

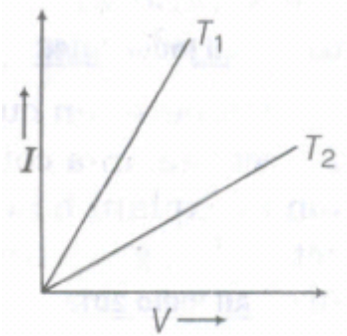
Test No- 5 - Annamalai
12th Standard CBSE
Physics
"All The Best"

Time : 03:00:00 Hrs

Total Marks : 70

Section-A

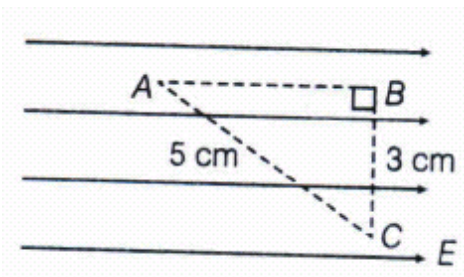
- 1) In which orientation, a dipole placed in a uniform field is in (i) stable (ii) unstable equilibrium? **1**
- 2) Why should the potentiometer wire be of uniform cross-section and composition? **1**
- 3) Why do we prefer a potentiometer with a longer bridge wire? **1**
- 4) I-V graph for a metallic wire at two different temperatures T_1 and T_2 is as shown in the figure below. Which of the two temperature is lower and why? **1**



- 5) State the principle of moving coil galvanometer. **1**

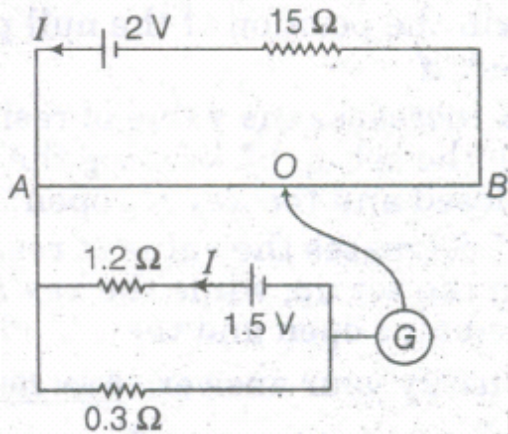
Section-B

- 6) A test charge q is moved without acceleration from A to C along the path from A to B and then from B to C in electric field E as shown in the figure. **2**



- (i) Calculate the potential difference between A and C.
- (ii) At which point (of the two) is the electric potential more and why?
- 7) Derive an expression for drift velocity of free electrons in a conductor in terms of relaxation time. **2**

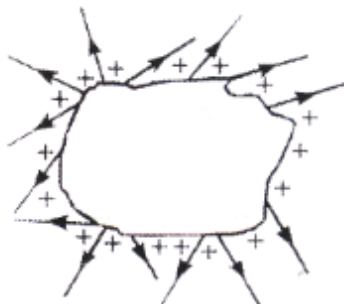
- 8) In the following potentiometer, circuit AB is a uniform wire of length 1m and resistance 10 n. 2
 Calculate the potential gradient along the wire and balance length AO(l)



- 9) A square coil, of side 10 cm has 20 turns and carries a current of I ampere. The coil is suspended vertically and the normal, to the plane of the coil, makes an angle of 30° with the direction of a uniform magnetic field of strength 0.80 T. If the torque experienced by coil, equals 0.96 N-m, find the value of I. 2
- 10) A power transmission line feeds power at 2200 V with a current of 5 A to step down transformer with its primary winding having 4000 turns. Calculate the number of turns and the current in the secondary in order to get output power at 220 V.

Section-C

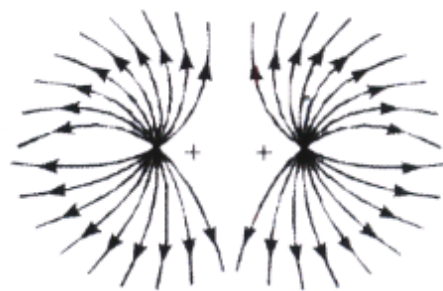
- 11) Which of the following figures cannot possibly represent electrostatic field lines? 3



(a)



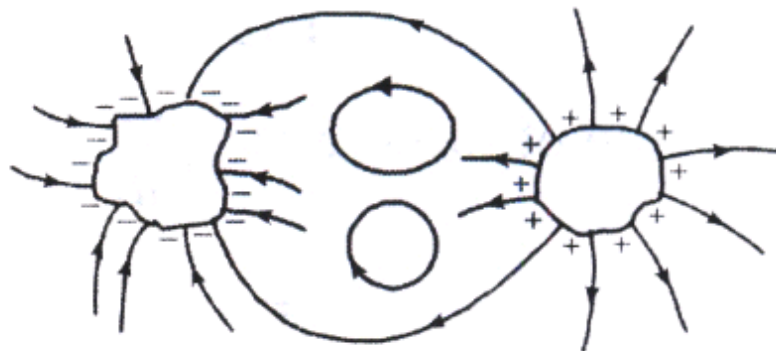
(b)



(c)



(d)

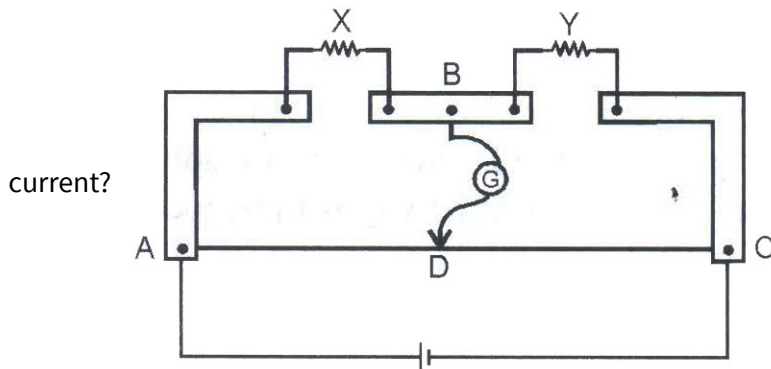


(e)

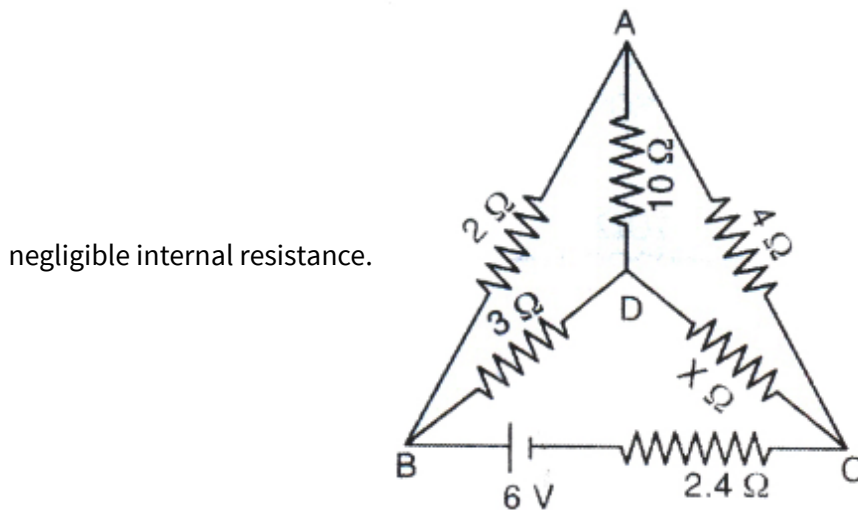
12) The area of parallel plates of an air capacitor is 0.2m^2 and the distance between them is 0.01m . The potential difference between the plates is 3000V . When a 0.01m thick sheet of an insulating material is placed between the plates, the potential difference decreases to 1000V . Determine (i) Capacitance of capacitor before placing the sheet (ii) charge on each plate (iii) dielectric constant of material (iv) capacitance after placing the insulator (v) absolute permittivity of the dielectric. 3

13) (i) Derive the expression for the electric potential due to an electric dipole at a point on its axial line. 3
 (ii) Depict the equipotential surfaces due to an electric dipole.

14) (a) In a meter bridge shown below the balance point is found to be at 39.5 cm from the end A, when the resistor Y is of 12.5Ω . Determine the resistance of X. Why are the connections between resistors in a wheatstone or meter bridge made of thick copper strips? (b) Determine the balance point of the bridge above if X and Y are interchanged. (c) What happens if the galvanometer and cell are interchanged at the balance point of the bridge? Would the galvanometer show any current? 3



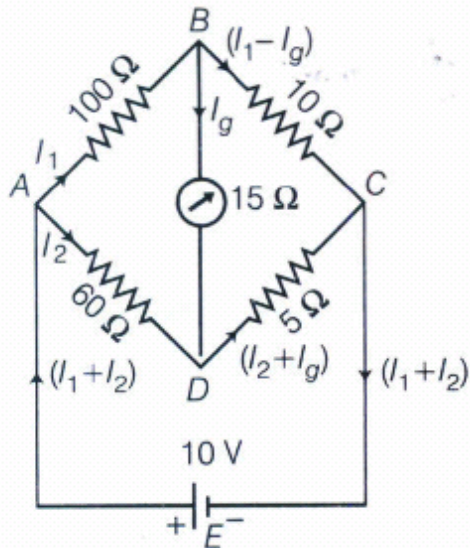
15) Find the value of unknown resistance X in the following circuit, if no current flows through the section AD. Also calculate the current drawn by the circuit from the battery of emf 6V and negligible internal resistance. 3



16) A room is lighted by 200 W , 124 V incandescent lamps fed by a generator whose output voltage is 130 V . The conducting wires from the generator to the user are made of aluminium wire of total length 150 m and cross-sectional area 15 mm^2 . How many such lamps can be installed? What is the total power consumed by the user? sp. resistance of aluminium is $2.9 \times 10^{-8}\Omega\text{m}$. 3

- 17) The Wheatstone bridge circuit have the resistances in various arms as shown in figure. Calculate the current through the galvanometer.

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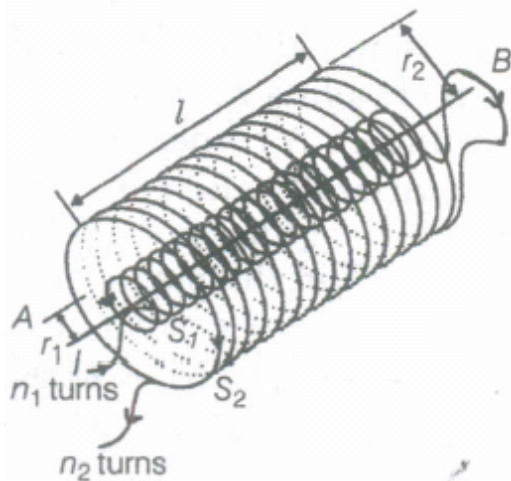


- 18) (i) State Ampere's circuital law expressing it in the integral form.

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(ii) Two long co-axial insulated solenoids S_1 and S_2 of equal length are wound one over the other as shown in the figure. A steady current I flows through the inner solenoid S_1 to the other end B which is connected to the outer solenoid S_2 through which the some current I flows in the opposite direction so, as to come out at end A. If n_1 and n_2 are the number of turns per unit length, find the magnitude and direction of the net magnetic field at a point

- (a) inside on the axis and
(b) outside the combined system.



- 19) Draw a schematic sketch of a cyclotron. Explain, giving the essential details of its construction, how it is used to accelerate the charged particles.

3

- 20) A circular coil, having 100 turns of wire, of radius (nearly) 20 cm each, lies in the XY plane with its centre at the origin of co-ordinates. Find the magnetic field at the point $(0, 0, 20\sqrt{3} \text{ cm})$ when this coil carries a current of $(\frac{2}{\pi}) \text{ A}$.

3

- 21) A pure inductor of 25.0 mH is connected to a source of 220V. Find the inductive reactance and rms current in the circuit, if the frequency of the source is 50Hz.

3

- 22) A series LCR circuit with $C = 80 \mu F$, $L = 5.0 H$ and $R = 40\Omega$ is connected to a variable frequency 240 V a.c. source. Calculate
- angular frequency of the source which drives the circuit in resonance.
 - current at the resonating frequency.
 - rms* pot. drop across the capacitor.

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Section-D

- 23) A physics teacher tells his students in the class that in paramagnetic materials, every atom has some permanent magnetic dipole moment. In the absence of an external magnetic field, the atomic dipoles are randomly oriented so that average magnetic moment per unit volume of the material behaves as a magnet. When an external magnetic field is applied, the torque developed tries to align the atomic magnetic dipoles in the direction of the field. That is why the specimen gets magnetized weakly in the direction of the field.

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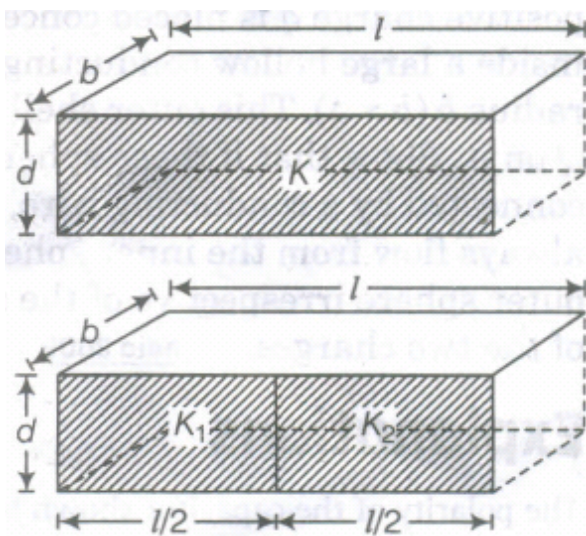
Read the above passage and answer the following questions:

- Name any three paramagnetic materials
- Name any two ferromagnetic materials. How is their behavior different from that of paramagnetic materials?
- The teacher asks the students how true is the famous saying: 'Spare the rod and spoil the child', comment.

Section-E

- 24) (a) Obtain the expression for the potential due to an electric dipole of dipole moment p at a point 'x' on the axial line.
- (b) Two identical capacitors of plate dimension $l \times b$ and plate separation d have dielectric slabs filled in between the space of the plates as shown in the figures.

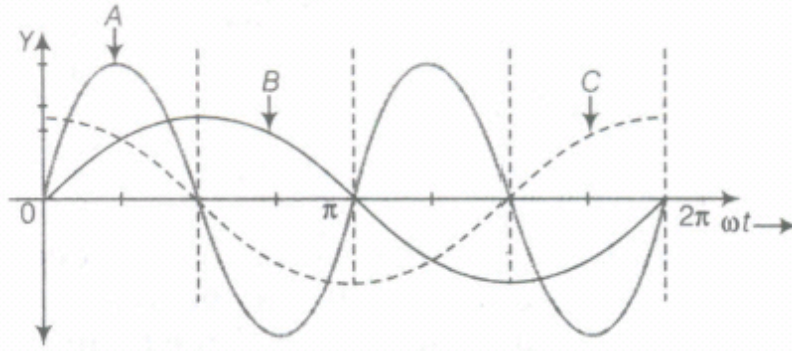
5



Obtain the relation between the dielectric constants K , K_1 and K_2

25) A device X is connected to an AC source, $V = V_0 \sin \omega t$. The variation of voltage, current and power in one cycle is shown in the following graph.

5



Identify the device X.

Which of the curves A, B, and C represents the voltage, current and the power consumed in the circuit? Justify the answer.

How does its impedance vary with frequency of the AC source? Show graphically.

Obtain an expression for the current in the circuit and its phase relation with AC voltage.

26) A toroid has a core of inner radius 20 cm and outer radius 22 cm around which 4200 turns of a wire are wound. If the current in the wire is 10 A, what is the magnetic field (a) inside the core of toroid (b) outside the toroid (c) in the empty space surrounded by toroid ?

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