Subject: Physics Final Term Exam Date: 29/6/2020

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Q1: (a) A slit of width α (alpha) is illuminated by white ligh

. For what value of α ....

Solution:-

At the first minimum, $m = 1$

So,

$a = m\lambda / \sin\theta$

$a(\alpha) = (1)(650\ nm) / (\sin(15))$

$= 2511\ nm \approx 2.51\ \mu m$

Q1 (b)

Q1 (b) What is the wavelength of the light whose first side diffraction maximum is at 15°...

Solution:-

maximum halfway between first / second minimum
so ... m = 1.5 (to reduce errors)

$a \sin\theta = 1.5 \lambda$

Solving for λ

$\lambda = a \sin\theta / 1.5$

$= (2511\ nm)(\sin(15)) / 1.5$

$\lambda = 430\ nm.$

Subject: Q2 (a)

Date:

2) Refraction :-

1) This phenomena usually occurs in lenses.

2) Refraction can be defined as the process of shift of light when it passes through a medium leading to the bending of light.

3) Light entering the medium travels from one medium to another.

4) Light waves passes through surface while simultaneously change from medium to medium

5) The angle of Incidence is not equal to the angle of reflection.

Subject: Q2 (a) Date:

Q2:-(a) Difference between reflection and refraction?

1) Reflection:-

1) Phenomen occurs in mirrors
2) Reflection can be simply defined as the reflection of light when it strikes the medium on a plane.
3) The light entering the medium turns back in the same direction.
4) Considering the light waves, they bounce from the plane and change direction.
5) The angle of incidence of the light is equal to the angle of reflection.

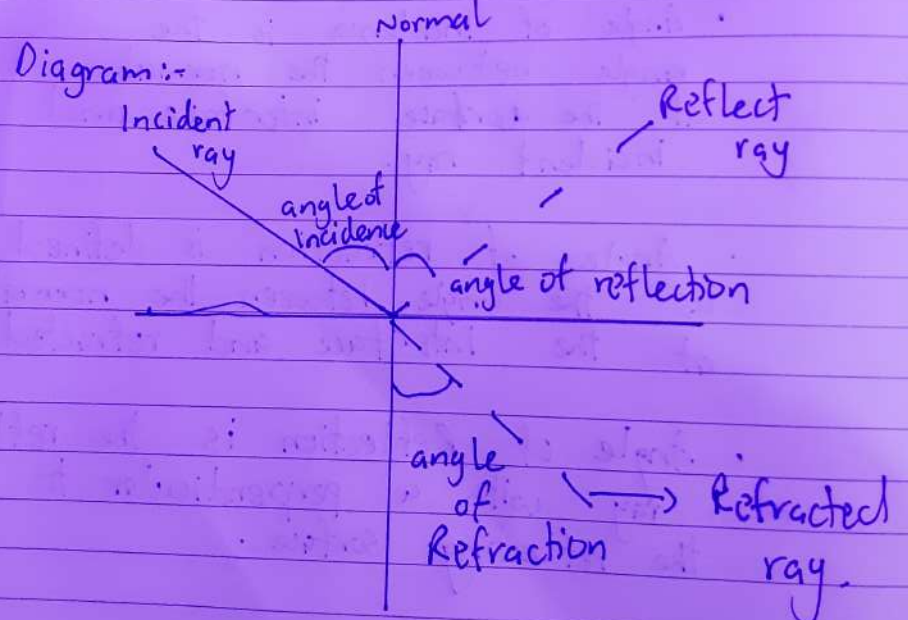
Q2(b)

The relationship between these angles are explained by Snell's law :-

$$n_i \sin(\theta_i) = n_r \sin(\theta_r)$$

where θ_i = angle of Incidence
θ_r = angle of Refraction

Diagram :-



Q2 (b)

Q2 (b) Explain the difference among angle of Incident, reflection and refraction with the help of formula and single diagram.

Ans:-

- Angle of Incidence is the angle between the normal at the ~~surface~~ interface and incident ray.
- Angle of refraction is defined as the angle between the normal at the interface and refracted ray.
- Angle of Reflection is the reflected ray with a perpendicular to the reflecting surface.

Subject: Q3

Date:

Substituting values:-

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

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

magnitude of induced emf =

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

$$\mathcal{E} = 75mV.$$

Q3 :-

(Not going to write the question)

Solution:-

Intial flux through solenoid C is $\Phi_{Bi} = BA_C = \mu_0 i n_s A_C$
$= \pi \mu_0 i n_s r_c^2$

using faraday's law:-

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

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

Q4 (a)

Subject: Date:

Where N is the number of charge carriers in the section of wire of length 'l'.

Now, $N = nV$

n = number of charge carriers per unit volume

V = Volume of wire in the field

Note:

$V = Al$

where

A = Cross-Sectional area of the wire.

Q4 (a)

So ::

$F = (nq\,Avd)\,l\,B\sin\theta$

Because $nq\,Avd = I$

$F = IL\,B\sin\theta$ (equation for magnetic force on a wire).

If we divide both sides of this expression by l, we find that magnetic force per unit length of wire in uniform field is:

$\frac{F}{L} = IB\sin\theta$

(Direction given by RHR).

Subject: Date:

Q 4 (a) How to Calculate the magnetic force on current carrying wire?

Ans:-

So the ~~org~~ magnetic field exerts a force on current carrying wire in a direction given by the "Right hand Rule".

Deriving an experssion for ~~mag~~ magnitude force :

- force on drift velocity (vd) is given by:-

$F = q v_d B \sin\theta$

B = uniform over a length of wire

Total magnetic force on the wire

$\Rightarrow F = (q v_d B \sin\theta)(N)$

Q4(b)

So $\sin 90 = 1$

$$B = \frac{mg}{iL\sin\theta} = \frac{(m/L)g}{i}$$

$$B = \frac{(4.6 \times 10^{-3})(9.8)}{(28A)}$$

$$B = 1.6 \times 10^{-2}\ T.$$

Q5(a)

Subject: Q4(b) Date:

Q4 (b)

i = 28 A

linear density = 46.6 g/m

find magnitude and direction of minimum magnetic field.

magnitude of $\vec{F_B}$ is $F_B = iLB\sin\theta$

Because we want $\vec{F_B}$ to balance. F_g

so we want

$iLB\sin\theta = mg$

Since we want minimal field magnitude for $\vec{F_B}$ to balance F_g

we maximize $\sin\theta$.

By placing θ as 90

Subject: Date:

Q5(a) whereas

- Resistivity is only proportional to the nature and temperature of the particular material

(main differences)

Q5 (b) What is the resistance of the two parallel sides

(i) square ends with dimensions 1.2x1.2cm
(ii) two rectangular sides with dimensions (1.2cm x 15cm)

Solution:-

(1) Ans:- Resistance = $\rho L/S$
where $\rho = 9.6 \times 10^{-8}$

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Q5 (a):- Difference between Resistance and Resistivity?

Definition Difference

- Resistance is the physical property of a substance because of which it opposes the flow of current i.e electrons

whereas

- Resitivity is the physical property of a particular substance which is having particular dimensions.

- Resistance is directly proportional to the length and temperature while it is inversly proportional to the cross-sectional area of the material

Subject: Q5 (b) Date:

(i) Sol:-

cross-sectional area of rectangular block is square.

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

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) Sol:-

cross-sectional area for rectangular block is rectangular.

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

$L = 6\ 1.2cm = 0.012m.$

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

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

All questions Done.