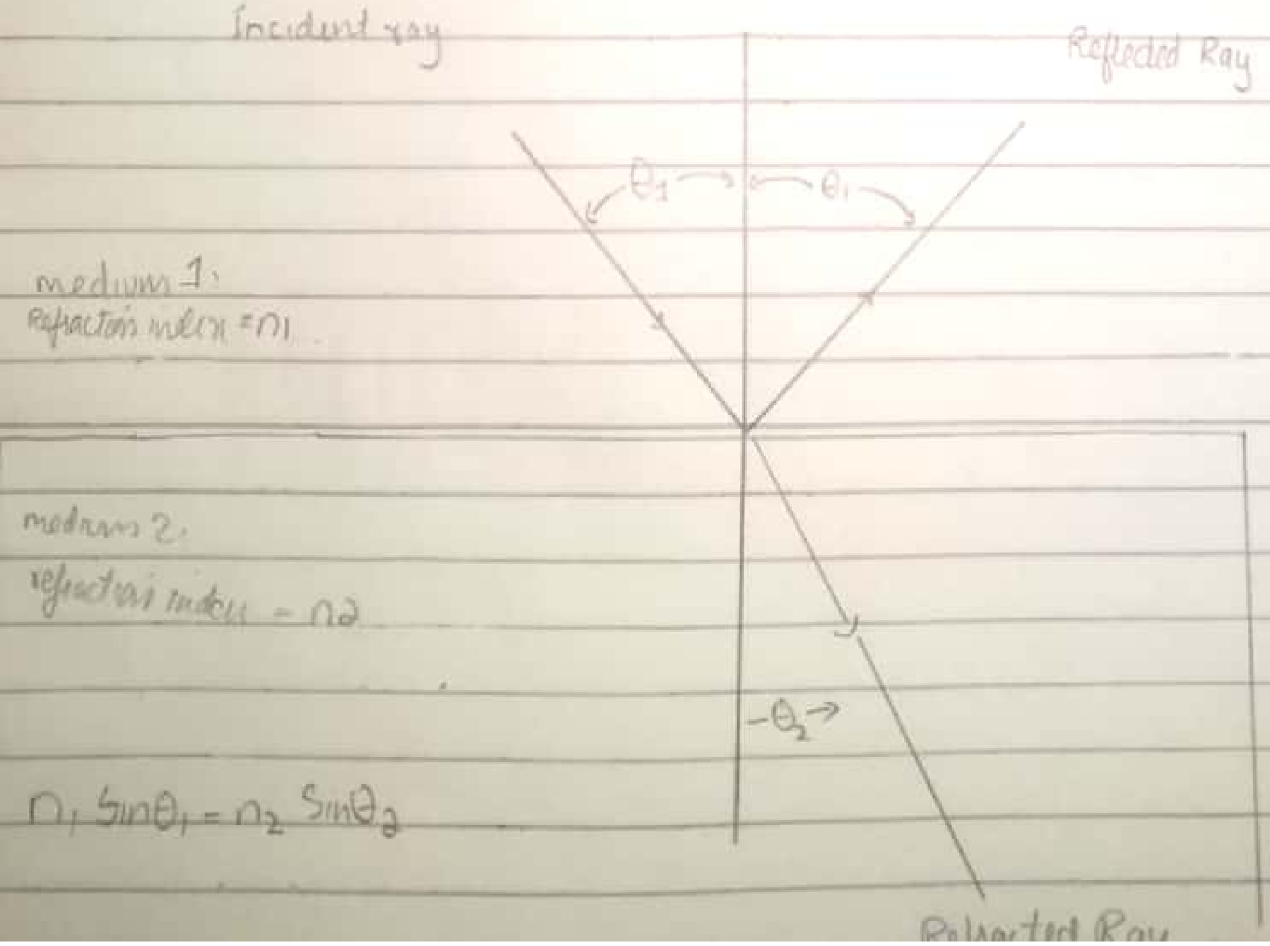
Examples: (Reflection vs refraction

when a ray of light strikes horizontal the surface at 45 degree. it always rebound the same 45 degree angle. these angle are the Some even when multiply rays hit the surface and bounce back. e.g. flat mirror produce an image that is upright.

α ——— α

Q2B

At the point incidence when the ray strikes the mirror, a line can be drawn perpendicular to the surface of the mirror. The angle between the incident ray and normal is known the ~~incident~~ angle of incidence. The angle between the reflected ray and the normal is known as the angle of reflection
Also the relationship between the Angle of incidence and angle of refraction is explained by Snell's law. which states that ratio of the sin of Angle of refraction and sin of the angle of incidence is always constant and equivalent to the ratio of phase velocities of two mediums.
So law of reflection is equal to angle of incidence through this law.



$n_1 \sin\theta_1 = n_2 \sin\theta_2$

Q3). The long Solenoid S shown (in cross section) in the following diagram has 220 turns/cm and carries a current i = 1.5 A; its diameter D is 3.2cm. At its center we place a 130 turn closely packed coil C of diameter d = 2.1cm. The current in the Solenoid is reduced to zero at a steady rate in 25ms. What is the magnitude of the emf that is induced in coil C while the current in the Solenoid is changing?

Ans). The initial flux through Solenoid C is,

$$\Phi_{Bi} = BA_c = \mu_0 i n_s A_c = \pi \mu_0 i n_s r_c^2$$

Now we can write

$$\frac{d\Phi_B}{dt} = \frac{\Delta\Phi_B}{\Delta t} = \frac{\Phi_{Bf} - \Phi_{Bi}}{\Delta t}$$

$$= \frac{0 - \pi \mu_0 i n_s r_c^2}{\Delta t} = -\frac{\pi \mu_0 i n_s r_c^2}{\Delta t}$$

Subsituting gives

$$\frac{d\Phi_B}{dt} = -\frac{\pi (4\pi \times 10^{-7}\ T \cdot \frac{m}{A})(1.5A)}{25ms} \times \left(22000 \frac{turn}{m}\right)(0.0105\ m)^2$$

$$= -5.76 \times 10^{-4}\ V.$$

The magnitude of the induced emf is then

$$\varepsilon = N\left|\frac{d\Phi_B}{dt}\right| = (130)(5.76 \times 10^{-4} V)$$

$$= 75 mV.$$

Q4)
a). How to calculate the magnetic force on current carrying wire?

Calculate the force on the wire shown in figure A given B = 1.50T, L = 5.00cm and I = 20.0A.

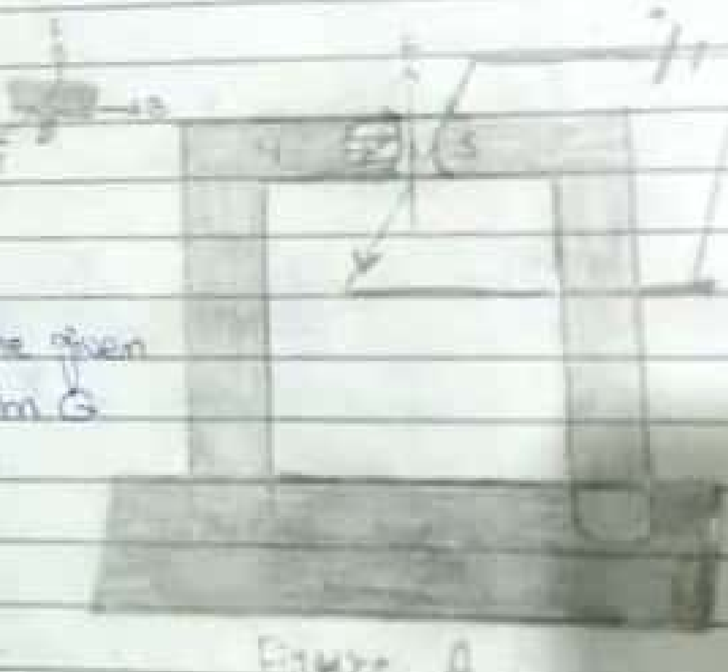


Figure A

Strategy

The force can be found with the given information by using $F = ILB \sin\theta$ and nothing that the angle θ between I and B is 90°,
so that $\sin\theta = 1$.

Solution

Entering the given values into $F = ILB \sin\theta$ yields

$F = ILB \sin\theta = (20.0A)(0.0500m)(1.50T)(1)$.

The units for tesla are $1T = \frac{N}{A \cdot m}$; thus,

$F = 1.50N$.

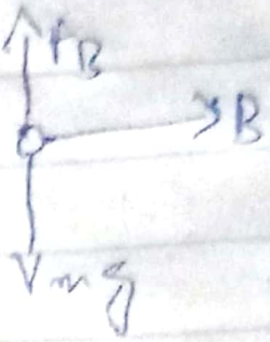
Q 4) ~~part (B)~~ .
Part (B)

Soloution:

Current, $i = 28A$

mass per unit length

$m_l = 46.6 g/m = 0.0466 kg/m$



etc the magnetic feild is B.

the weight of the wire is bbalanced by magnetic force

$mg = ilB$

$B = mg/iL$

$B = (m/i) \times gli$

$B = 0.0466 \times 9.8/28$

$B = 0.01631T$

thus the magnetic feild is

$\therefore$ **(0.01631T)** $\therefore$

(Q no 5... Part (A))

Definition of resistance :-

the resistance is the property of the material which creates an obstruction in the flow of the current. when the voltage is applied. while moving these electron collapse with atom or molecule and hence produce heat. these atoms or molecule oppose the movement of free electrons in a material.

Formula $R = \rho \frac{l}{a}$

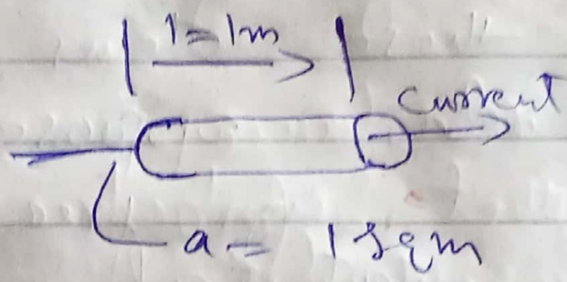
where l - length of the conductor.

a - cross section area

ρ - resistivity of material

Definition of resistivity:

the resistivity is also known as Specific resistance. the resistivity represent the resistance which as Specific dimension. i.e the material has 1-meter length and 1 square meter area of Cross Section.



Formula: $\rho = \frac{R \times a}{l}$

Difference b/w them

① The resistance is the propert[y] of the material which

Obstruct the flows of Current !-

② The resistance is the ratio of the length and cross-section area of the conducter, whereaso, the resistivity of material is the ratio of the product of the resistance and length of the conducter.

③ the resistance is represented by the Symbol R whereiase the resistivity is represent by Symbol ρ.

④ the SI unit of the resistan is Ohm. and the Si unit of resistivity is ohm - meter.

Q5(b)

i) Soln

Cross-sectional area of rectangular block is square:-

$S = 1.2 \times 1.2 \ cm^3 = 1.44 \times 10^{-4} m^2$

L is 15cm so $L = 0.15m$

so $R = (9.6 \times 10^{-8}) \left(\frac{0.15}{1.44 \times 10^{-4}} \right)$

$R = 1 \times 10^{-4} \ \Omega$

ii) Soln

Cross-sectional area for rectangular block is rectangular:-

$S = 1.2 \times 15 cm^2 = 1.8 \times 10^{-3} m^2$

$L = 1.2cm = 0.012m$

$R = (9.6 \times 10^{-8}) \left(0.012 / 1.8 \times 10^{-3} \right)$

$R = 6.4 \times 10^{-7} \ \Omega.$