

AFBBS

Kartar

FIRST TERM (2015-2016)

BB

CLASS XII

S

SUBJECT : PHYSICS

Time : 3 Hours

M.M. : 70

SECTION-A

(1×5=5)

- Q. 1. A point charge $+Q$ is placed in the vicinity of a conducting surface. Trace the field lines between the charge and the conducting surface.
- Q. 2. Define the term 'mobility' of charge carriers. Write its SI unit.
- Q. 3. Power factor of an AC circuit is 0.5. What is the phase difference between voltage and current in this circuit.
- Q. 4. Two wires of equal length are bent in the form of two loops. One of the loops is square shaped whereas the other loop is circular. These are suspended in a uniform magnetic field and the same current passed through them. Which loop will experience greater torque?
- Q. 5. Why does a paramagnetic material display greater magnetisation (for the same magnetising field) when cooled?

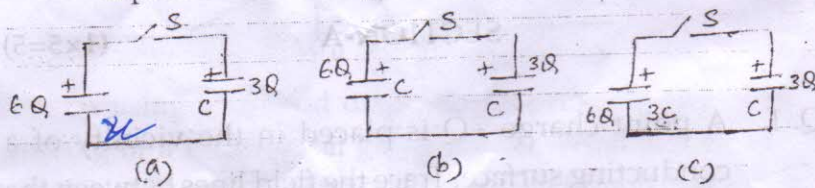
Cold

VS
V/W

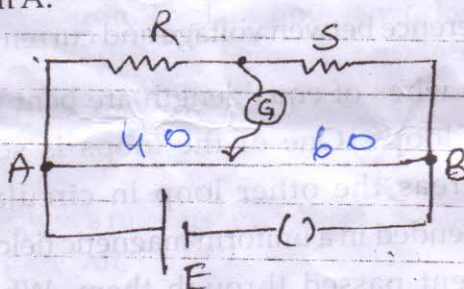
SECTION-B

(2×5=10)

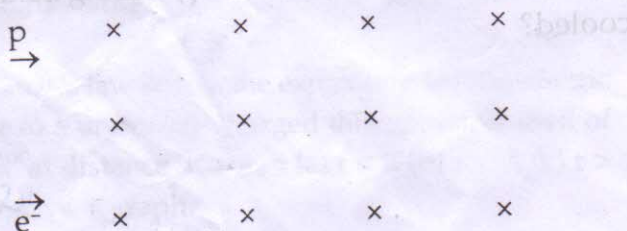
Q. 6. After the switch has been closed, in which circuit will the charge on the left hand capacitor: (i) increase, (ii) remain same. Give reason Initially both capacitors are charged.



Q. 7. In a meter bridge shown in the figure, the balance point is found to be 40 cm from A. Calculate the value of R and S, if on connecting a resistance of 10Ω in series with R, balance point is obtained to be at 60 cm from A.



Q. 8. An electron and a proton enter a region of uniform magnetic field B with same speed 'v', in a perpendicular direction.



- (a) Show the trajectories followed by two particles.
- (b) What is the ratio of the radii of circular paths of electron to proton?
- Q. 9. (a) If x stands for the magnetic susceptibility of a given material, identify the type of material for which (i) $-1 \geq x < 0$, (ii) $0 < x < \epsilon$ (ϵ is a small positive number). Write the range of relative magnetic permeability of these materials.
- (b) Draw the pattern of the magnetic field lines when these materials are placed on an strong magnetic field.

Q. 10. State Lenz Law. Prove that the charge induced is independent of time.

OR

A metallic rod of length 'L' rotates with an angular speed 'w' in a uniform magnetic field 'B'. Find the emf developed between the two ends of the rod. The field is perpendicular to the motion of the rod.

SECTION-C (12×3=36)

Q. 11. How are electromagnetic wave produced? What is the source of energy of these waves?

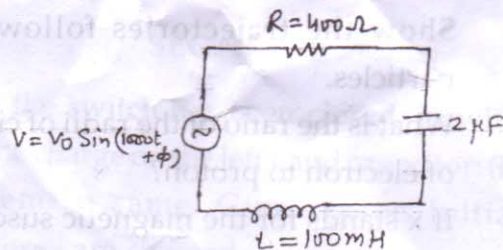
Draw a schematic sketch of the electromagnetic wave propagating along the +x axis. Indicate the direction of the electric and magnetic field. Write the relation between the velocity of propagation and the magnitude of electric and magnetic field?

XII/Physics

$$\frac{m \omega^2 r^3}{2} = \frac{1}{2} q v \times b$$

P.T.O.

Q. 12.

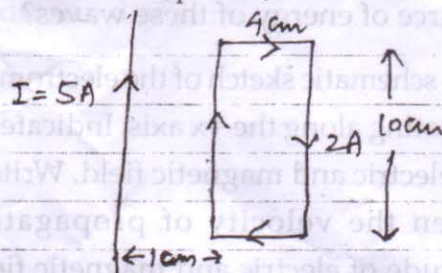


- (a) Find the phase difference between current and voltage. $\pi/4$
- (b) Calculate the value of additional capacitor which may be joined suitably to the capacitor C that would make the power factor of the circuit unity. $20 \mu F$

Q. 13. Define self inductance. Write its SI unit. Derive an expression for self inductance of a long Solenoid of length 'l', cross sectional area 'A' having 'N' number of turns.

Q. 14. Name and define the magnetic elements of earth's magnetic field at a place. Derive an expression for the angle of dip in terms of the horizontal component and the resultant magnetic field of the earth at a given place.

Q. 15. A rectangular loop of wire of size 4 cm \times 10 cm carries a steady current of 2A. A straight long wire carrying 5A current is kept near the loop as shown. If the loop and the wire are coplanar, find:



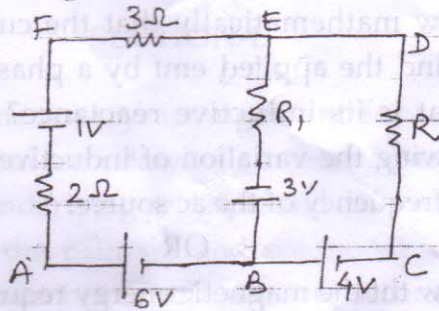
XII/Physics

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$$\frac{\mu_0 I}{2\pi a}$$

- (i) the torque acting on the loop
 (ii) the magnitude and direction of force on the loop due to the straight current carrying wire.

Q. 16. Use Kirchhoff's rule to determine the potential difference between the points A and D when no current flows in the arm BE of the electric network as shown in fig.



- Q. 17. Define relaxation time of the free electrons drifting in a conductor. How is it related to the drift velocity of free electron? Use this relation to deduce the expression for the electrical resistivity of the material.
- Q. 18. What is an equipotential surface? Give an example. show that the equipotential surfaces are closed together in the regions of strong field and far apart in the region of weak field.
- Q. 19. Define electric potential at a point. Write its SI unit. Derive an expression for the potential energy of two point charges q_1 and q_2 separated by a distance r_{12} in an electric field \vec{E} .
- Q. 20. Name the parts of the electromagnetic spectrum which is:

- (a) Suitable for radar systems used in aircraft navigation.

Radio

XII/Physics

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$$\frac{qE}{v}$$

$$ud = \frac{eEt}{m} \text{ P.T.O.}$$

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

$$u \propto \frac{1}{r^2}$$

(b) used to treat muscular pain

X-Ray

(c) used as a diagnostic tool in medicine.

Carom

Write in brief how these wave can be produced.

Q. 21. Using Ampere's circuital law, derive an expression for the magnetic field along the axis of a toroidal solenoid.

Q. 22. A pure inductor is connected across an a.c. source. Show mathematically that the current in it lags behind the applied emf by a phase angle of $\pi/2$. What is its inductive reactance? Draw a graph showing the variation of inductive reactance with the frequency of the ac source.

OR

Show that the magnetic energy required to build up the current I_0 in a coil of self inductance L is $\frac{1}{2}LI_0^2$. Define Wattless current and prove that an ideal inductor does not dissipate power in an ac circuit.

SECTION-D

(1×4=4)

Q. 23. Ram is in the habit of charging his mobile and then leaving the charger connected through the mains with the switch on. When his sister Asha pointed it out to him, he replied there was no harm as the mobile had been disconnected. Asha then explained to him and convinced him. How the energy was still being wasted as the charger was continuously consuming energy.

Answer the following questions:

(a) What values did Asha display in convincing her brother?

- (b) What measures, in your view, should be adopted to minimize the wastage of electric energy in your household?
- (c) Imagine an electric appliance of $2W$, left connected to the mains for 20 hours. Estimate the amount of electrical energy wasted.

$$I = \frac{V^2 T}{R}$$

$$I = \frac{V^2}{R}$$

SECTION-E

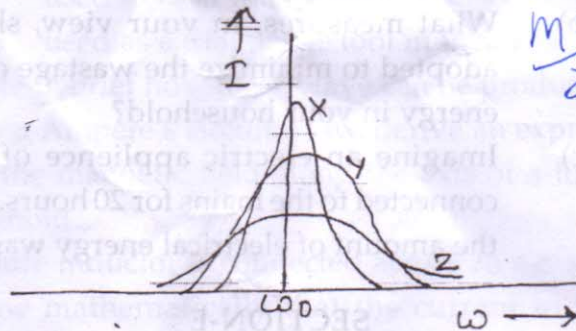
(3×5=15)

Q. 24 Draw a necessary arrangement for winding of primary and secondary coils in a step up transformer. State its underlying principle and derive the relation between the primary and secondary voltages in terms of number of primary and secondary turns. Mention the two basic assumptions used in obtaining the above relation, state any two causes of energy loss in actual transformer.

OR

Three students X, Y and Z performed an experiment for studying the variation of alternating currents with angular frequency in a series LCR circuit and obtained the graphs shown below. They all used a.c. sources of the same rms value and inductances of same value.

- (a) What is ω_0 .
- (b) What can we conclude about the (i) capacitance values, (ii) resistance values.
- (c) In which case will the quality factor be maximum?
- (d) What can we conclude about nature of the impedance of the setup at frequency ω_0 ?



Q. 25. Explain using a labelled diagram, the principle and working of a moving coil galvanometer. What is the function of (i) uniform radial magnetic field (ii) soft iron core? Define the terms (i) current sensitivity, (ii) voltage sensitivity of galvanometer. Why does increasing the current sensitivity not necessarily increase voltage sensitivity?

OR

With the help of a labelled diagram, state the underlying principle of a cyclotron. Explain how it works to accelerate the charge particle. Show that cyclotron frequency is independent of energy of the particle. Is there an upper limit of the energy acquired by the particle? Give reason.

Q. 26. (a) State Kirchhoff's rules and explain on what basis they are justified?

(b) Two cells of emf E_1 and E_2 and internal resistances r_1 and r_2 are connected in parallel. Derive the expression for the (i) emf (ii) internal resistance of a single equivalent cell which can replace this combination.

OR

Using Gauss's law obtain the expression for the electric field due to a uniformly charged thin spherical shell of radius ' R ' at distance ' r ' when (a) $r < R$ (b) $r = R$, (c) $r > R$. Draw E vs. r graph.