Section B

Question no: 02

(i)

Answer:

Given Data:

charge $= q = 3\times10^{-6}C$ $\quad k = 9\times10^9$

Distance $= r = 30cm = 30\times10^{-2}m$.

Required:

Electric field $= E = ?$

Formula used:

$$E = \frac{kq}{r^2}$$

Solution:

Putting values in eq-①

$$E = \frac{kq}{r^2}$$

$$E = 9\times10^{9} \times \frac{3\times10^{-6}}{(30\times10^{-2})^{2}}$$

$$= \frac{9\times10^{9}\times3\times10^{-6}}{900\times10^{-4}}$$

$$= \frac{27\times10^{3}}{900\times10^{-4}}$$

$$= \frac{\overset{3}{\cancel{27}}\times10^{3}}{\underset{1}{\cancel{9}}\times10^{-2}}$$

$$\boxed{E = 3\times10^{5}\,N/C}$$

Answer:

Thus the answer is

QUESTION NO: X

ANSWER:

Coercive force of steel is greater than that of iron.

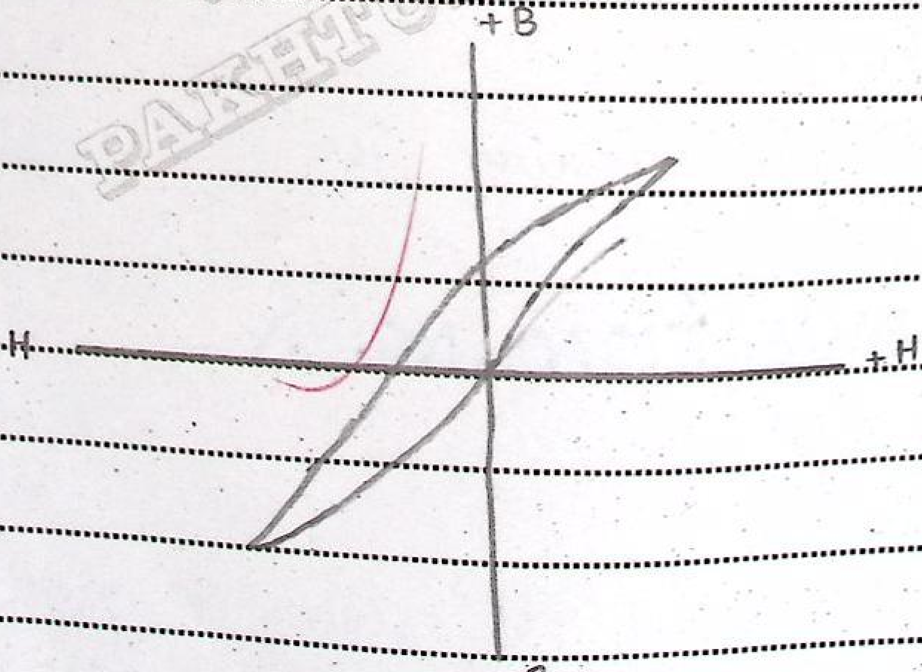
Reason And Explanation:

As we know that coercive force is the one that is required to demagnetize a magnetized material.

Steel:

In case of steel all the domains are magnetized and is a strong magnetized material. Thus for its demagnetization we need greater. Also it has greater hystersis loop thus will require greater force to demagnetize a strong magnetized material.

Diagram:

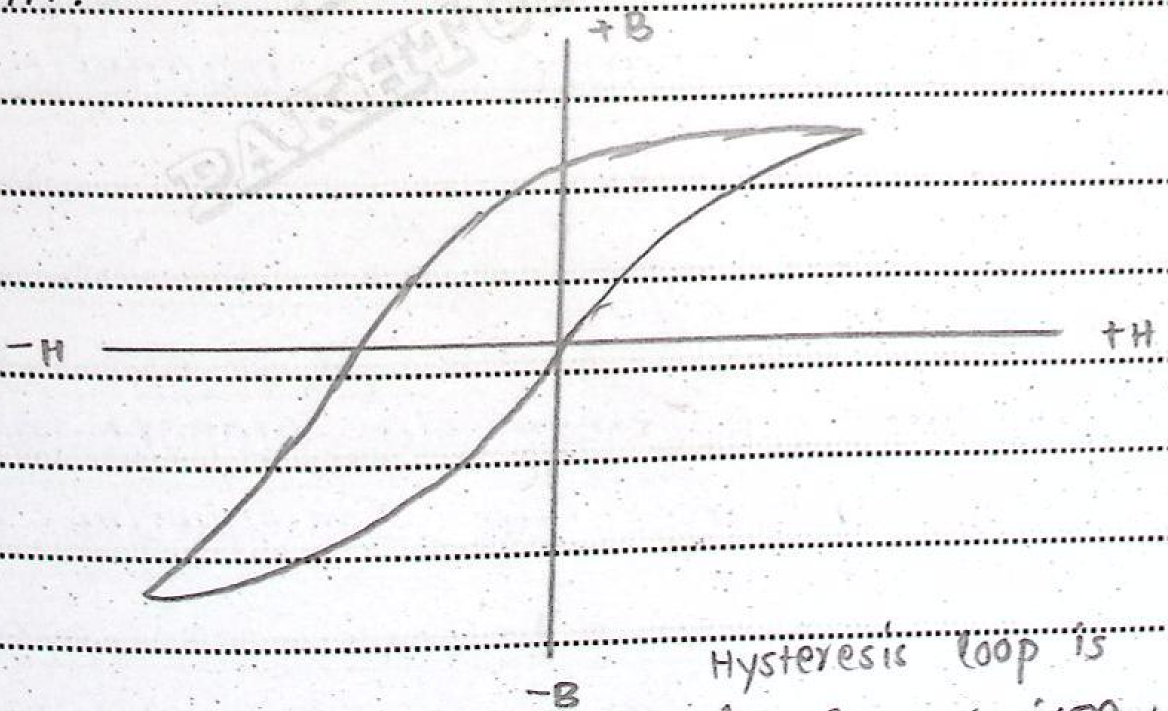


Hysteresis loop is small for steel

Iron:

Now in case of iron, as we know that iron is a paramagnetic substance and is not magnetized permanantly but temporarily for a small time and it can be demagnetized easily b/c it's all atoms are not oriented in the applied magnetic field thus it is easy for iron to be demagnetized. Also its hysteresis loop is small which means it requires less energy for demagnetization.

Diagram:



Hysteresis loop is large for iron.

(vi)

ANSWER:

FACTORS AFFECTING INDUCTANCE

As we know that there are various factors that affect inductance. Some of which are given below:

Factor 1:

Inductance is directly proportional to number of turns in a coil.

Factor 2:

Inductance is diretly proportional to the rate of change of magnetic flux.

Factor 3:

Inductance is inversely proportional to the distance b/w consequetive loops of the coil.

Factor 4:

Inductance is directly proportional to the permeability of medium b/w the coil.

(vii)

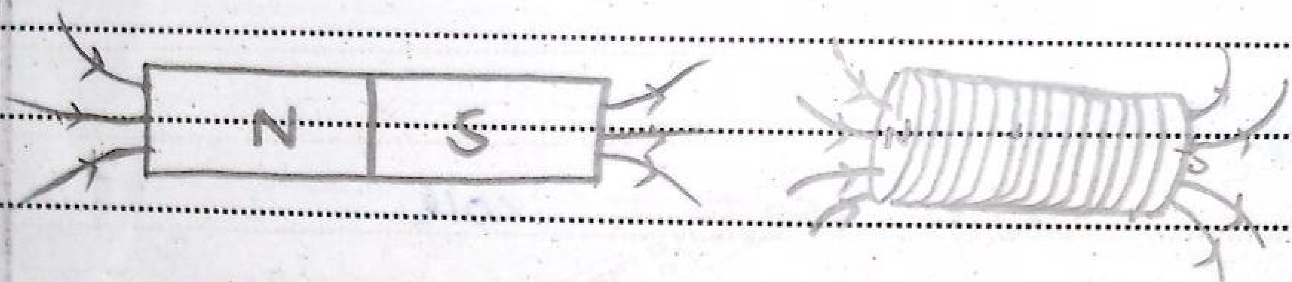
ANSWER:

A current carrying coil behaves like a bar magnet.

Explanation:

Consider a coil as shown in the figure. As current flows through it magnetic dipoles are created in the coil. At one direction, all the north poles are directed inwards and at the other side all the south poles are directed outwards. And this is made much more clear by the observation, if we let a current carrying coil in open atmosphere unoriented in proper direction, it will automatically orient itself in accordance with the earth magnetic dipoles i.e. North pole of the coil orient in the direction of south pole of the earth and south pole of the coil will orient itself in the direction of north pole of the earth.

Diagram:



Conclusion:

Thus in this way a current carrying coil behaves like a bar magnet.

(viii)

ANSWER:-

As we know that the reactance of an inductor and a capacitor are both affected by a change in frequency.

(i) As in case of inductive reactance:
The inductive reactance is given by

$$X_L = 2\pi f L$$

By doubling the frequency the net reactance is;

$$X_L' = 2\pi f' L = 2\pi(2f)L$$

since $f' = 2f$

$$X'_L = 2(2\pi f L) = 2X_L$$

So by doubling the frequency f, inductive reactance is also doubled.

(ii) In case of capacitive reactance
Capacitive reactance is given by

$$X_c = \frac{1}{2\pi f C}$$

Now by doubling frequency:

$$f' = 2f$$

$$X'_c = \frac{1}{2\pi f' C}$$

$$X'_c = \frac{1}{2\pi (2f) C}$$

$$X'_c = \frac{1}{4\pi f C}$$

$$X'_c = \frac{1}{2\pi f C}\left(\frac{1}{2}\right)$$

Thus It is concluded that capacitive reactance become half by doubling frequency.

Conclusion:

Thus concluded that by doubling frequency the inductive reactance increases by a factor of 2 while capacitance reactance decreases by a factor of

2 by doubling frequency.

(ix)

ANSWER:

Soft Magnetic Materials:

Soft magnetic materials are those materials which has a smaller area enclosed by itis hysteresis loop.

They have low ramnent magnetization.

They have low coercivity.

They have low initial permeability.

Hystersis loss is small.

Eddy current loss is small.

Area of hystersis loop is small

Hard Magnetic Materials:

Hard magnetic materials are those which has a larger area enclosed by itis hysteresis loop.

They have high ramnent magnetization.

They have high coercivity.

They have high initial permeability.
Hysteresis loss is high.
Eddy current loss is also high.
Area of hysteresis loop is large.

xi

Answer:

As we know that current gain is

$$\beta = \frac{I_C}{I_B}$$

Since $I_B = I_E - I_C$

$$\beta = \frac{I_C}{I_E - I_C}$$

$$\beta = \frac{I_C / I_E}{\frac{I_E - I_C}{I_E}}$$

$\because$ Since $\alpha = \frac{I_C}{I_E}$

$$\beta = \frac{\alpha}{1 - \frac{I_C}{I_E}}$$

$$\beta = \frac{\alpha}{1-\alpha}$$ Hence

(ii)

ANSWER:

As we know that

workdone on a test charge = Force x displacement

$$\Delta W = F \Delta r \quad \text{——} \ (1)$$

In an electric field, the force is equal to the charge times the field strength.

$$F = q_0 E \quad \text{——} \ (2)$$

Thus putting eq (2) in (1)

$$\Delta W = q_0 E \times \Delta r$$

As $E \Delta r = \Delta V$:- $E \Delta r = \Delta V$

thus

$$\Delta W = -q_0 \Delta V$$

The -ive sign is applied b/c the workdone on q_0 is against the force $q_0 E$, so

$$\cancel{q_0} \Delta V = -E \cancel{q_0} \Delta r$$

$$\Delta V = -E \Delta r$$

thus

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

The strength of field is equal to the potential gradient.

(v)

ANSWER:

OHM'S LAW:

Statement:

"The electric current passing through a conductor is directly proportional to the potential difference b/w the ends of conductor, if physical condition of the conductor remains constant.

(i) Ohmic conductors:

A conductor whose I-V graph is a straight line is called ohmic conductor.

This means that the conductors obey

ohm's law.

The slope of the line is given by;

$$\tan\theta = I/V = 1/R.$$

As R is constant,
hence the slope is
constant for ohmic
conductors as shown
in the figure.

exps:

Metallic conductor.

Non ohmic Conductors:

conductors whose I-V graph is not a straight line are called non ohmic conductors. as shown in the figure.

As R is not constt
thus the slope is
not constt for non-
ohmic conductors.

exp: bulb filament,

thermister.

(xii)

ANSWER:

De-Broglie's wavelength can be written as:

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

$$v = \frac{h}{m\lambda}$$

As given that the wavelenth of proton and electron is the same so we can write the above eqn as:

$$v \propto \frac{1}{m}$$

From last expression, it can be concluded that particle with smaller mass will move with higher velocity. As mass of electron is lesser (1836 times) than that of proton, thus electron will move with higher velocity than proton.

Thus we can conclude that speed of electron is greater than speed of proton provided that both particles have same De-Broglie's wavelength.

S-C

Question no: 06

Part (a)

CAPACITENCE OF PARALLEL PLATE CAPACITOR:

Let us consider that the charge on the plates of a parallel plate capacitor is $+Q$ as shown in the figure. Then the electric field strength b/w plates is

$$E = \frac{V}{d} \quad \text{——} (1)$$

Where V is the P.D b/w the plates and d is the separation b/w the plates.

By using Gauss's law the electric field strength b/w the plates of capacitor is

$$E = \frac{\sigma}{\varepsilon_0}$$

where $\sigma = \frac{Q}{A}$

Hence $E = \frac{Q}{\varepsilon_0 A}$ —— ②

From eq. ① & ②

$$\frac{V}{d} = \frac{Q}{\varepsilon_0 A}$$

$$Q = \frac{\varepsilon_0 V A}{d} \text{ —— ③}$$

since; $C_{vac} = \frac{Q}{V}$ —— ④

Putting eq 3 in 4

$$C_{vac} = \frac{\varepsilon_0 A}{d}$$

The above eqn shows the dependance of capacitor upon.

(i) Area of plates

(ii) The separation b/w plates

(iii) Medium b/w them.

(b)

Wheatstone Bridge:

Wheatstone bridge is one of the widely used instrument by measuring electrical resistance. It consists of a battery, a galvanometer and a network of four resistances. Ordinarily, resistances R_1, R_2 are fixed and R_3 is a variable resistance. R_4 is an unknown resistance and to be determined. The network consists of two parallel branches ABC and ADC. The galvanometer is fixed b/w the junction

As the keys k_1 & k_2 are closed, current starts to flow and divided b/w the two branches unequally. By adjusting current the deflection of the galvanometer is made zero as shown by zero deflection. This bridge is said to be balanced then. that is the point B & D are at the same potential as that from

C and D. Similarly the P.D b/w C & D is equal to that of A and B.

For the balanced bridge the current through R_1 & R_2 be I_1 and through R_3 and R_4 be I_2.

Since the fall of potential at AB is equal to Potential drop at CD.

$$R_1 I_1 = R_3 I_2$$

similarly.

$$R_2 I_1 = R_4 I_2$$

Dividing both eqn we get,

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

Hence if the resistances are known then we can find the unknown resistance. This is the principal of finding unknown resistance by wheatstone bridge.

Thus we can find the R_4 i.e the unknown resistance.

Diagram:

Question no: 04

Part (b)

Given Data:

Excited $n=4$ state of $\bar{e} = n_2 = 4$

Ground state of $\bar{e} = n_1 = 1$

Required:

wavelength $= \lambda_4 = ?$

Formula used:

$$\lambda_n = \frac{h}{mV_n} \quad \text{——} \; (A)$$

$$V_n = \frac{V_0}{n} = \frac{2.19 \times 10^6}{n}$$

Solution:

By putting values in the above eqn.

put $n=4$

$$V_4 = \frac{2.19 \times 10^6}{4}$$

$$V_4 = 0.54 \times 10^6 \, m/s.$$

B

Put in (A)

$$\lambda_4 = \frac{h}{mV_4}$$

$$\lambda_4 = \frac{6.63 \times 10^{-3}}{9.11 \times 10^{-3} \times 0.54 \times 10^6} = \boxed{1.34 nm}$$

Part (a)

Bohr's Postulates about Hydrogen Atom:

1. Electrons of an atom revolve in a fixed orbit around the nucleus called shells or orbits. They are named as K, L, M, N, ...

2. As long as electrons are in its shell they neither absorb nor radiate energy i.e. energy of the shell is constant.

3. When ever electron jump from lower to higher energy orbit it absorbs energy. And when electrons jump from higher to lower energy orbit they radiate energy.

4. Electrons absorb energy only of specific amount. i.e absorb energy equal to that of difference of energy b/w two consequetive energy levels.

$$\Delta E = E_2 - E_1$$

Electrons revolves in orbits having momentum equal to integral multiple of $nh/2\pi$

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

Electron only radiate energy of specific frequency to jump from one orbit to another.

$$hf = E_2 - E_1$$

Expression of electron orbit radii

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

$$v = \frac{nh}{2\pi m r_n}$$

Also for electron:

$$F_c = F_{coul}$$

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

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

Board Of Intermediate & Secondary Education Khyber Pakhtunkhwa

CONTINUATION SHEET

Fic. No. 541

(صرف بورڈ کے استعمال کیلئے) اُمیدوار یہاں کچھ نہ لکھیں

$m(nh/2\pi mr)^2 = ke^2/r$

$m \times n^2h^2/4\pi m^2 r^2 = ke^2/r$

$n^2h^2/4\pi mr = ke^2$

$r = \dfrac{n^2h^2}{4\pi^2 mke^2}$

$r_1 = \dfrac{h^2}{4\pi^2 mke^2}$

$r_n = n^2 r_1$

By putting values: we get

$r_1 = 0.53 \times 10^{-10} m$

$r_1 = 0.53 A^\circ.$

$r_n = n^2 \times 0.53 A^\circ.$

Question no: 5
(D)

(a) It is often convenien, in nuclear physics to express certain masses in energy unit.

Acc to Einstien mass energy relation

$E = mc^2$

Hence 1 energy unit u =

$1u = 1.66 \times 10^{-27} kg \times (3 \times 10^8 m/s)^2$

$1u = 1.4924 \times 10^{-10} J$

Since $1ev = 1.6 \times 10^{-19} J$, so;

$1u = 1.4924 \times 10^{-10} / 1.6 \times 10^{-19} ev$

$1u = 9.315 \times 10^8 ev = 931.5 MeV.$

(b) If mass is 1u then ~~energy~~ mass =

$m = \frac{E}{c^2}$

$\frac{931.5 \times 10^6 ev}{(3 \times 10^8)^2}$

$= \frac{931 \times 10^6 eV}{9 \times 10^{16}} = \frac{931 \times 10^6 \times 1.67 \times 10^{-19}}{9 \times 10^{16}}$

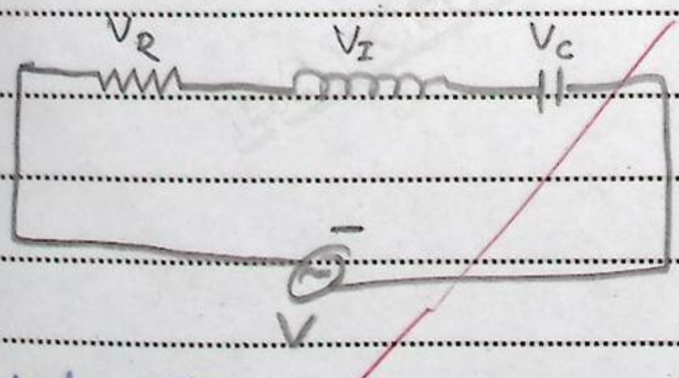
thus $m =$

1.66×10^{-27} kg.

(a)

RLC AC series circuit.

many circuits used in practical electronics involves resistors, inductors & capacitors. In the figure is a RLC series circuit Which is excited by is sin ac voltage source of angular ferequency w. In practice, R may be the R of inductor. we would like to find impedence of the circuit, as



a whole. the rms current that flows & the phase diff b/w source voltage & current.
First we note that the curr