Brain International School
Vikas Puri, New Delhi

REVISION SHEET

SUBJECT: PHYSICS **CLASS-XII** **TERM-1**

1MARKS

1. When a negative charge (- Q) is brought near one face of a metal cube, the:

a) cube becomes negatively charged
b) face near the charge becomes positively charged and the opposite face becomes negatively charged
c) cube becomes positively charged
d) face near the charge becomes negatively charged and the opposite face becomes positively charged

2. Out of the following which one is not a property of field lines:

a) They form closed loops
b) Field lines are continuous curves without any breaks
c) Two field lines cannot cross each other
d) Field lines start at positive charges and end at negative charges

3. Six charges, each equal to +q, are placed at the corners of a regular hexagon of side **a** . The electric field at the point of intersection of diagonals is -

a) $\frac{1}{4\pi\epsilon_o}.\frac{q}{a^2}$
b) $\frac{1}{4\pi\epsilon_o}.\frac{6q}{a^2}$
c) zero
d) $\frac{1}{4\pi\epsilon_o}.\frac{\sqrt{3q}}{2a^2}$

4. An electric dipole placed in a non - uniform electric field can experience

a) a torque but not a force.
b) always a force and a torque.
c) neither a force nor a torque.
d) a force but not a torque.

5. An isolated conductor, with a cavity, has a net charge +Q. A point charge +q is inside the cavity. The charges on the cavity wall and the outer surface are respectively:

a) 0 and Q - q
b) - q and Q + q
c) 0 and Q

d) - q and Q - q

6. Capacitance of a parallel plate capacitor can be increased by

a) decreasing the distance between the plates.

b) increasing the distance between the plates.

c) decreasing the area of plates.

d) increasing the thickness of the plates

7. In bringing an electron towards another electron, the electrostatic potential energy of the system

a) decreases

b) remains same

c) become zero

d) increases

8. Two points charges of +10μ C and - 10 μ C are placed at points A and B. If P and Q are the two pointslying on the perpendicular bisector of the line AB, then work done in taking a charge of 5 μ C from P to Q will be equal to:

a) zero and distance between A & B

b) zero

c) distance between A & B

d) distance between P and Q

9. The electric field between the plates of a fully charged capacitor is E. If a material of dielectric constant Kis introduced between the plates, the electric field at a point between the plates

a) remains unchanged

b) becomes zero

c) becomes EK

d) becomes E/K

10. Dielectric polarization is the phenomenon, in which atomic dipoles are aligned

a) at an acute angle to the direction of the electric field

b) in the direction of the electric field

c) perpendicular to the direction of the electric field

d) opposite to the direction of the electric field

11. According to Kirchhoff's Loop Rule,

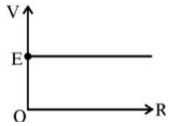
a) The algebraic sum of changes in potential around any closed loop must be positive.

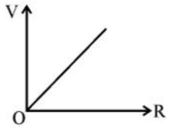
b) The algebraic sum of changes in potential around any closed loop must be negative.

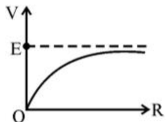
c) The absolute sum of changes in potential around any closed loop must be zero.

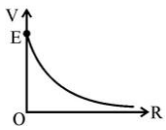
d) The algebraic sum of changes in potential around any closed loop must be zero.

12. A cell of emf (E) and internal resistance r is connected across a variable external resistance R. The graph of terminal potential difference V as a function of R is -

a) 

b) 

c) 

d) 

13. A student connects 10 dry cells each of emf E and internal resistance r in series, but by mistake the one cell gets wrongly connected. Then net emf and net internal resistance of the combination will be:

a) 8E, 8r

b) 10E, 10r

c) 8E, 10r

d) 8E,$\frac{r}{10}$

14. The SI unit of mobility of charge carriers is:

a) Ωm

b) m s^{-1} V^{-1}

c) Ωs^{-1}

d) m^2 V^{-1} s^{-1}

15. A proton and an α - particle follow the same circular path in a transverse magnetic field. Their kinetic energies are in the ratio:

a) 1: 4

b) 1: 1

c) 1: 2

d) 1: $\sqrt{2}$

16. To convert a galvanometer into a voltmeter:

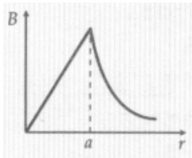
a) a low resistance is connected in series

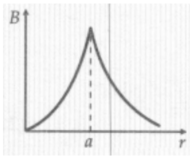
b) a high resistance is connected in series

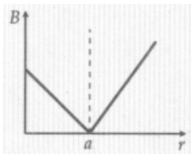
c) a high resistance is connected in parallel

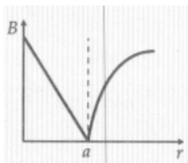
d) a low resistance is connected in parallel

17. A long straight wire of circular cross - section (radius a) carries a steady current Iand the current I is uniformly distributed across this cross - section. Which of the following plots represents the variation of the magnitude of magnetic field B with distance centre of the wire?

a) 

b) 

c) 

d) 

18. A voltmeter has a resistance of G ohm and a range of V volt. The value of resistance used in series to convert it into a voltmeter of range nV volt is

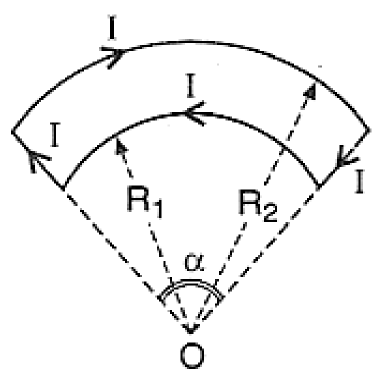
a) (n - 1) G

b) $\frac{G}{n}$

c) $\frac{G}{n-1}$

d) nG

19. The magnetic induction at the centre O of the current carrying bent wise shown in the adjoining figure is:



a) $\frac{\mu_0 I\alpha}{4\pi}\left(\frac{1}{R_1}-\frac{1}{R_2}\right)$

b) $\frac{\mu_0 I\alpha}{4\pi}\left(\frac{1}{R_1}+\frac{1}{R_2}\right)$

c) $\frac{\mu_0 I}{4\pi R_2}\alpha$

d) $\frac{\mu_0 I}{4\pi R_1}\alpha$

20. Assertion (A): A proton and an alpha particle having the same kinetic energy are moving in circular paths in a uniform magnetic field. The radii of their circular paths will be equal.

Reason (R): Any two charged particles having equal kinetic energies and entering a region of the uniform magnetic field $\vec{B}$ in a direction perpendicular to $\vec{B}$ will describe circular trajectories of equal radii.

21. Assertion (A): Voltmeter put across a part of the circuit, it read slightly more than the original voltage.

Reason (R): Voltmeter is always connected in parallel in circuit across which voltage is to be measured.

22. Assertion (A): Magnetic field is not associated with a stationary charge.

Reason (R): A magnetic field can be detected by means of its effect on a current - carrying conductor.

23. Assertion (A): Higher the range, lower is the resistance of an ammeter.

Reason (R): To increase the range of an ammeter additional shunt is added in series to it.

24. The susceptibility of a magnetic substance is found to depend on temperature and the strength of the magnetizing field. The material is a:

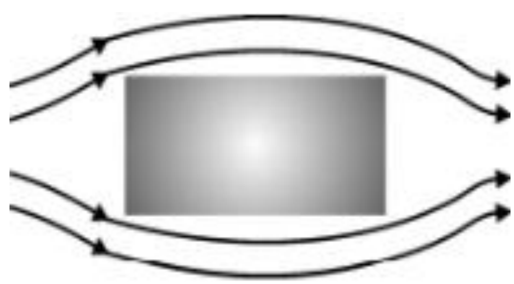
a) diamagnet

b) superconductor

c) paramagnet

d) ferromagnet

25. Which of the following cannot modify an external magnetic field as shown in the figure?



a) Sodium Chloride

b) Silicon

c) Nickel

d) Copper

26. The susceptibility of ferromagnetic material is:

a) independent of temperature

b) inversely proportional to square of temperature

c) directly proportional to temperature

d) inversely proportional to temperature

27. If number of turns per unit length of a coil of a solenoid is doubled, its self - inductance will

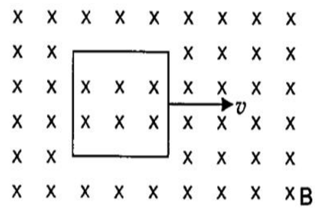
a) be doubled

b) remain constant

c) be four times

d) be halved

28. A conducting square loop of side L and resistance R moves in its plane with a uniform velocity v perpendicular to one of its sides. A magnetic induction B constant in time and space, pointing perpendicular and into the plane of the loop exists everywhere as in given figure. The current induced in the loop is



a) $\frac{2Blv}{R}$ anticlock wise

b) $\frac{Blv}{R}$ clockwise

c) zero.

d) $\frac{Blv}{R}$ anticlockwise

29. A metal ring is held horizontally and bar magnet is dropped through the ring with its length along the axis of the ring. The acceleration of the falling magnet is:

a) more than g

b) equal to g

c) either equal to g or more than g

d) less than g

30. Lenz's law is a consequence of the law of conservation of

a) mass

b) energy

c) charge

d) momentum

31. Assertion (A): Acceleration of a magnet falling through a long solenoid decrease.

Reason (R): The induced current produced in a circuit always flows in such a direction that it opposes the change to the cause that produced it.

32. Assertion (A): As the magnetic field increases, the magnetic energy stored in a solenoid increases.

Reason (R): Magnetic energy stored in a solenoid is proportional to the square of magnetic field strength.

33. Assertion (A): If we use a battery across the primary of a step up transformer, then voltage is aiso obtained across secondary.

Reason (R): Battery gives a steady current, so there is no change in magnetic flux through the secondary of transformer and hence, no emf is induced across secondary.

34. In a circuit, the current lags behind thevoltage by a phase difference of$\pi/2$. The circuit contains which of the following?

a) only L

b) only R

c) only C

d) R and C

35. An ac voltage $v = v_0 \sin \omega t$ is applied to a series combination of a resistor R and an element X. The instantaneous current in the circuit is $I = I_0 \sin\left(\omega t + \frac{\pi}{4}\right)$ .Then which of the following is correct?

a) X is a capacitor and $X_C = \sqrt{2}$ R

b) X is a capacitor and X_C =R

c) X is an inductor and $X_L = \sqrt{2}$ R

d) X is an inductor and X_L = R

36. In a pure capacitive circuit, the current

a. leads the applied emf by angle$\frac{\pi}{2}$

b. and applied emf are in same phase

c. lags behind the applied emf by angle$\frac{\pi}{2}$

d. leads the applied emf by an angleπ

37. An inductor, a capacitor and a resistor are connected in series across an ac source of voltage. If the frequency of the source is decreased gradually, the reactance of:

a) inductor increases and the capacitor decreases.

b) both the inductor and the capacitor increase.

c) inductor decreases and the capacitor increases.

d) both the inductor and the capacitor decrease.

38. The core of a transformer is laminated to reduce the effect of

a) flux leakage

b) copper loss

c) hysteresis loss

d) eddy current

39. Assertion (A): When capacitive reactance is smaller than the inductive reactance in LCR current, e.m.f. leads the current.

Reason (R): The phase angle is the angle between the alternating e.m.f. and alternating current of the circuit.

40. Which of the following radiations has the highest frequency?

a) Visible light

b) X - rays

c) Microwaves

d) Infrared rays

41. Optical and radio telescopes are built on the ground, but X - ray Astronomy is possible only from satellites orbiting the earth because

a) Satellites orbiting the earth make use of interstellar effects
b) Atmosphere reflects X - rays horizontally so they don't reach the earth
c) Atmosphere reflects X - rays away from earth
d) Atmosphere absorbs X - rays, while visible and radio waves can penetrate it.

42. Solar radiation is

a. none of these
b. transverse electromagnetic wave
c. latitudinal electromagnetic wave
d. longitudinal electromagnetic wave

43. Assertion (A): It is necessary to use satellites for long distance T.V. transmission.

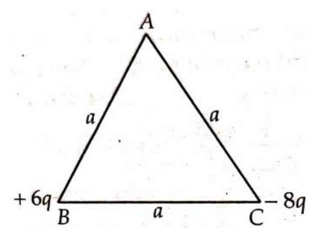
Reason (R): The television signals are low frequency signals.

2MARKS

44. Two-point charges +6q and −8q are placed at the vertex's 'B' and 'C' of an equilateral triangle ABC of side 'a' as shown in figure.

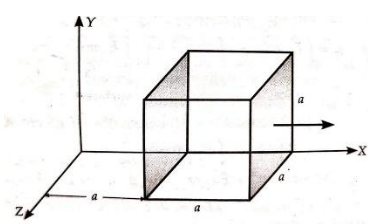
(a) Obtain the expression for the magnitude and

(b) the direction of the resultant electric field at the vertex A due to these two charges.



45. An electric dipole is placed at an angle of 60° with an electric field of magnitude 4×10^5 NC^{-1}. It experiences a torque of $8\sqrt{3}$ Nm. If the length of the dipole is 4 cm, determine the magnitude of either charge of the dipole.

46. The electric field components in figure are $E_x = \alpha\ x^{1/2}$, $E_y = E_z = 0$, in which α=800 N/Cm^2. Calculate (i) the flux ϕ_E through the cube and (ii) the charge within the cube. Assume that a = 0.1m.

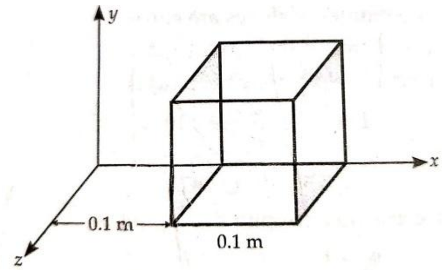


47. Consider a uniform electric field $\vec{E} = 3\times10^3\hat{\imath}\ NC^{-1}$. Calculate the flux of this field through a square surface of area 10 cm^2 when its plane is parallel to the y-z plane, and (ii) the normal to its plane makes a 60° angle with the x-axis.

48. Given a uniform electric field $\vec{E} = 5\times10^3\hat{\imath}\ NC^{-1}$, find the flux of this field through a square of 10 cm on a side whose plane is parallel to the Y-Z plane. What would be the flux through the same square if the plane makes at 30° angle with the X-axis?

49. The electric field components due to a charge inside the cube of side 0.1 m are as shown.

$$E_x = \alpha x, \text{ where } \alpha = 500 \text{N/C-m } E_y = 0, E_z = 0$$



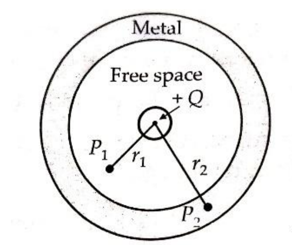
50. A small conducting sphere of radius ‘r’ carrying a charge +q is surrounded by a large concentric conducting shell of radius R on which a charge +Q is placed. Using Gauss’s law, derive the expression for the electric field at a point ‘x’.

(a) between the sphere and

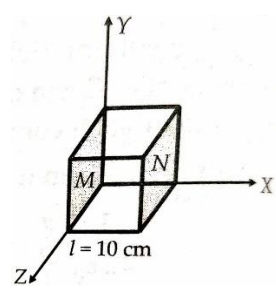
(b) the shell (r < x < R), outside the spherical shell.

51. Plot a graph showing the variation of coulomb force (F) versus $\left[\frac{1}{r^2}\right]$, where r is the distance between the two charges of each pair of charges: (1μC, 2μC) and (2μC, −3μC). Interpret with graphs obtained.

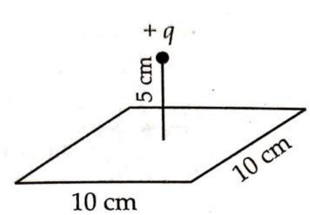
52. A small metal sphere carrying charge +Q is located at the centre of a spherical cavity in a large uncharged metal sphere as shown in figure. Use Gauss’s theorem to find electric field at points P_1 and P_2.



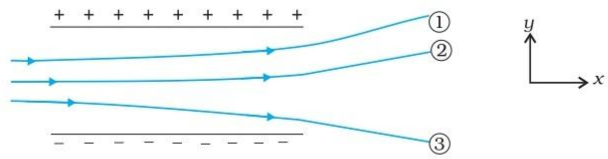
53. Electric field in figure is directed along +X direction and given by E_x= 5 Ax + 2 B, where E is in $NC^{-1}$and x is in metre, A and B are constants with dimensions. Taking A= 10 NC^{-1} m^{-1} and B = 5 NC^{-1}, calculate(i) the electric flux through the cube. (ii) net charge enclosed within the cube.



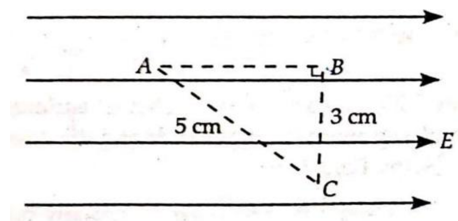
54. A point charge +10 μC is a distance 5 cm directly above the centre of a square of side 10 cm as shown in Fig. (a) What is the magnitude of the electric flux through the square?



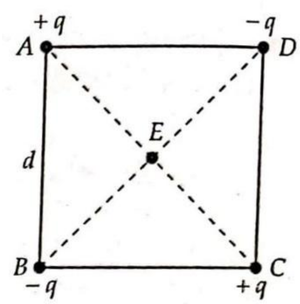
55. A particle of mass m and charge (–q) enters the region between the two charged plates initially moving along x-axis with speed v_x (like particle 1 in Fig.). The length of plate is L and a uniform electric field E is maintained between the plates. Show that the vertical deflection of the particle at the far edge of the plate is $qEL^2/(2mv_x^2)$.



56. Three points A, B and C lie in a uniform electric field (E) of $5 \times 10^3\ NC^{-1}$ as shown in the figure.Find the potential difference between A and C.



57. Four charges are arranged at the corners of a square. ABCD of side d as shown in figure. (i) Find the work required to put together this arrangement. (ii) A charge q_0 is brought to the centre E of the square, the four charges being held fixed at its corners. How much extra work is needed to do this?



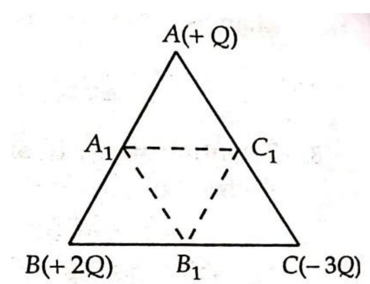
58. An electric dipole of length 2 cm is placed with its axis making an angle of 60° to a uniform electric field of 10^5 N/C. If it experiences a torque of $8\sqrt{3}$ Nm, calculate the

(i) magnitude of the charge on the dipole, and

(ii) potential energy of the dipole.

59. An electric dipole of length 4 cm, when placed with its axis making an angle of 60° with a uniform electric field experiences a torque of $4\sqrt{3}$ Nm. Calculate (i) the magnitude of the electric field, (ii) potential energy of the dipole, if the dipole has charges of ± 8 nC.

60. Three-point charges, + Q, + 2Q and – 3Q are placed at the vertices of an equilateral triangle ABC of side l. If these charges are displaced to the midpoints A_1, B_1 and C_1 respectively, find the amount of the work done in shifting the charges to the new locations.



61. Two-point charges + 10 μC and −10 μC are separated by a distance of 2.0 cm in air. (i) Calculate the potential energy of the system, assuming the zero of the potential energy to be at infinity. (ii) Draw an equipotential surface of the system.

Ans: −45 J

62. Two-point charges A and B of values + 15 μC and + 9μC are kept 18 cm apart in air. Calculate the work done when charge B is moved by 3 cm towards A.

Ans: 1.35 J

63. Two-point charges 20×10^{-6} C and -4×10^{-6} C are separated by a distance of 50 cm in air. (i) Find the point on the line joining the charges, where the electric potential is zero. (ii) Also find electrostatic potential energy of the system.

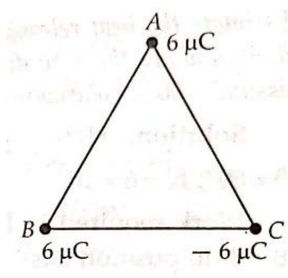
Ans: (i) 41 cm from the charge of 20×10^{-6} C

(ii) −1.44 J

64. Two charges, of magnitude 5 nC and −2 nC, are placed at points (2 cm, 0, 0) and (x cm, 0, 0) in a region of space, where there is no other external field. If the electrostatic potential energy of the system is − 0.5 μ J, what is the value of x?

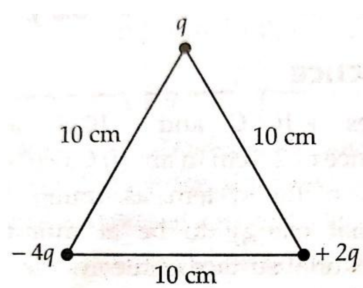
Ans: x = 4 cm

65. Find the amount of work done in arranging the three-point charges, on the vertices of an equilateral triangle ABC, of side 10cm, as shown in the adjacent figure.



Ans: −3.24 J.

66. Calculate the work done to dissociate the system of three charges placed on the vertices of a triangle as shown in figure. Here $q = 1.6 \times 10^{-10}$ C.



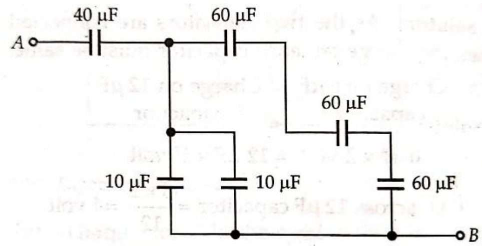
Ans: 2.304×10^{-8} J

67. Find the amount of work done in rotating an electric dipole, of dipole moment 3.2×10^{-8} Cm, from its position of stable equilibrium, to the position of unstable equilibrium, in a uniform electric field of intensity 10^4 N / C.

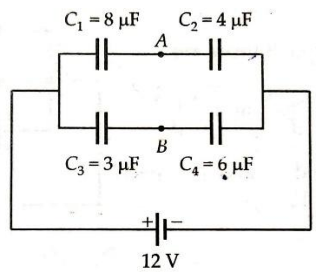
Ans: 6.4×10^{-4} J

68. Eight identical spherical drops, each carrying a charge 1 nC are at a potential of 900 V each. All these drops combine together to form a single large drop. Calculate the potential of this large drop. (Assume no wastage of any kind and take the capacitance of a sphere of radius r as proportional to r).

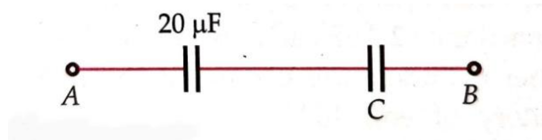
69. Find the equivalent capacitance of the combination of capacitors between the points A and B as shown in figure. Also calculate the total charge that flows in the circuit when a 100 V battery is connected between the points A and B.



70. Four capacitors C_1, C_2, C_3, and C_4 are connected to a battery of 12 V, as shown in figure. Find the potential difference between the points A and B.



71. The equivalent capacitance of the combination between A and B in figure is 4 μF.



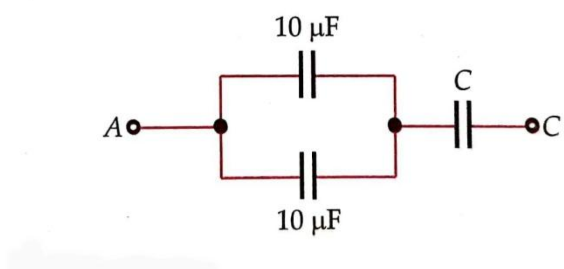
(i) Calculate the capacitance of the capacitor C.

(ii) Calculate charge on each capacitor if a 12 V battery is connected across terminals A and B.

(iii) What will be the potential drop across each capacitor?

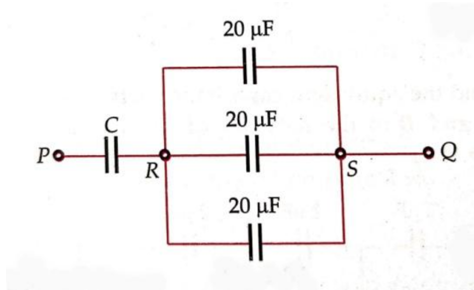
Ans: (i) 5μF (ii) 48μC (iii) 2.4 V, 9.6 V

72. Calculate the capacitance of the capacitor in figure. If the equivalent capacitance of the combination between A and B is 15 μF.



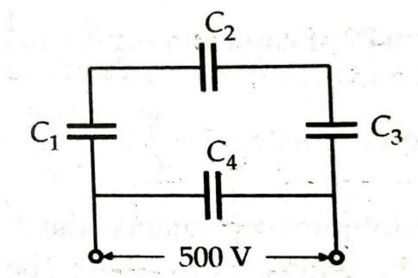
Ans: 60 μF.

73. Calculate the capacitance of the capacitor C in figure. The equivalent capacitance of the combination between P and Q is 30 μF.



Ans: 60 μF.

74. A network of four capacitors each of 12 μF capacitance is connected to a 500 V supply as shown in figure. Determine (a) equivalent capacitance of the network, (b) charge on each capacitor.

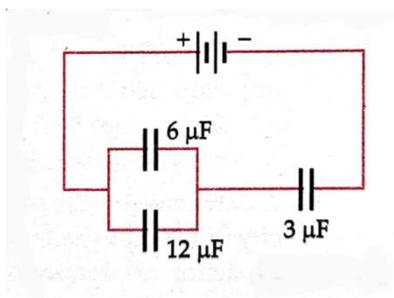


75. In the following arrangement of capacitors, the energy stored in the 6 μF capacitor is E. Find the value of the following:

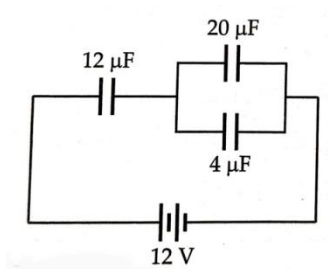
(i) Energy stored in 12 μF capacitor.

(ii)Energy stored in 3 μF capacitor.

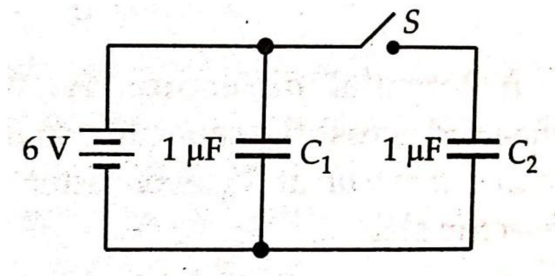
(iii) Total energy drawn from the battery.



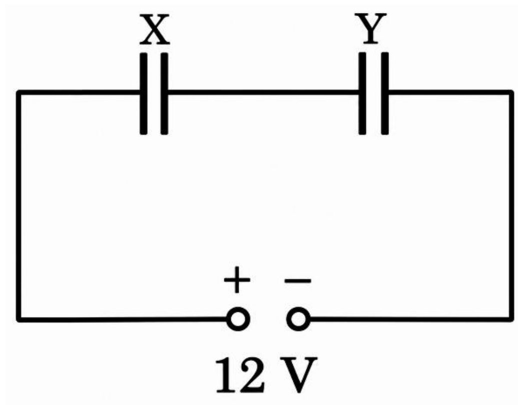
76. In the circuit shown in figure, the charge on the capacitor of 4 μF is 16 μC. Calculate the energy stored in the capacitor of 12 μF capacitance.



77. Figure shows two identical capacitors, $C_1$and C_2, each of 1μF capacitance connected to a battery of 6V . Initially switch 'S' is closed. After some time 'S' is left open and dielectric slabs of dielectric constant κ = 3 are inserted to fill completely the space between the plates of the two capacitors. How will the (i) charge and (ii) potential difference between the plates of the capacitors be affected after the slabs are inserted?



78. Two parallel plate capacitors, X and Y, have the same area of plates and same separation between them. X has air between the plates while Y contains a dielectric medium of $\varepsilon_r = 4$.

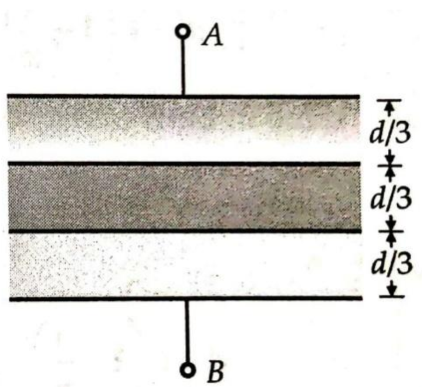


(i) Calculate capacitance of a capacitor if equivalent capacitance of the combination is 4 μF.

(ii) Calculate the potential difference between the plates of X and Y.

(iii) Estimate the ratio of electrostatic energy stored in X and Y.

79. Figure shows a parallel plate capacitor of plate area A and plate separation d. Its entire space is filled with three different dielectric slabs of same thickness. Find the equivalent capacitance of the arrangement.



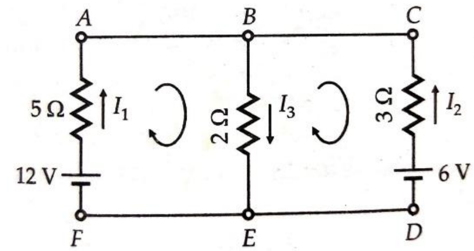
80. The magnetic field in a plane electromagnetic wave is given by $B_y = 12 \times 10^{-8} \sin(1.20 \times 10^{7} z + 3.60 \times 10^{15} t)$. Calculate the

(a) Energy density associated with the Electromagnetic waves

(b) Speed of the wave.

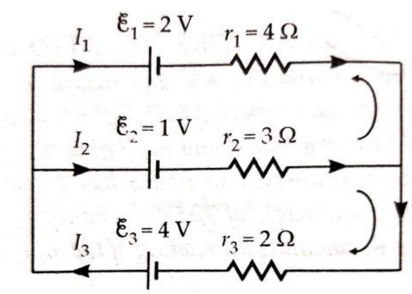
3MARKS

81. Using Kirchhoff's laws in the electrical network shown in figure, calculate the values of I_1, I_2 and I_3.



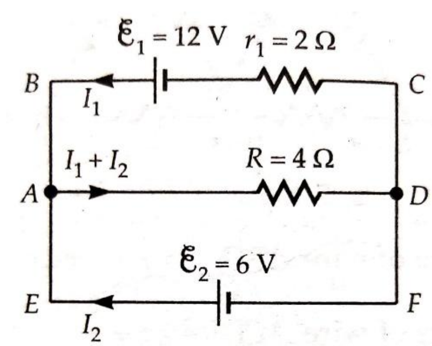
Ans: I_1=48/31 A, I_2= 18/31 A and I_3= 66/31 A

82. Use Kirchhoff's rules to write the expression for the currentsI_1, I_2 and I_3 in the circuit diagram shown in figure.



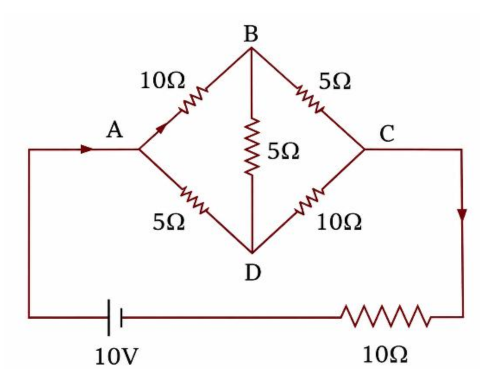
Ans:I_1= 2/13 A, I_2 =7/13 A, and I_3 = 9/13 A

83. In the electric network shown in figure, use Kirchhoff's rules to calculate the CURRENT in the resistance R=4Ω.



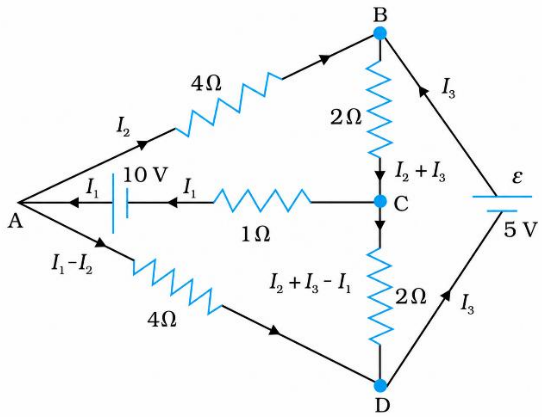
Ans: 1.5 A

84. Determine the current in each branch of the network shown in



ANS: The current in branch AB is 4/17. The current in branch BC is 6/17. The current in branch CD is 4/17. The current in branch AD is 6/17. The current in branch BD is 2/17.

85. Determine the current in each branch of the network shown in Fig.

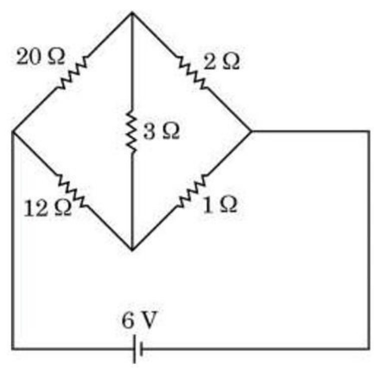


The currents in the various branches of the network are

AB : $\frac{5}{8}$ A, CA : $2\frac{1}{2}$ A, DEB : $1\frac{7}{8}$ A

AD : $1\frac{7}{8}$ A, CD : 0 A, BC : $2\frac{1}{2}$ A

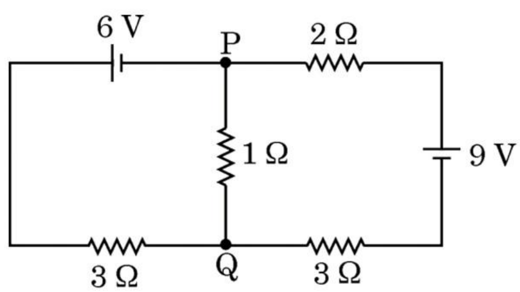
86. Determine the current in 3 Ω branch of a Wheatstone Bridge in the circuit shown in the figure.



ANS: 12/821 A

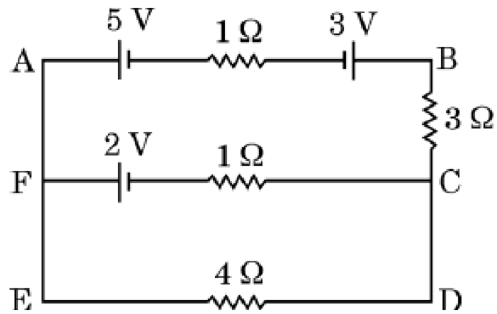
87. (a) The two Kirchhoff 's rules are based on law of conservation of two physical quantities. Name the quantities.

(b) Find magnitude and direction of current in 1 Ω resistor in the given circuit.



ANS: 3/23 A

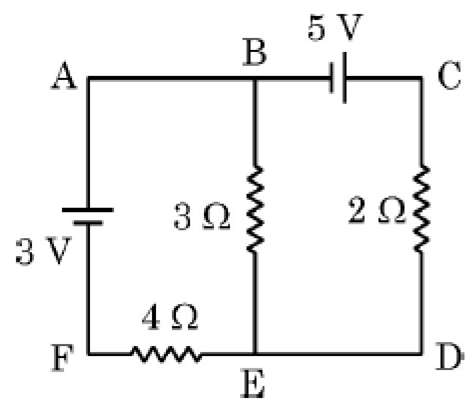
88. State Kirchhoff 's rules. Using these rules, find the current flowing through branch FC in the given circuit.



Ans: 1/3 A

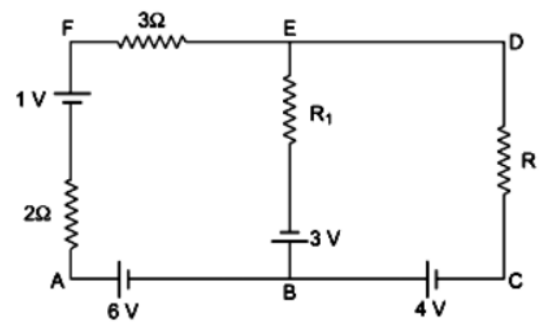
89. (a) Explain the statement: "Current is a scalar although we represent current with an arrow".

(b) Use Kirchhoff's rules to find the current through 3 Ω resistor in the circuit shown in the figure:



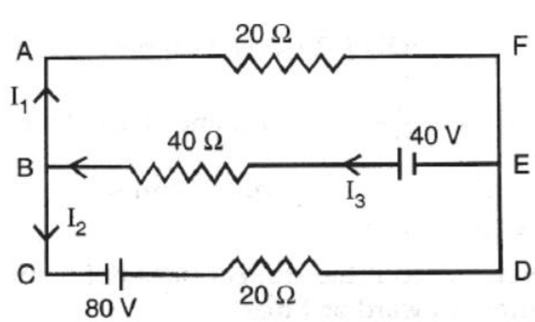
Ans:7/13 A

90. 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.

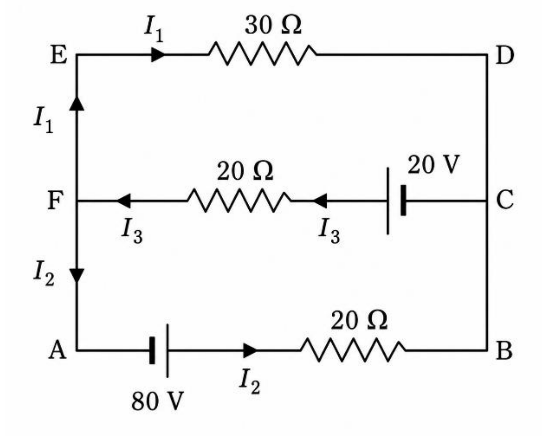


Ans:9V

91. State Kirchhoff 's laws of current distribution in an electrical network. Using these rules determine the value of the current I_1 in the electric circuit given.

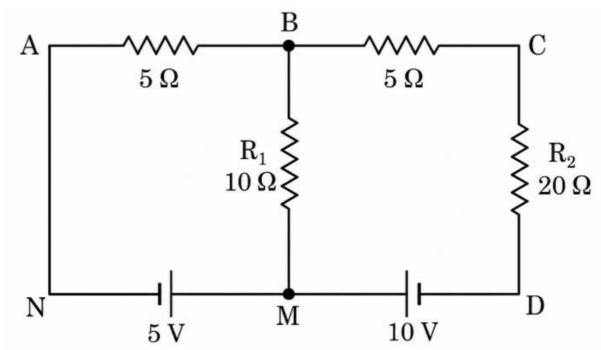


92. State Kirchhoff 's laws of current distribution in an electrical network. Using these rules determine the value of the current I_1 in the electric circuit given.



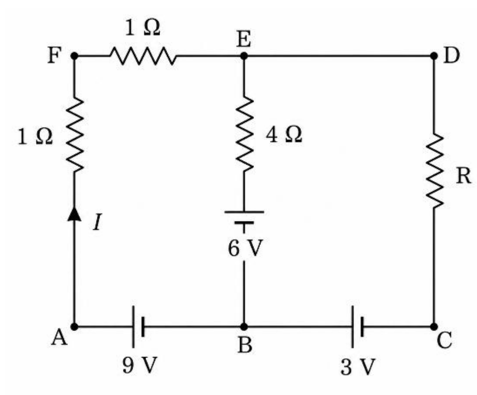
ANS: 0 .75A

93. Find the currents flowing through the branches AB and BC in the network shown.



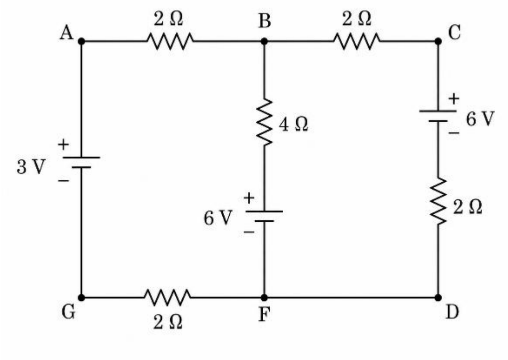
ANS: 3/17 A and 4/17 A

94. Using Kirchoff's rules determine the value of unknown resistance R in the circuit shown in figure, so that no current flows through 4 Ω resistance. Also find the potential difference between A and D.



ANS:3V

95. The figure shows a circuit with three ideal batteries. Find the magnitude and direction of currents in the branches AG, BF and CD.



ANS: 1/3 A, 1/4 A, 1/4 A

5MARKS

96. Using Biot-Savart's law, deduce an expression for the magnetic field at the centre of a circular current carrying loop of radius R.

97. Using Biot-Savart's law, deduce an expression for the magnetic field on the axis of a circular current carrying loop of radius R. Also, find the ratio of the magnitudes of the magnetic field of this coil at the centre and at an axial point for which d$= a\sqrt{3}$.

98. A long straight wire of a circular cross – section of radius a carry a steady current I. The current is uniformly distributed across the cross – section. Apply ampere's circuital law to calculate the magnetic field at a point in the region for (i) r < a, and (ii) r > a.

99. A long solenoid of length L having N turns carries a current I. deduce the expression for the magnetic field in the interior of the solenoid.

100. Two long straight parallel conductors carrying steady currents I_1 and I_2 are separated by a distance d. Explain briefly with the help of a suitable diagram, how the magnetic field due to one conductor acts the other. Hence, deduce the expression for the force acting between the two conductors. Mention the nature of this force. Using the concept of force between two infinitely long parallel current carrying conductors define one ampere of current.

101. Draw a labelled diagram of a moving coil galvanometer and explain its working. What is the function of radial magnetic field inside the coil?

102. State the underlying principle of a moving coil galvanometer. Write two reasons why a galvanometer cannot be used as such to measure the current in a given circuit. Name any two factors which the current sensitivity of a galvanometer depends.

103. Define current sensitivity and voltage sensitivity of galvanometer. Increasing the current sensitivity may not necessarily increase the voltage sensitivity of a galvanometer, justify your answer.

104. How is a moving coil galvanometer converted into a voltmeter? Explain giving the necessary circuit diagram and the required mathematical relation used.

105. 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?

106. Define the terms

(i) Current sensitivity and

(ii) Voltage sensitivity of a galvanometer.

Why does increasing the current sensitivity not necessarily increase voltage sensitivity?

107. Explain giving reasons, the basic difference in converting a galvanometer into (a) a voltmeter and (b) an ammeter.

108. Derive an expression for the drift velocity of free electrons in a conductor in terms of relaxation time.

109. Derive an expression for the current density of the conductor in terms of the drift speed of the electrons.

110. Define the term 'drift velocity' of charge carriers in a conductor. Obtain the expression for the current density in terms of relaxation time.

111. Use this relation to deduce the expression for the electrical resistivity of the material.

112. Derive the relation between current density j and potential difference V across a current carrying conductor of length ***l***, area of cross-section A and the number density ***n*** of free electrons.

113. Define relaxation time of electrons in a conductor. Explain how it varies with increase in temperature of a conductor. State the relation between resistivity and relaxation time.

114. Two cells of emf E_1 , E_2 and internal resistances r_1 and r_2 respectively are connected in parallel. Derive the expression for the emf and internal resistance of a cell which replace this combination.

115. State Kirchhoff's rule, obtain the balance condition in terms of the resistances of four arms of Wheatstone bridge.

116. (a) Obtain an expression for the potential energy of an electric dipole placed in a uniform electric field.

(b) Three capacitors of capacitance C_1 , C_2 and C_3 are connected in series to a source of Vvolt. Show that the total energy stored in the combination of capacitors is equal to sum of the energy stored in individual capacitors.

(c) A capacitor of capacitance Cis connected across a battery. After charging, the battery is disconnected and the separation between the plates is doubled. How will (i) the capacitance of the capacitor, and (ii) the electric field between the plates be affected? Justify your answer

116. An emf ε = 100 sin 314 t is applied across a pure capacitor of 637 μ F. Find

(a) the instantaneous current I

(b) instantaneous power P

(c) the frequency of power and

(d) the maximum energy stored in the capacitor.

117. Define self - inductance of a coil. Obtain the expression for the energy stored in an inductor L connected across a source of emf.

118. A toroidal solenoid with an air core has an average radius of 0.15 m, area of cross section$12 \times 10^{-4} m^2$ and 1200 turns. Obtain the self inductance of the toroid. Ignore field variation across the cross section of the toroid.

119. A second coil of 300 turns is wound closely on the toroid above. If the current in the primary coil is increased from zero to 2.0 A in 0.05 s, obtain the induced emf in the secondary coil.

120. (a) Draw a labelled diagram of a step - up transformer and describe its working principle. Explain any three causes for energy losses in a real transformer.

(b) A step - up transformer converts a low voltage into high voltage. Does it violate the principle of conservation of energy? Explain.

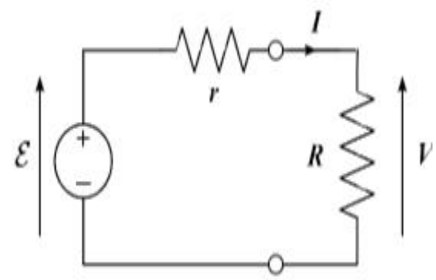
(c) A step - up transformer has 200 and 3000 turns in its primary and secondary coils respectively. The input voltage given to the primary coil is 90 V. Calculate:

a. The output voltage across the secondary coil

b. The current in the primary coil if the current in the secondary coil is 2.0 A.

<u>CBQ</u>

121. **Read the text carefully and answer the questions: Internal resistance** refers to the opposition to the flow of current offered by the **cells** and batteries themselves resulting in the generation of heat. **Internal resistance** is measured in Ohms.



a) Internal resistance of a cell is due to: -

a) Electrode resistance

b) Surface contact resistance between electrode and electrolyte

c) Resistance of electrolyte

d) all of these

b) Terminal potential difference of a battery depends upon?

a) temperature

b) current

c) resistance of external resistor.

d) Both current and temperature

c) On increasing the current drawn from a cell, the potential difference of its terminal is:

a) constant

b) increased

c) unchanged

d) decreased

d) When cells are connected in parallel current capacity will

a) decreased

b) unchanged

c) increase

d) Constant

e) The SI unit of conductance is: -

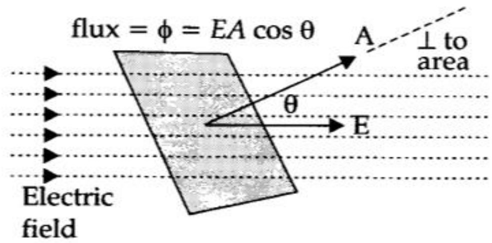
a) mho - m^{-1}

b) ohm - m

c) ohm

d) mho

122. The total number of electric field lines passing a given area in a unit time is defined as the electric flux.



If the plane is normal to the flow of the electric field, the total flux is given as:

ϕ = EA

When the same plane is tilted at an angle θ , the projected area is given as A cos θ and the total flux through this surface is given as:

ϕ = EA cos θ

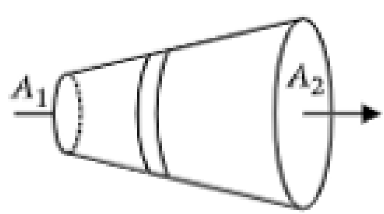
where, E is the magnitude of the electric field. A is the area of the surface through which the electric flux is to be calculated.

(a) If a unit positive charge is kept in the air, then what is the total flux coming out of unit charge? (1)

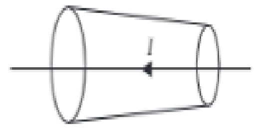
(b) What is the value of electric flux (φ)on a plane of area 1 m^2 on which an electric field of 2 V/mcrosses with an angle of 30^o . (2)

(c) When is the flux through a surface taken as positive? (1)

123. The flow of charge in a particular direction constitutes the electric current. Current is measured in Ampere. Quantitatively, electric current in a conductor across an area held perpendicular to the direction of flow of charge is defined as the amount of charge is flowing across that area per unit time. Current density at a point in a conductor is the ratio of the current at that point in the conductor to the area of cross - section of the conductor of that point. The given figure shows a steady current flows in a metallic conductor of a nonuniform cross - section. Current density depends inversely on area, so, here $J_1 > J_2$, as $A_1 < A_2$.



(a) A constant current Iis flowing along the length of a conductor of variable cross - section as shown in the figure. The quantity which does not depend upon the area of cross - section is



a. drift velocity

b. current density

c. electron density

d. electric field

(b) When a current of40 A flows through a conductor of area 10 m^2 , then the current density is

a) 1 A/m^2

b) 4 A/m^2

c) 2 A/m^2

d) 8 A/m^2

(c) A steady current flows in a metallic conductor of the non - uniform cross - section. Which of these quantities is constant along the conductor?

a) Electric field

b) Current density

c) Current

d) Drift velocity

(d) What is the current flowing through a conductor, if one million electrons are crossing in one millisecond through a cross - section of it?

a) 7.5×10^{-10} A

b) 8.2×10^{-10} A

c) 1.6×10^{-10} A

d) 2.5×10^{-10} A