Amity

First Terminal Examination 2016 - 2017

Class – XII

Subject – Physics

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

General Instructions :

(a) All questions are compulsory.

(b) There are 26 questions in total.

Questions 1 to 5 carry 1 mark each.

Questions 6 to 10 carry 2 marks each.

Questions 11 to 22 carry 3 marks each.

Question 23 carry 4 marks.

Questions 24 to 26 carry 5 marks each.

(c) There is no overall choice. However some internal choices have been provided.

(d) Use of calculator is not permitted.

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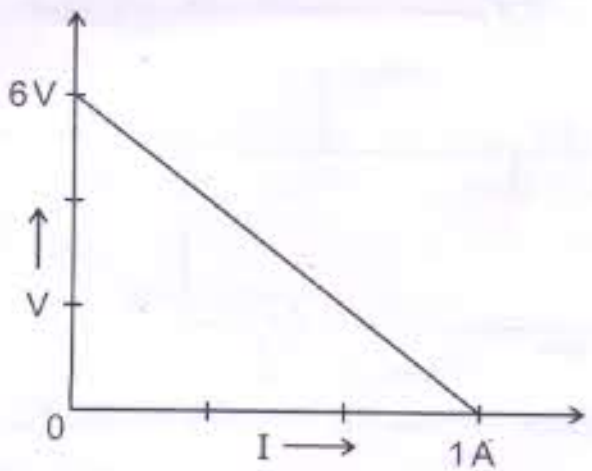
1. What is the amount of work done in moving a point charge around a circular arc of radius r at the centre of which another point charge q is located ?

2. Define mobility of a charge carrier. What is its relation with relaxation time ?

3. The plot of the variation of potential difference across a combination of three identical cells in series, versus current is shown below. What is the emf and internal resistance of each cell ?



4. An a.c. source of voltage $V = V_0 \sin \omega t$ is connected to an ideal inductor. Draw graphs of voltage V and current i versus ωt.

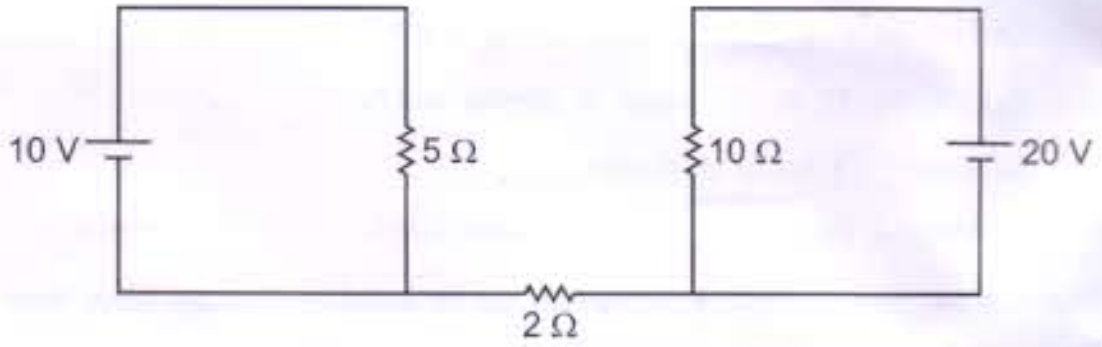
5. A point charge +Q is placed in the vicinity of a conducting surface. Trace the fie lines between the charge and the conducting surface.

6. Explain the basic differences between the construction and working of a telescop and a microscope.

OR

Draw ray diagram of compound microscope for far point position.

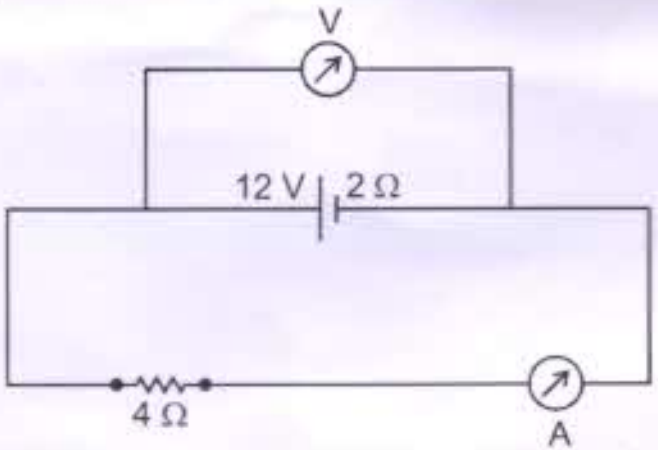
7. Find out current in 2Ω resistance.



8. Derive the expression of electric field intensity due to long line charge.

9. A ray of light incident on one of the faces of a glass prism of angle 'A' has angle of incidence 2A. The refracted ray in the prism strikes the opposite face which is silvered, the reflected ray from it retracing its path. Trace the ray diagram and find the relation between the refractive index of the material of the prism and the angle of the prism.

10. A battery of emf 12V and internal resistance 2Ω is connected to a 4Ω resistor as shown in the figure :



(a) Show that a voltmeter when placed across the cell and across the resistor, in turn, gives the same reading.

(b) To record the voltage and the current in the circuit, why is voltmeter placed in parallel and ammeter in series in the circuit ?

11. A convex lens, of focal length 20 cm, is placed coaxially with a convex mirror of radius of curvature 20 cm. The two are kept 15 cm apart from each other. A point object is placed 60 cm in front of the convex lens. Find the position of the image formed by this combination.

12. Define an equipotential surface. Draw equipotential surface :

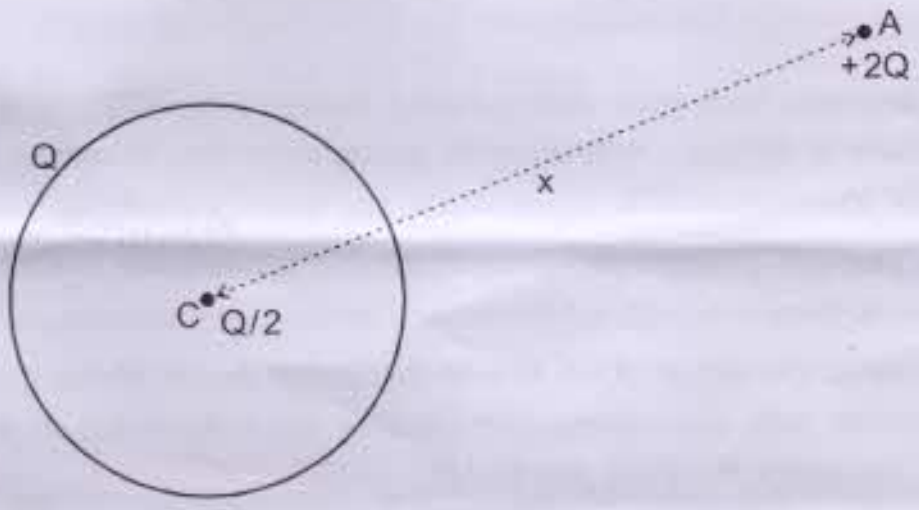
(a) in the case of a single point charge.

(b) in a constant electric field in – Z direction.

Why the equipotential surfaces about a single charge are not equidistant ?

(c) Can electric field exist tangential to an equipotential surface ? Give reason.

13. A thin metallic spherical shell of radius carries a charge on its surface. A point charge +Q/2 is placed at the centre C and another charge +2Q is placed outside the shell at A at a distance x from the centre as shown in the figure :



(a) Find the electric flux through the shell.

(b) State the law used.

(c) Find the force on the charges at the centre C of the shell and at the point A.

14. State Lenz's law. Illustrate, by giving an example, how this law helps in predicting the direction of the current in a loop in the presence of a changing magnetic flux.

In a given coil of self-inductance of 5 mH, current changes from 4 A to 1 A in 30 ms. Calculate the emf induced in the coil.

OR

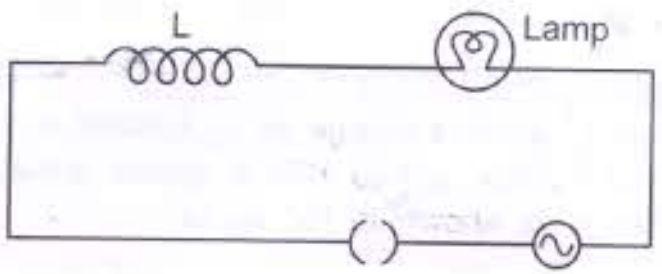
In what way is Gauss's law in magnetism different from that used in electrostatics ? Explain briefly.

The Earth's magnetic field at the equator is approximately 0.4 G. Estimate the Earth's magnetic dipole moment. (Given : Radius of the Earth = 6400 km)

15. Derive lens maker's formula for convex lens.

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

(b) A lamp is connected in series with an inductor and an AC source. What happens to the brightness of the lamp when the key is plugged in and an iron rod is inserted inside the inductor? Explain.

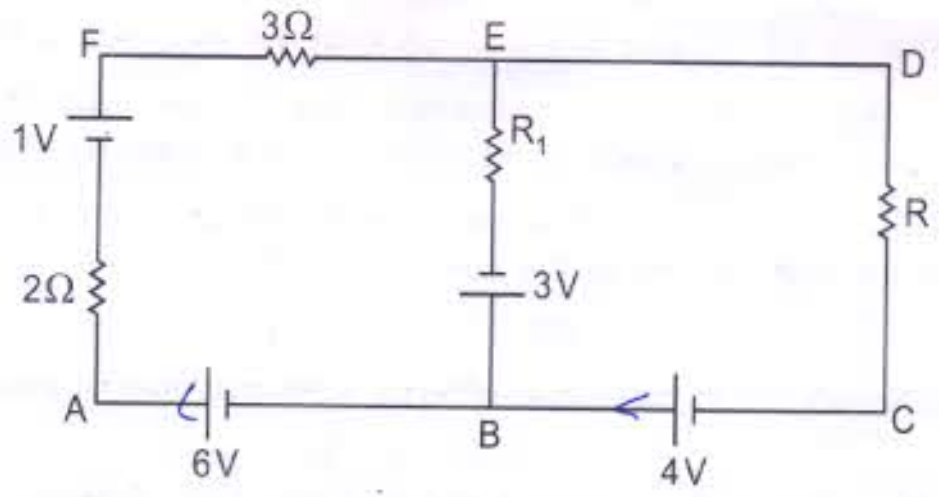


17. Draw the magnetic field lines distinguishing between diamagnetic and paramagnetic materials. Give a simple explanation to account for the difference in the magnetic behaviour of these materials.

18. (a) Show that the average power consumed in an ~~inductor~~ capacitor L connected to an a.c. source is zero.

(b) In a series LR circuit, $X_L = R$ and the power factor of the circuit is P_1. When a capacitor with capacitance C such that $X_C = X_L$ is put in series, the power factor becomes P_2. Find out P_1 / P_2.

19. Use Kirchhoff's rules to determine the potential difference between the points A and D when no current flows in the arm BE of the electric network shown in the figure:



20. Find the relation between drift velocity and relaxation time of charge carriers in a conductor. A conductor of length L is connected to a d.c. source of emf 'E'. If the length of the conductor is tripled by stretching it, keeping 'E' constant, explain how its drift velocity would be affected.

21. A uniform magnetic field is set up along the positive x-axis. A particle of charge 'q' and mass 'm' moving with a velocity V enters the field B at the origin in X – Y plane such that it has velocity components both along and perpendicular to the magnetic field. Trace, giving reason, the trajectory followed by the particle. Find out the expression for the distance moved by the particle along the magnetic field in one rotation.

22. State the underlying principle of a potentiometer. Write two factors by which current sensitivity of a potentiometer can be increased. Why is a potentiometer preferred over a voltmeter for measuring the emf of a cell ?

23. Deepika and Ruchika were asked by their teacher to perform an experiment using a galvanometer. Before doing the experiment, they were very keen to know the different parts of the galvanometer which was given to them in the form of a small box. They approached the teacher and asked for the permission. The teacher thought it would be a good idea if the galvanometer be opened before the whole class and explained its construction and working to all of them.

Based on the above paragraph, answer the following questions :

(a) What, in your opinion, were the qualities displayed by Deepika, Ruchika and the teacher ?

(b) State briefly the working principle of the galvanometer.

(c) What is the shape of the magnets used and why is it so designed ?

24. (a) Express Biot-Savart's law in the vector form.

(b) Use it to obtain the expression for the magnetic field at an axial point, distanced from the centre of a circular coil of radius carrying current I.

(c) Also, find the ratio of the magnitudes of the magnetic field of this coil at the centre and at an axial point for which $x = \sqrt{3}$.

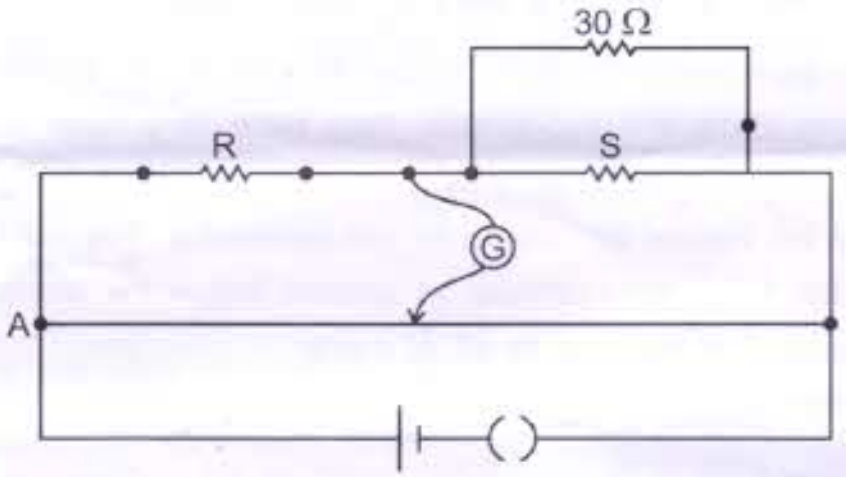
OR

(a) Consider a beam of charged particles moving with varying speeds. Show how crossed electric and magnetic fields can be used to select charged particles of a particular velocity ?

(b) Name another device / machine which uses crossed electric and magnetic fields. What does this machine do and what are the functions of magnetic and electric fields in this machine ? Where do these fields exist in this machine ? Write about their natures.

25. (a) State the principle of working of a meter bridge. Draw the circuit diagram for finding an unknown resistance using a meter bridge. Derive the relevant formula used.

(b) In a meter bridge with R and S in the gaps, the null point is found at 4 cm from A. If a resistance of 30 Ω is connected in parallel with S, the null point occurs at 50 cm from A. Determine the values of R and S.



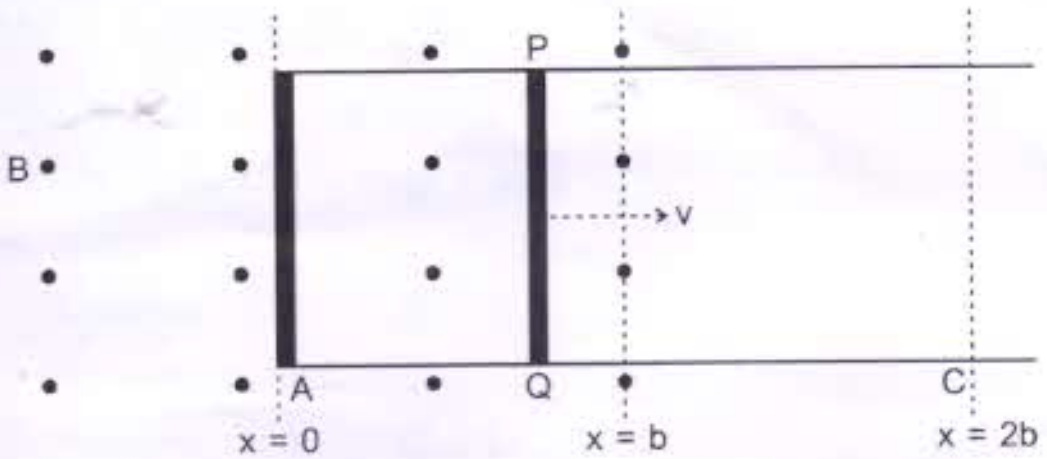
OR

Deduce the expression for the torque acting on a dipole of dipole moment p placed in a uniform electric field E. Depict the direction of the torque. Express it in the vector form. Show that the potential energy of a dipole making angle θ with the direction of the field is given by $U(\theta) = -\vec{P}.\vec{E}$

Hence find out the amount of work done in rotating it from the position of unstable equilibrium to the stable equilibrium.

26 (a) When a bar magnet is pushed towards or away from the coil connected to a galvanometer, the pointer in the galvanometer deflects. Identify the phenomenon causing this deflection and write the factors on which the amount and direction of the deflection depends. State the laws describing this phenomenon.

(b) Sketch the change in flux, emf and force when a conducting rod P of resistance R and length ℓ moves freely to and fro between A and C with speed v on a rectangular conductor placed in uniform magnetic field as shown in the figure :



OR

In a series LCR circuit connected to an a.c. source of voltage $v = v_m \sin \omega t$, use phasor diagram to derive an expression for the current in the circuit. Hence obtain the expression for the power dissipated in the circuit. How that power dissipated at resonance is maximum ?

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