

SECTION-B

SHORT Questions

— (Question: 1) —

ANSWER:

Numerical: 1

Given Data:

$$r = 30 \text{ cm}$$

$$\frac{30}{100} = 0.3 \text{ m}$$

$$q = 3 \mu\text{C}$$

$$= 3 \times 10^{-6} \text{ C}$$

Required:

$$\vec{E} = ?$$

By using formula:

$$\vec{E} = k \frac{q}{r^2}$$

$$\begin{aligned}
 \vec{E} &= \frac{(9 \times 10^9)(3 \times 10^{-6})}{(0.3)^2} \\
 &= \frac{(9 \times 10^9)(3 \times 10^{-6})}{0.09} \\
 &= \frac{27000}{0.09}
 \end{aligned}$$

$$\vec{E} = 300,000 \text{ N/C}$$

— (Question: 2) —

ANSWER:

Show that $E = -\frac{\Delta V}{\Delta r}$

Electrical Potential gradient:

$$\begin{aligned}
 \Delta V &= \frac{W}{q} \\
 &= \frac{Fd}{q} \\
 &= \frac{Ed \cos 180}{q}
 \end{aligned}$$

$$\Delta V = \frac{-Fd}{q}$$

$$E = \frac{F}{q}$$

$$F = Eq$$

Put value of F :

$$\Delta V = \frac{-Eqd}{q}$$

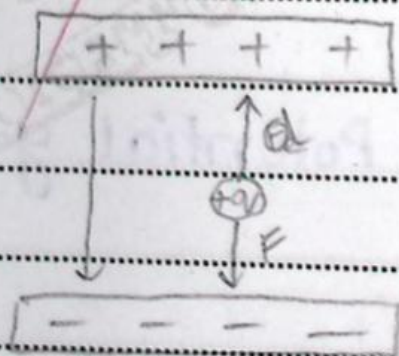
$$\Delta V = -Ed$$

shift d to opposite side:

$$\Delta V = -E \Delta x$$

$$\Delta x$$

$$E = \frac{-\Delta V}{\Delta x} \quad \text{--- (eq.)}$$



Here in above equation negative sign shows that we move charge against the field.

— (Question : 4) —

ANSWER

VOLT :

Volt is the unit of Potential difference.

Potential difference is the amount of workdone required to move charge from Lower potential to higher Potential by keeping charge in electrostatic equilibrium.

$$\Delta V = \frac{W}{q}$$

1 volt is equal to 1 J/C

ELECTRON VOLT :

Electronvolt is the unit of energy at microscopic level.

It is the smaller unit of energy.

We can also say that when we move charge against electric field some amount of energy is stored in charge which is equal to its K.E. When we leave charge this K.E converts to P.E

$$\Delta K.E = q \Delta V$$

$$\Delta P.E = q \Delta V$$

$$1eV = 1.6 \times 10^{-19} J$$

DIFFERENCE :

Electron volts and Volts are two different units of two different Physical Quantities. Volt is unit of

Potential difference electron volt
is unit of energy.

— (Question: 5) —

ANSWER:

Ohm's Law :

Statement :

This

law states that the magnitude of current in a conductor is directly proportional to the magnitude of Applied Voltage provided that Temperature and Physical state of conductor is kept constant.

MATHEMATICAL FORM :

$$I \propto V$$

$$I \propto V$$

$$I = \frac{1}{R} V$$

$\frac{1}{R}$ is reciprocal to resistance and equal to conductance.

$$V = IR$$

Ohmic And non-Ohmic Devices

The

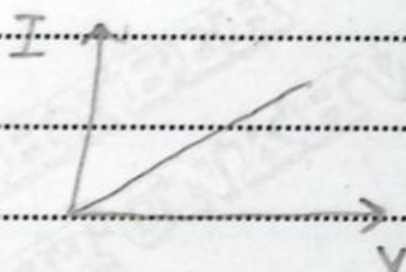
devices which obey ohm's law are ohmic devices and which cannot obey ohm's law are non-ohmic devices.

Metals are conductors and they obey ohm's law because of very very less amount of Resistance. So when

Resistance is less and current is greater. No device is 100% ohmic and Metal obeys ohm law to some extent.

The rest of Diodes, thermistors and filament bulb don't obey ohm law because of greater resistance.

Graph for ohm's law:



— (Question: 7) —

ANSWER:

Statement:

Current carrying coil

behaves like a Bar magnet.

EXPLANATION:

A wire in the form of spring is known as solenoid.

When potential difference attach to solenoid then current flows through the solenoid. When current flow through it around it magnetic field also generates. This magnetic field of Solenoid is in the form of Bar magnet. Inside the solenoid Magnetic field is strong and from $S \rightarrow N$ and outside the solenoid Magnetic field is weak and from $N \rightarrow S$.



we can find $\vec{B}$ in solenoid by using formula:

$$\vec{B} = \mu_0 n I$$

—(Question: 12)—

ANSWER

Statement :

Electron and proton have same de-broglie wavelength, electron has greater speed.

EXPLANATION:

We will use here de-broglie wavelength equation which is:

$$\lambda = \frac{h}{mv} \quad - (eq)$$

So here is the case that wavelength for both electron and proton is same so speed will depend on:

$$v \propto \frac{1}{m} \quad - (eq)$$

As we know that mass of electron is less as compared to mass of proton so electron having less mass will have greater speed and proton having greater mass will have less speed.

— { Question: 13 } —

ANSWER :

PAIR PRODUCTION :

DEFINITION :

Pair Production is the Phenomenon in which highly energetic gamma ray Photon strikes a heavy Nucleus and that photon is converted to particle and Antiparticle. Particle is electron and Antiparticle is Positron.

EXPLANATION :

Electrons and positrons are particle and antiparticles having same magnitude but opposite

signs: (e, e^+)

In this Phenomenon of Pair Production charge, energy and Momentum of Photon is conserved.

Conservation of charge:

$$q_\gamma = q_e + q_{e^+}$$

$$= +1e - 1e$$

$$\boxed{0 = 0}$$

Conservation of Momentum:

$$P = p_e + p_{e^+}$$

$$0 = +mv - mv$$

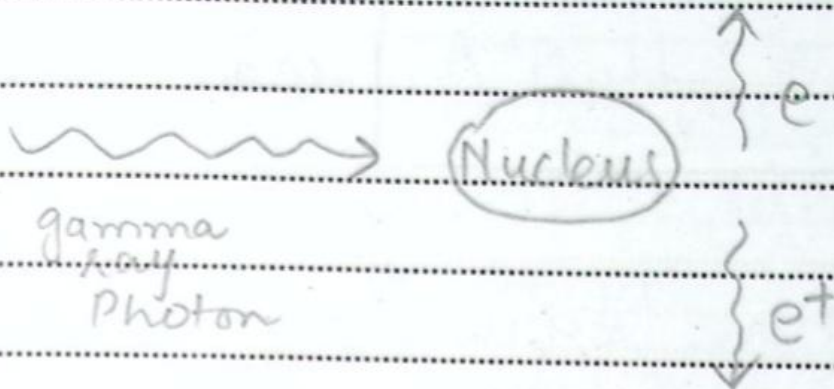
$$\boxed{0 = 0}$$

Conservation of Energy:

$$E = mc^2$$

$$hf = (9.11 \times 10^{-31})(3 \times 10^8)^2$$

$$\boxed{hf = 1.02 \text{ MeV}}$$



—(Question: 6)—

ANSWER:

Statement:

Various factors of inductance.

There are two types of Inductance.

1) Self Inductance.

2) Mutual Inductance.

Factors THAT AFFECT SELF INDUCTANCE:

Factors

that affect Self Inductance are:

$$L = \frac{\mu_0 N^2 A}{l} \quad \text{--- (eq.)}$$

From above equation we can see the dependance of Self Inductance on various factors that are Permeability of Free space, Number of turns, Area and length.

Greater the Number of turns, Area and Permeability of Free space, Greater the self Inductance. Lesser the length, Greater will be the Inductance.

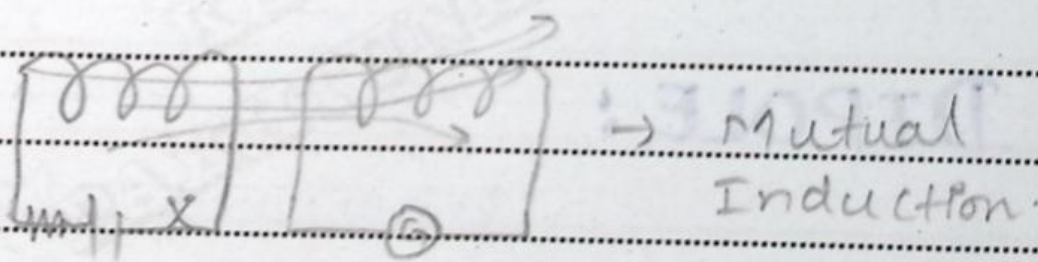
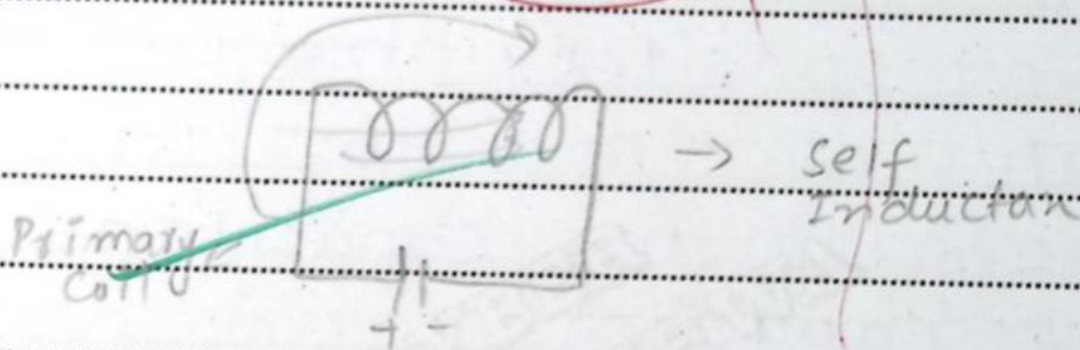
FACTORS THAT AFFECT MUTUAL Inductance:

Factors that affect Mutual Inductance are follows:

$$M = \frac{N_s \Phi_s}{I_p} \quad \text{--- (eq.)}$$



From the equation we can see that Mutual Inductance directly depends on Number of turns of secondary coil and flux change in secondary coil and inversely Proportional to current change in Primary coil.



—(Question: 3)—

ANSWER:

DIELECTRIC:

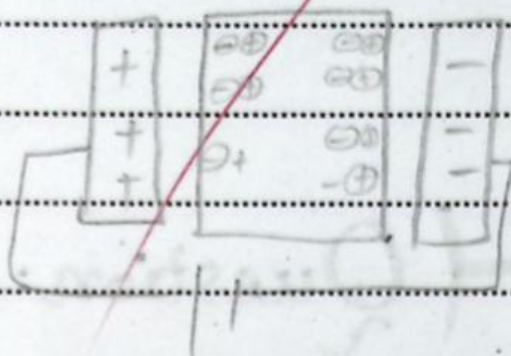
Dielectric is an insulator material which is placed between two oppositely charged plates of capacitors to increase the capacitance of capacitor.

DIPOLE:

When we place an insulator medium between plates of capacitors then positive plates attract -ve charges from medium placed between plates and negative plate of capacitor attract



the charges from medium placed.
Then Dipole is created.



DIPOLE MOMENT:

When

Dipole is created then automatically Dipole moment also forms. Dipole moment is a Vector Quantity.

Dipole moment is from +ve to -ve.

$$\vec{P} = q \cdot d$$

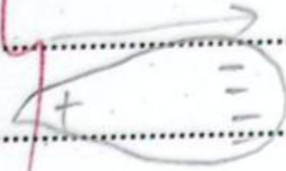
POLARIZATION:

Polarization

is Phenomenon in which

any Neutral atom is polarized means its electron cloud goes to one side and +ve charges

to another side. That undergo
Polarization is polarized.



{ Question: 8 }

ANSWER:

Statement:

Frequency affect
the reactance of Inductor
and capacitor.

REACTANCE OF INDUCTOR:

Reactance
of inductor depends on:

$$X_L = 2\pi f$$

By doubling the frequency
the reactance of inductor
Doubles.



Reactance of Capacitor:

$$X_C = \frac{1}{2\pi f}$$

By doubling the frequency
the reactance of capacitor
half.

— (SECTION: C) —

LONG Questions.

— (Question: 1) —

ANSWER:

— (Part (a)) —

AC GENERATOR :

The device which converts Mechanical energy to electrical energy is called AC generator.

CONSTRUCTION :

AC generator consist of :
North and south poles of magnets , a coil wound by many turns of wire ,
Slip rings and carbon Brushes attach to slip rings.

WORKING :

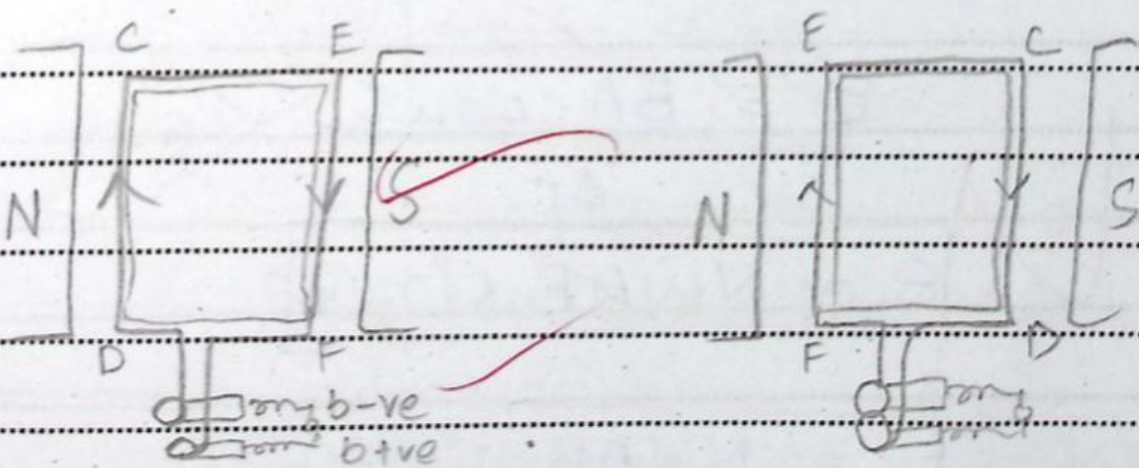
When magnetic field is from North to south poles of magnetic , we apply

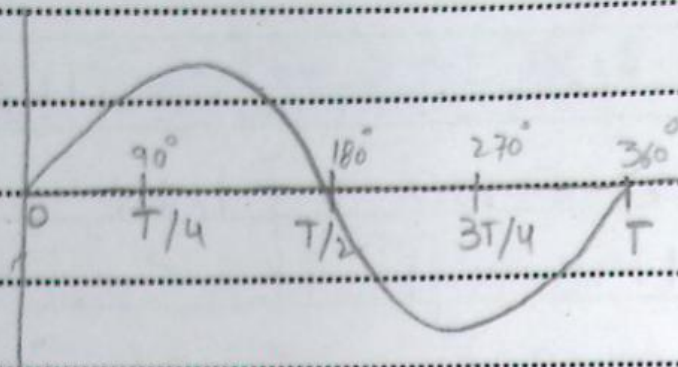


Mechanical force on coil then coil turns and flux change through it, when flux changes, emf is Induced in coil which Induces current.

AC Generator act as a Battery - Because it provides electrical energy.

Here in AC generator polarity is changed at one point i-e at 180° .





MATHEMATICAL:

$$\epsilon = \frac{\Delta \phi}{\Delta t} \quad \text{--- (eq.)}$$

$$\begin{aligned} \Delta \phi &= BA \cos \omega t \\ &= BA \cos \omega t \quad \text{--- (i)} \end{aligned}$$

Put value of (i) in (eq.)

$$\epsilon = \frac{BA \cos \omega t}{\Delta t}$$

$$\epsilon = NWAB \sin \omega t$$

$$\epsilon = NWAB \sin 90^\circ$$

$$\epsilon_{\max} = NWAB$$

$$\epsilon = \epsilon_{\max} \sin \omega t$$

Board Of Intermediate & Secondary Education Khyber Pakhtunkhwa
CONTINUATION SHEET



Fic. No.

1074

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(Part : (b))

Numerical:

Given Data :-

'cur current $I = 0-5$

$$\Delta I = 0-5$$
$$= -5$$

$$\frac{\Delta I}{\Delta t} = \frac{-5}{0.1}$$

$$\frac{\Delta I}{\Delta t} = -50$$

$$\mathcal{E} = 2.00 \text{ V}$$

$$\mathcal{E} \propto \frac{\Delta I}{\Delta t}$$

Required:

$$L = ?$$

$$L = \frac{\mathcal{E}}{\frac{\Delta I}{\Delta t}}$$

Using formula,

$$L = \frac{\mathcal{E}}{\frac{\Delta I}{\Delta t}}$$



$$L = \frac{\epsilon}{\Delta I / \Delta t}$$

$$= \frac{200}{0.5}$$

$$= 200 \times 0.1$$

$$= \frac{20}{-5}$$

$$L = -4 \text{ Henry}$$

(Question: 2)

-(Part (a))-

ANSWER:

BOHR'S POSTULATES OF
HYDROGEN ATOM:



Following are postulates of Hydrogen atom.

Electrons are revolving around the Nucleus in shells, orbits or energy levels.

The necessary centripetal force is provided by coulombic force.

$$F_c = F_e$$

$$\frac{mv^2}{r} = \frac{ke^2}{r^2}$$

$$mv^2 = \frac{ke^2}{r}$$

Electrons are revolving in quantized orbits whose angular momentum is integral multiple of

$$\frac{nh}{2\pi}$$

$$mvr = \frac{nh}{2\pi}$$



(iii) Electron in shells does not change its position as far as they absorb or emit energy.

They absorb energy. They go to higher state. They emit energy and return to ground state.

$$E = E_n - E_p$$

Radii of electron orbit:

$$\frac{mv^2}{r} = \frac{ke^2}{r^2}$$

$$mv^2 = \frac{ke^2}{r} \quad \text{--- (eq) (i)}$$

$$mvr = \frac{nh}{2\pi}$$

$$v = \frac{nh}{2\pi rm} \quad \text{--- (ii)}$$

Put value of eq(2) in eq(1)

$$mv^2 = \frac{ke^2}{\lambda}$$

$$m \left(\frac{nh}{2\pi\lambda m} \right)^2 = \frac{ke^2}{\lambda}$$

$$\cancel{m} \left(\frac{n^2 \cancel{h^2}}{4\pi^2 \cancel{h^2} m^2} \right) = \frac{ke^2}{\lambda}$$

$$\lambda = \frac{n^2 h^2}{4\pi^2 ke^2 m}$$

$$\lambda = \frac{\cancel{n^2} h^2}{4\pi^2 ke^2 m}$$

$$\boxed{\lambda = n^2 \lambda_0}$$

$$\lambda_0 = 0.53 \text{ \AA}$$

$$\lambda_0 = 0.53 \times 10^{-10} \text{ m}$$



- Part (b) -

Numerical:

Given Data:

$$n = 4$$

Required ✓

$$\lambda = ?$$

using formula:

7

6

$$\lambda = \frac{h}{mv}$$

$$\lambda = \frac{h}{nh}$$

$$\lambda = \frac{h}{mv}$$

$$= \frac{h}{nh}$$

$$= \frac{h \cdot 2\pi n}{nh}$$

$$= \frac{h \cdot 2\pi n}{nh}$$

$$= \frac{2\pi h}{n}$$

$$\lambda = \frac{h \cdot 2\pi n}{nh}$$

$$\lambda = \frac{2\pi h}{n}$$

$$\lambda = \frac{2 (3.14) (0.53 \times 10^{-10}) (4)}{(4)}$$



$$= (6.28)(2.12 \times 10^{-10})$$

$$\lambda = \frac{4}{8.321 \times 10^{-11}} \text{ nm}$$

—(Question: 6)—

—(Part - b)—

WHEATSTONE BRIDGE:

A

device which is used to find unknown resistance is known as wheat stone Bridge.

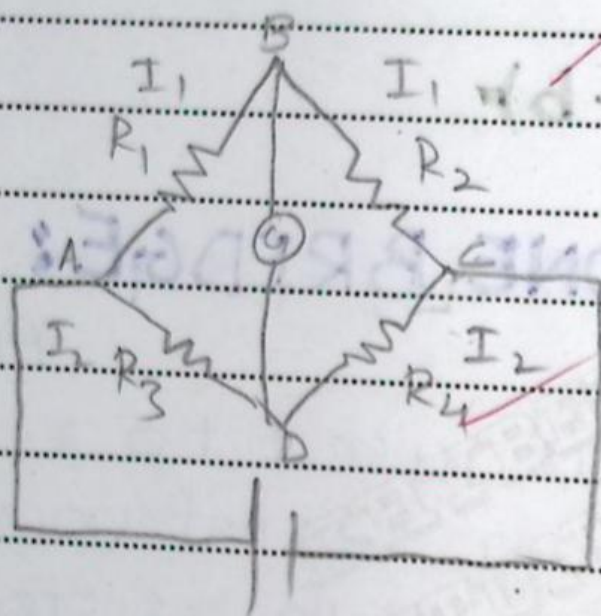
EXPLANATION:

wheat

stone Bridge consist of four resistances, R_1 and R_2 and fixed known resistance. R_3 is variable



known resistance. R_4 is unknown
Resistance. Wheat stone
Bridge will be functional
when it is Balanced.
Mean $I_g = 0$



$$V_{AB} = I_1 R_1$$

$$V_{BC} = I_1 R_2$$

$$V_{AD} = I_2 R_3$$

$$V_{CD} = I_2 R_4$$

$$\frac{I_1 R_1}{I_1 R_2} = \frac{I_2 R_3}{I_2 R_4}$$



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$$\frac{R_1}{R_2} = \frac{R_3}{R_4}$$

$$R_4 = \frac{R_3 \times R_2}{R_1}$$

- Part - (a) -

CAPACITANCE OF PARALLEL

PLATE CAPACITOR :

Capacitance
of Parallel plate capacitor
is:

$$Q \propto V$$

$$Q = CV$$

$$C = \frac{Q}{V}$$



Capacitance of Parallel plate capacitor does not depends on charge and voltage.

$$E = \frac{V}{d}$$

$$\frac{Q}{A\epsilon_0} = \frac{V}{d}$$

$$\frac{Q}{V} = \frac{A\epsilon_0}{d}$$

$$C_{vac} = \frac{A\epsilon_0}{d}$$

$$C_{med} = \frac{A\epsilon_0\epsilon_r}{d}$$

