Mukul Dahiya
XII - B

AMITY, PV

First Terminal Examination 2016 - 2017

Class – XII

Subject – Physics

Time : 3 Hours **Max. Marks : 70**

General Instructions :

1. All questions are compulsory.
2. There are 26 questions in total.
3. Questions 1 to 5 are very short answer type questions and carry 1 mark each.
4. Questions 6 to 10 are also very short answer type questions carrying 2 marks each.
5. Questions 11 to 22 are short answer type questions carrying 3 marks each.
6. Question 23 is value based question carrying 4 marks.
7. Questions 24 to 26 are long answer type questions carrying 5 marks each.
8. Use of calculators is not permitted. However, you may use log table if necessary.
9. You may use the following values of physical constants wherever necessary :

$c = 3 \times 10^8$ m/s	Boltzmann constant $k = 1.38 \times 10^{-23}$ Jk
$h = 6.63 \times 10^{-34}$ Js	Avogadro's number $N_A = 6.023 \times 10^{23}$ / mole
$e = 1.6 \times 10^{-19}$ C	Mass of neutron $M_n = 1.675 \times 10^{-27}$ kg
$\mu_o = 4\pi \times 10^{-7}$ TmA^{-1}	Mass of proton $= 1.673 \times 10^{-27}$ kg
$\frac{1}{4\pi\epsilon_o} = 9 \times 10^9 \frac{Nm^2}{C^2}$	Mass of electron $= 9.1 \times 10^{-31}$ kg
$\epsilon_0 = 8.854 \times 10^{-12}$ C^2 N^{-1} m^{-2}	

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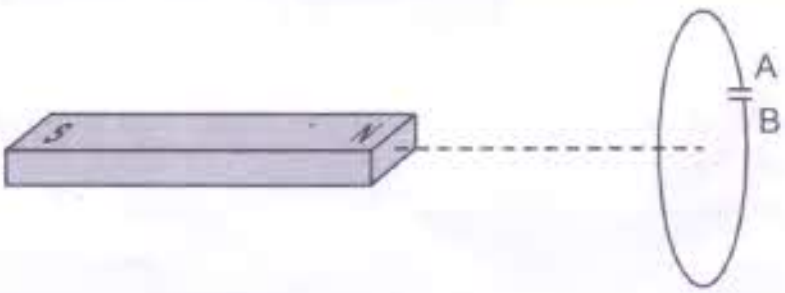
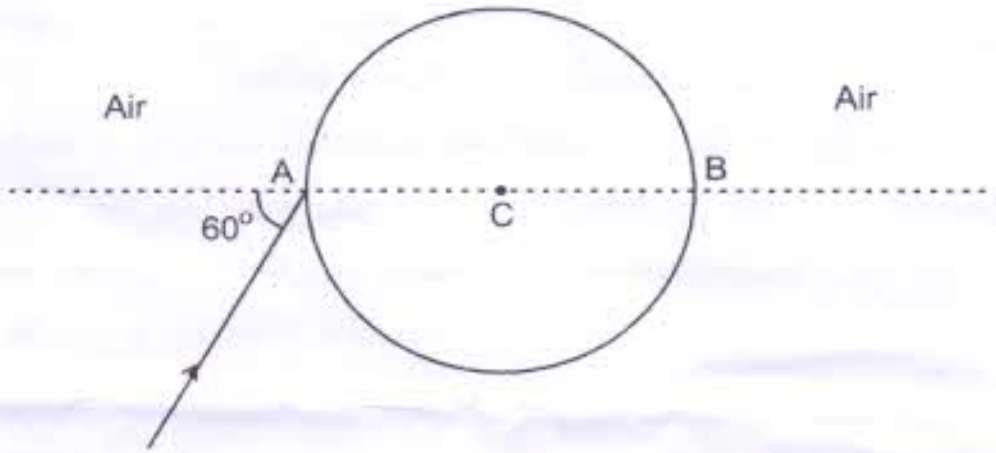
1. State the unit of dielectric constant of a dielectric medium.
2. Name the quantity whose unit is Gauss.
3. A bar magnet is quickly moved towards a conducting loop having a capacitor as shown in fig. Predict the polarity of the plates A and B of the capacitor.



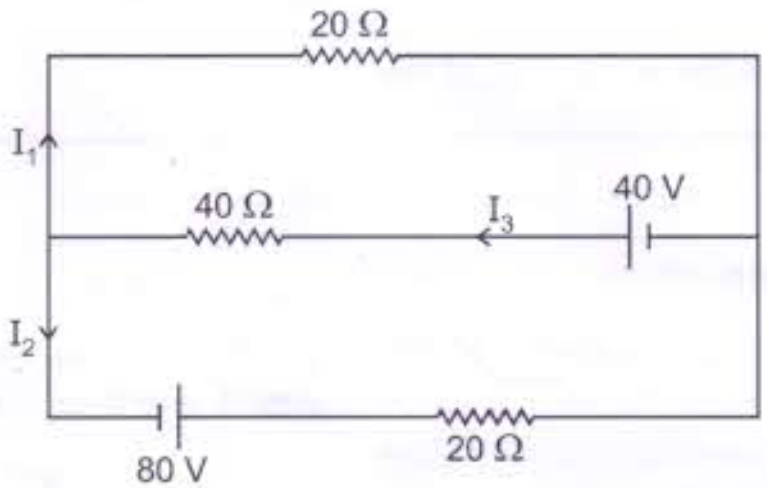
4. State with reason which of the two, the capacitor and inductor, tend to become SHORT when the frequency of the applied alternating voltage has a high value.

5. How does electric field and electric potential due to a point charge vary with distance from the point charge? Draw graph to show the relationship.

6. A Ray of light falls on a transparent sphere with centre C as shown in figure. The ray emerges from the sphere parallel to the line AB. Find the angle of refraction at A, if refractive index of the material of sphere is $\sqrt{3}$.



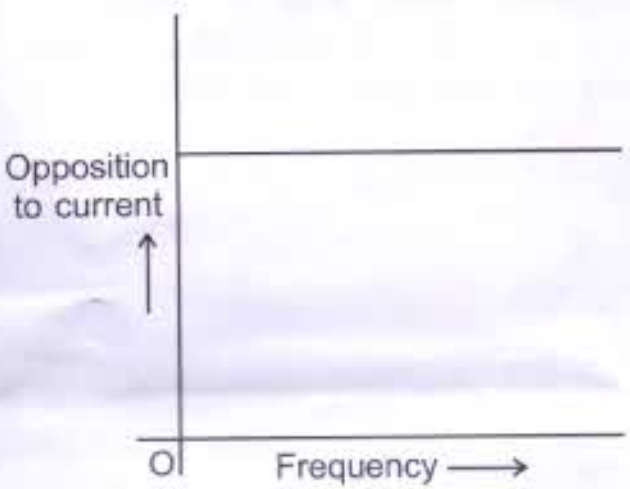
7. Using Kirchhoff's laws, determine the value of current I_1 in the electrical network shown in figure .



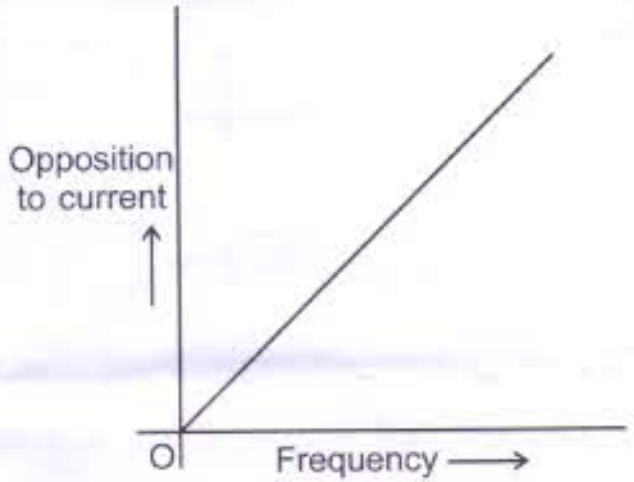
8. State the principle of working of a cyclotron. Write two uses of this machine.

9. The electric current in a wire in the direction from B to A is increasing. What is the direction of induced current in the metallic loop kept above the wire are shown in fig. ?

10. The graph (a) and (b) represent the variation of the opposition offered by the circuit element to the flow of alternating current with frequency of the applied EMF. Identify the circuit element corresponding to each graph.



(a)

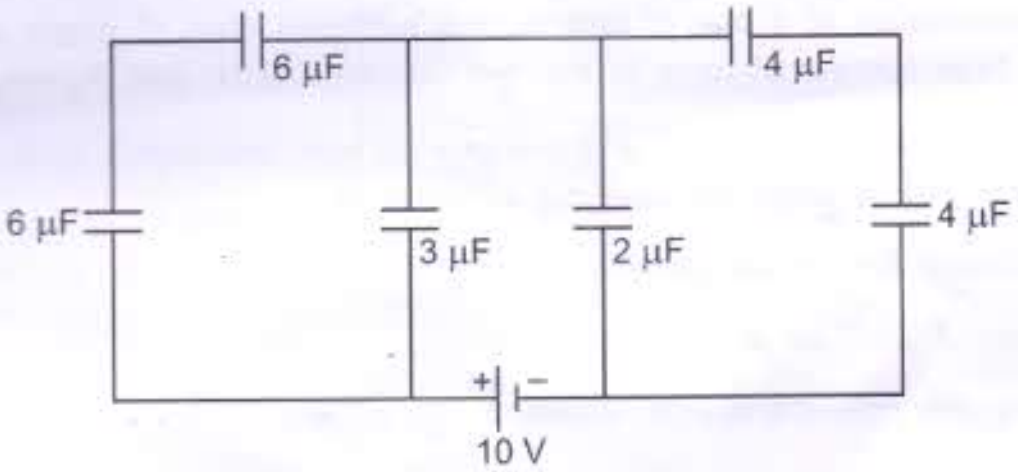


(b)

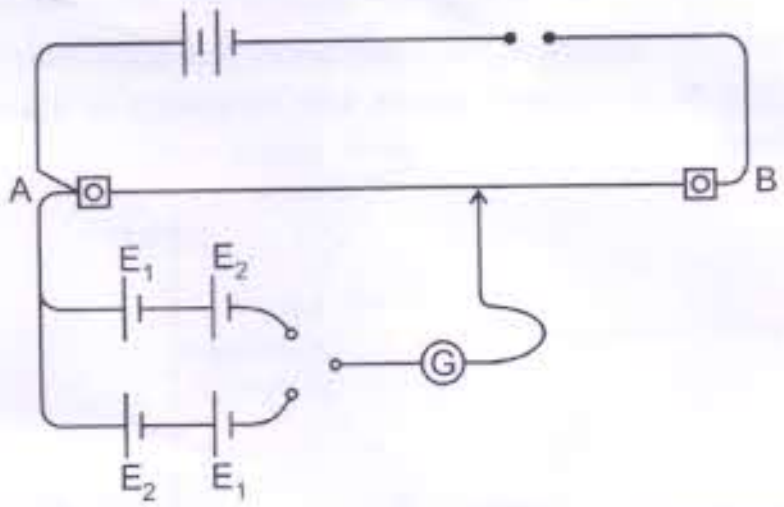
11. (a) How are microwaves produced ? Why is it necessary in microwave oven to select the frequency of microwaves to match the resonant frequency of water molecules ?

(b) Write the important uses of infrared waves.

12. Find the charge on 3 μF and 4 μF capacitors of the arrangement shown in fig.



13. A circuit using a potentiometer and a battery of negligible resistance is set up to develop a constant potential gradient along the wire AB. Two cells of emf ε_1 and ε_2 are connected in series in two different combinations as shown in fig. The balance points are obtained respectively at 400 cm and 240 cm from the point A in the two cases respectively. Then, find the ratio of $\varepsilon_1 / \varepsilon_2$.



14. Deduce an expression for the frequency of revolution of a charged particle in a magnetic field and show that it is independent of velocity or energy of the particle.

15. Compare current sensitivity and voltage sensitivity of the following moving coil galvanometer :

Meter A : n = 30; $A = 1.5 \times 10^{-3}$ m^2; B = 0.25 T; R = 20 ohm

Meter B : n = 35; $A = 2.0 \times 10^{-3}$ m^2; B = 0.25 T; R = 30 ohm

You are given that springs in the two meters have the same torsional constants.

16. Define the term mutual inductance between the two coils. Obtain the expression for mutual inductance of a pair of long coaxial solenoids each of length L and radii r_1 and r_2. Total number of turns in the two solenoids is N_1 and N_2 respectively.

17. The current flowing through and inductor of self inductance L is continuously increasing. Plot a graph showing the variation of :

(a) Magnetic flux vs the current

(b) Induced EMF vs dI / dt

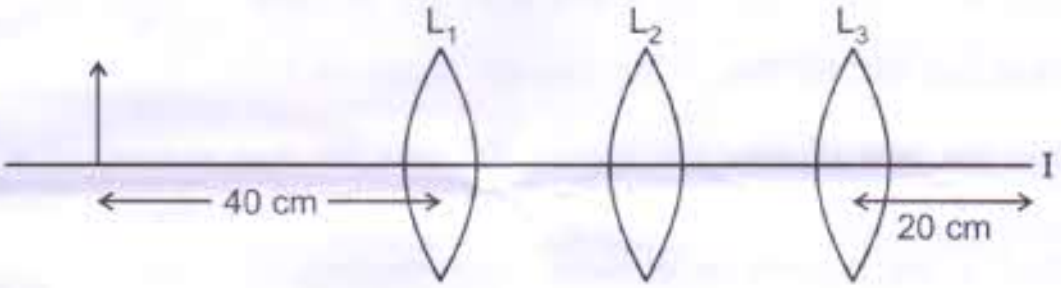
(c) Magnetic potential energy stored vs the current

18. (a) When an AC source is connected to an ideal capacitor, show that the average power supplied by the source over a complete cycle is zero.

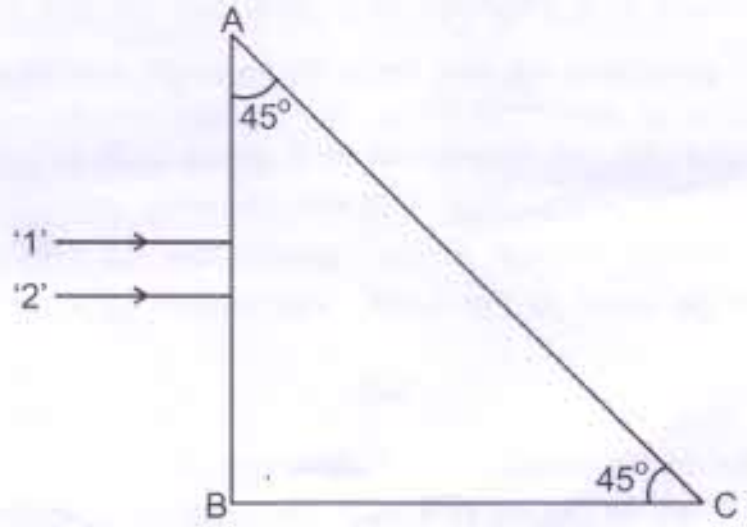
(b) A lamp is connected in series with a capacitor. Predict your observation when the system is connected first cross the DC and then with ac source. What happens in each case is the capacitance of the capacitor is reduced?

19. A parallel plate capacitor is being charged by a time varying current. Explain briefly how Ampere's circuital law is the generalized to incorporate the effect due to the displacement current.

20. You are given three lenses L_1, L_2 and L_3 each of focal length 20 cm. An object is placed at 40 cm in front of L_1, as shown. The final real image is formed at the focus I of L_3. Find the separation between the lenses.



21. Two monochromatic rays of light incident normally on the face AB of an isosceles right angled prism ABC. The refractive index of the glass prism for the two rays '1' and '2' are respectively 1.35 and 1.45. Trace the path of these rays after entering through the prism.



22. Define the terms :

(a) Drift velocity

(b) Relaxation time

A conductor of length L is connected to a DC source of emf ε. If this conductor is replaced by another conductor of same material and same area of cross-section but of length 3L, how will the drift velocity change ?

23. Divyam is in class 12th standard. His Physics teacher demonstrated an experiment to explain Faraday's law of electromagnetic induction. Divyam interrupted his lectures and asked. "Is there any possibility of induced EMF due to the earth's magnetism ?" The teacher was stunned for a moment and gave this question for group discussion. Finally, the Student came out with correct answer.

(a) Write the values that you learnt from this incident.

(b) What can be the reason for Divyam questions ?

24. (a) With the help of diagram, explain the principle and working of a moving coil galvanometer.

(b) What is the importance of radial magnetic field and how is it produced ?

(c) Why is that while using a moving coil galvanometer as a Voltmeters, a high resistance in series as required, whereas in an ammeter, a shunt is used ?

OR

(a) Derive an expression for the force experienced by a current carrying straight conductor placed in a magnetic field. How can we find the direction of force ?

(b) Under what conditions, is this force (i) zero (ii) maximum ?

25. Drive and expression for the impedance of a series LCR circuit connected to an AC supply of variable frequency. Plot a graph showing variation of current with the frequency of the applied voltage. Explain briefly how the phenomenon of resonance in the circuit can be used in the tuning mechanism of a radio or a TV set.

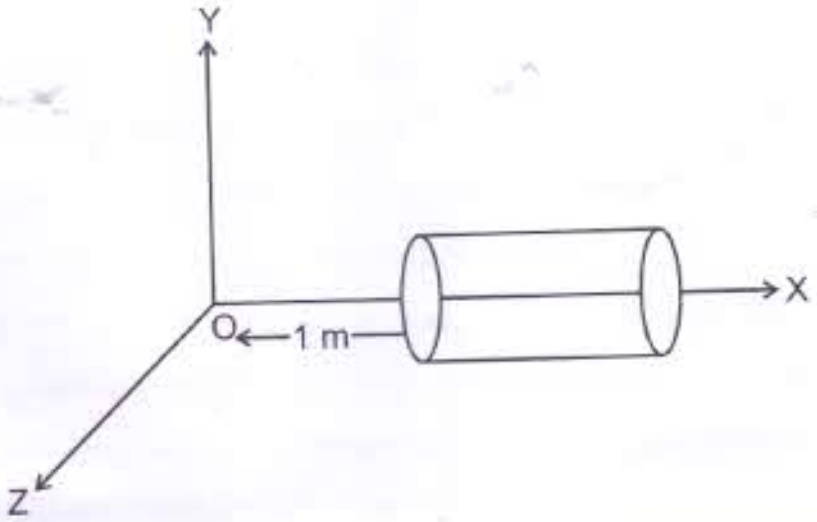
OR

Explain Gauss law of electrostatics. A hollow cylindrical box of length 1 m and area of cross section 25 cm^2 is placed in a three dimensional co-ordinate system as shown

in figure. The electric field in the region is given by $\vec{E} = 50x\hat{i}$, where E is in NC^{-1} and x is in meters. Find :

(a) Net flux through the cylinder.

(b) Charge enclosed by the cylinder.



26. (a) Draw a labeled diagram showing the image formation of a distant object by refracting telescope. Deduce the expression for its magnifying power when the final image is formed at infinity.

(b) The sum of focal length of the two lenses of the refracting telescope is 105 cm. The focal length of one lens is 20 times that of the other. Determine the total magnification of the telescope when the final images formed at infinity.

OR

Draw a diagram to show the working of compound microscope deduce an expression for the total magnification and the final images formed at near point. In a compound microscope, an object is placed at a distance of 1.5 cm from the objective of focal length 1.25 cm. If the eyepiece has a focal length of 5 cm and the final images formed at the near point, estimate the magnifying power of the microscope.

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