CBSE Sample Question Paper Term 1

Class – XII (Session : 2021 - 22)

SUBJECT - PHYSICS 042 - TEST - 05

Class 12 - Physics

Time Allowed: 1 hour and 30 minutes **Maximum Marks: 35**

General Instructions:

1. The Question Paper contains three sections.
2. Section A has 25 questions. Attempt any 20 questions.
3. Section B has 24 questions. Attempt any20 questions.
4. Section C has 6 questions. Attempt any 5 questions.
5. All questions carry equal marks.
6. There is no negative marking.

Section A

Attempt any 20 questions

1. Let E_a be the electric field due to a dipole in its axial plane distant l and let E_q be the field in the equatorial plane distant l. The relation between E_a and E_q is: **[0.77]**

   a) $E_a = 2E_q$ b) $E_a = E_q$

   c) $E_q = 2E_a$ d) $E_a = 3E_q$

2. Electric potential of earth is taken to be zero, because earth is a good **[0.77]**

   a) insulator b) semiconductor

   c) conductor d) dielectric

3. The wire of the potentiometer has resistance 4 ohms and length 1 m. It is connected to a cell of e.m.f. 2 volts and internal resistance 1 ohm, if a cell of e.m.f. 1.2 volt is balanced by it, the balancing length will be **[0.77]**

   a) 60 cm b) 50 cm

   c) 90 cm d) 75 cm

4. What would happen if a plastic rod rubbed with fur is brought near the glass rod rubbed with silk? **[0.77]**

   a) None of these b) Attract each other.

   c) Mix up with each other. d) Repel each other.

5. Two infinite plane parallel non conducting sheets, separated by a distance d have equal and opposite charge densities σ. Electric field intensity at a point between the sheets is: **[0.77]**

   a) depends upon location of the point b) $\frac{\sigma}{2\varepsilon_0}$

c) zero

d) $\frac{\sigma}{\varepsilon_0}$

6. According to Kirchhoff's Loop Rule, **[0.77]**

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

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

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

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

7. In a pure inductive circuit with a.c. source, the current lags behind emf by phase angle of **[0.77]**

a) $\frac{\pi}{2}$

b) $\frac{\pi}{4}$

c) 2π

d) π

8. The susceptibility of a paramagnetic material is χ at 27° C. At what temperature will its susceptibility be $\frac{\chi}{2}$? **[0.77]**

a) 54° C

b) 327° C

c) 237° C

d) 1600° C

9. In a coil of self-induction 5 H, the rate of change of current is 2 A s^{-1}. Then, e.m.f. induced in the coil is **[0.77]**

a) 10 V

b) -10 V

c) -5 V

d) 5 V

10. A coil of self-inductance 50 H is joined to the terminals of a battery of emf 2 V through a resistance of 10 Ω. What is the time-constant and maximum current finally established in the circuit? **[0.77]**

a) 5 s and 0.2 A

b) 3 s and 0.5 A

c) 1s and 0.3 A

d) 8 s and 0.8 A

11. A galvanometer coil has a resistance of 10 Ω and the meter shows full-scale deflection for a current of 1 mA. The shunt resistance required to convert the galvanometer into an ammeter of range 0 - 100 mA is about: **[0.77]**

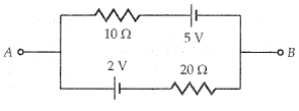
a) 0.01 Ω

b) 0.1 Ω

c) 10 Ω

d) 1 Ω

12. The current I in the given circuit is: **[0.77]**



a) 0.3 A

b) 0.4 A

c) 0.1 A

d) 0.2 A

13. A uniformly wound long solenoid of inductance L and resistance R is broken into two equal parts in the ratio $\frac{\eta}{1}$, which are then joined in parallel. This combination is then joined to a cell of emf ε. The time constant of the circuit is **[0.77]**

a) $\frac{2L}{R}$ b) $\frac{L}{R}$

c) $\frac{L}{2R}$ d) $\frac{L}{R^2}$

14. The primary winding of a transformer has 500 turns, whereas its secondary has 5,000 turns. The primary is connected to an a.c. supply 20 V-50 Hz. The secondary will have an output of: **[0.77]**

a) 200 V - 50 Hz b) 200 V - 500 Hz

c) 2 V - 50 Hz d) 2 V - 5 Hz

15. The number of electrons for one coulomb of charge is **[0.77]**

a) 6.25×10^{19} b) 6.25×10^{23}

c) 6.25×10^{21} d) 6.25×10^{18}

16. If the electric current in a lamp decreases by 5%, then the power output decreases by: **[0.77]**

a) 20% b) 25%

c) 10% d) 5%

17. What uniform magnetic field applied perpendicular to a beam of electrons moving at 1.3×10^6 m/s, is required to make the electrons travel in a circular arc of radius 0.35 m? **[0.77]**

a) 2.11×10^{-5} T b) 6×10^{-5} G

c) 6×10^{-5} T d) 2.1×10^{-5} G

18. Choose the correct statement. **[0.77]**

i. The capacitor can conduct in a d.c. circuit but not an inductor.
ii. In d.c. circuit the inductor can conduct but not a capacitor.
iii. in d.c. circuit both the inductor and capacitor cannot conduct.
iv. The inductor has infinite resistance in a d.c. circuit.

a) Option (i) b) Option (iv)

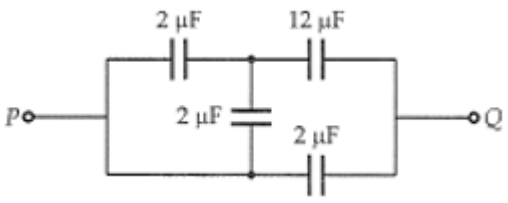
c) Option (iii) d) Option (ii)

19. A tape-recorder records sound in the form of **[0.77]**

a) magnetic energy b) the magnetic field on the tape

c) electrical energy d) variable resistance on the tape

20. Four capacitors are connected in a circuit as shown in the figure. The effective capacitance between P and Q will be **[0.77]**



a) 7.5 μF b) 5 μF

c) 2 μF d) 10 μF

21. When a negatively charged conductor is connected to earth **[0.77]**

a) Electrons flow from the earth to the conductor

b) Protons flow from the conductor to the earth

c) No charge flow occurs

d) Electrons flow from the conductor to the earth

22. What are the dimensions of impedance? **[0.77]**

a) $ML^3T^{-3}I^{-2}$

b) $M^{-1}L^2T^3I^2$

c) $ML^2T^{-3}I^{-2}$

d) $M^{-1}L^3T^3I^2$

23. A long solenoid has 800 turns per meter. A current of 1.6 A flows through it. The magnetic induction at the end of solenoid on its axis is **[0.77]**

a) $16.0 \times 10^{-4}T$

b) $8.04 \times 10^{-4}T$

c) $4.0 \times 10^{-4}T$

d) $2.0 \times 10^{-4}T$

24. Tesla is the unit of **[0.77]**

a) magnetic induction

b) electric field

c) electric flux

d) magnetic flux

25. A proton travelling at 23° w.r.t the direction of a magnetic field of a strength 2.6 mT experiences, a magnetic force of 6.5×10^{-17} N. What is the speed of the proton? **[0.77]**

a) 6×10^5 m/second

b) 8×10^5 m/second

c) 2×10^5 m/second

d) 4×10^5 m/second

Section B

Attempt any 20 questions

26. A positively charged particle moving due east enters a region of uniform magnetic field directed vertically upward. The particle will: **[0.77]**

a) move in a circular path with an increased speed

b) get deflected in a vertically upward direction

c) move in a circular path with a decreased speed

d) move in a circular path with a uniform speed

27. If potential (in volts) in a region is expressed as V(x, y, z) = 6xy - y + 2yz, the electric field (in N/C) at point (1, 1, 0) is: **[0.77]**

a) $-(3\hat{i} + 5\hat{j} + 3\hat{k})$

b) $-(2\hat{i} + 3\hat{j} + \hat{k})$

c) $-(6\hat{i} + 5\hat{j} + 2\hat{k})$

d) $(6\hat{i} + 5\hat{j} + 2\hat{k})$

28. Two equal negative charges -q are fixed at points (0, a) and (0, -a). A positive charge Q is released from rest at the point (2a, 0) on the x-axis. The charge Q will: **[0.77]**

a) Move to origin and remain at rest

b) Execute oscillation but not SHM

c) Execute SHM about the origin

d) Move to infinity

29. A step down transformer is used on a 1000 V line to deliver 20 A at 120 V at the secondary coil. If the efficiency of the transformer is 80%, the current drawn from the line is **[0.77]**

a) 3 A
b) 30 A
c) 2.4 A
d) 0.3 A

30. Whenever a magnet is moved either towards or away from a conducting coil, an e.m.f is induced, the magnitude of which is independent of **[0.77]**

a) the number of turns in the coil
b) the resistance of the coil
c) the speed with which, the magnet is moved
d) the strength of the magnetic field

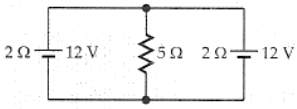
31. Angle of dip is 90° at **[0.77]**

a) both poles and equator
b) equator
c) poles
d) none of these

32. If the speed of rotation of a dynamo is doubled, then the induced e.m.f. will **[0.77]**

a) become four times
b) become half
c) become double
d) remain unchanged

33. In the arrangement shown in the figure, the current through 5 Ω resistor is: **[0.77]**



a) $\frac{12}{7}$
b) 2 A
c) Zero
d) 1 A

34. The potential at the centre of the sphere, if the hollow metallic sphere of radius 10 cm is charged such that the potential of its surface is 70 V, is **[0.77]**

a) 35 V
b) 7 V
c) 70 V
d) 100 V

35. In a meter bridge experiment, a balance point is obtained at a distance of 60 cm from the left end when unknown resistance R is in a left gap and 8 ohms resistor is connected in the right gap. When the position of R and 8 ohm resistor is interchanged the balance point will be at distance of **[0.77]**

a) 40 cm
b) 30 cm
c) 60 cm
d) 50 cm

36. Alternating current can not be measured by d.c. ammeter, because: **[0.77]**

a) average value of current of complete cycle is zero
b) a.c. cannot pass through a.c. ammeter
c) a.c. ammeter will get damaged
d) a.c. changes direction

37. A straight line conductor of length 0.4 m is moved with a speed of 7 ms^{-1} perpendiculars to the magnetic field of intensity 0.9 Wbm^{-2}. The induced emf across the conductor is **[0.77]**

a) 5.24 V
b) 25.2 V
c) 2.52 V
d) 1.26 V

38. The μ_0 is also known as : **[0.77]**

a) magnetic dipole

b) Absolute Permittivity

c) Magnetic dipole moment

d) Magnetic flux

39. In a series RLC circuit R = 300 Ω, L = 60 mH, C = 0.50 μF applied voltage V = 50 V and ω = 10,000 rad/s. Inductive reactance X_L, capacitive reactance X_C and impedance Z are **[0.77]**

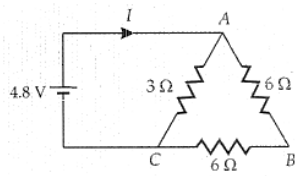
a) 600 Ω, 200 Ω and 500Ω

b) 450 Ω, 200 Ω and 450 Ω

c) 550 Ω, 300 Ω and 100 Ω

d) 500 Ω, 250 Ω and 500 Ω

40. The current in the given circuit is: **[0.77]**



a) 2 A

b) 4.92 A

c) 8.31 A

d) 6.28 A

41. In India, electricity is supplied for domestic use at 220 V. It is supplied at 110 V in the U.S.A. If the resistance of a 60 W bulb for use in India is R, the resistance of a 60 W bulb for use in the U.S.A. will be: **[0.77]**

a) 2R

b) $\frac{R}{4}$

c) R

d) $\frac{R}{2}$

42. An electric dipole with dipole moment 4×10^{-9}Cm is aligned at 30° with the direction of a uniform electric field of magnitude $5 \times 10^{4}\mathrm{N/C}$. Calculate the magnitude of the torque acting on the dipole. **[0.77]**

a) 1.0×10^{-4}Nm

b) 1.5×10^{-8}Nm

c) 2.5×10^{-4}Nm

d) 3.5×10^{-4}Nm

43. Two infinitely long wires carry currents in opposite directions. Then the field at a point P lying midway between them is **[0.77]**

a) twice the field due to each wire alone

b) square of the field due to each wire alone

c) zero

d) half of the field due to each wire alone

44. The force between two magnetic poles is F. If the distance between the poles and pole strengths of each pole are doubled, then the force experienced is: **[0.77]**

a) F

b) $\frac{F}{4}$

c) 2F

d) $\frac{F}{2}$

45. **Assertion (A):** Electric potential of the earth is taken zero. **[0.77]**
Reason (R): No electric field exists on the earth's surface.

a) Both A and R are true and R is the

b) Both A and R are true but R is not the

correct explanation of A.

correct explanation of A.

c) A is true but R is false.

d) A is false but R is true.

46. **Assertion (A):** If a compass needle is kept at the magnetic north pole of the earth the compass needle may stay in any direction. **[0.77]**

Reason (R): Dip needle will stay vertical at the north pole of the earth.

a) Both A and R are true and R is the correct explanation of A.

b) Both A and R are true but R is not the correct explanation of A.

c) A is true but R is false.

d) A is false but R is true.

47. **Assertion (A):** A piece of copper and a similar piece of stone are dropped simultaneously from a height near the earth's surface. Both will touch the ground at the same time. **[0.77]**

Reason (R): There is no effect of the earth's magnetic field on the motion of falling bodies.

a) Both A and R are true and R is the correct explanation of A

b) Both A and R are true but R is NOT the correct explanation of A

c) A is true but R is false

d) A is false and R is also false

48. **Assertion (A):** Faraday's laws are consequences of the conservation of energy. **[0.77]**

Reason (R): In a purely resistive AC circuit, the current lags behind the emf in phase.

a) Both A and R are true and R is the correct explanation of A.

b) Both A and R are true but R is not the correct explanation of A.

c) A is true but R is false.

d) A is false but R is true.

49. **Assertion (A):** A metallic shield in form of a hollow shell may be built to block an electric field. **[0.77]**

Reason (R): In a hollow spherical shield, the electric field inside it is zero at every point.

a) Both A and R are true and R is the correct explanation of A.

b) Both A and R are true but R is not the correct explanation of A.

c) A is true but R is false.

d) A is false but R is true.

Section C

Attempt any 5 questions

50. Four-point charges -Q, -q, 2q, and 2Q are placed, one at each corner of the square. The relation between Q and q for which the potential at the centre of the square is zero is: **[0.77]**

a) $Q = -\frac{1}{q}$

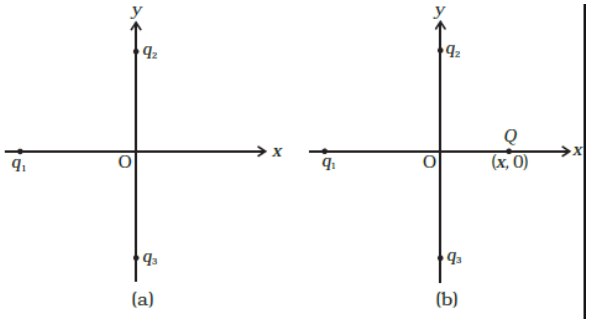
b) $Q = \frac{1}{q}$

c) Q = -q

d) Q = q

51. In Fig, two positive charges q_2 and q_3 fixed along the y axis, exert a net electric force in the + x direction on a charge q_1 fixed along the x axis. If a positive charge Q is added at (x, 0), **[0.77]**

the force on q_1



a) shall increase along the positive x-axis.

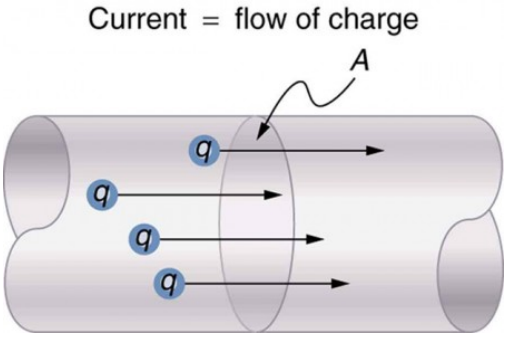
b) shall point along the negative x-axis.

c) shall decrease along the positive x-axis.

d) shall increase but the direction changes because of the intersection of Q with q_2 and q_3.

Question No. 52 to 55 are based on the given text. Read the text carefully and answer the questions:

The rate of flow of charge through any cross-section of a wire is called electric current flowing through it. Electric current (I) = $\frac{q}{t}$. Its SI unit is ampere (A). The conventional direction of electric current is the direction of motion of positive charge. The current is the same for all cross-sections of a conductor of the non-uniform cross-section. Resistance is a measure of the opposition to current flow in an electrical circuit.



52. An example of non-ohmic resistance is: **[0.77]**

a) carbon resistance

b) tungsten wire

c) diode

d) copper wire

53. Current is: **[0.77]**

a) both scalar and vector quantity

b) vector quantity

c) scalar quantity

d) none of these

54. In a current-carrying conductor, the net charge is: **[0.77]**

a) zero

b) 6.25×10^{-18} coulomb

c) 1.6×10^{-19} coulomb

d) infinite

55. The current which is assumed to be flowing in a circuit from the positive terminal to negative is called: **[0.77]**

a) none of these

b) conventional current

c) pulsating current

d) direct current

Solution

SUBJECT - PHYSICS 042 - TEST - 05

Class 12 - Physics

Section A

1. **(a)** $E_a = 2E_q$

   Explanation: Electric field at any axial point is twice the electric field at the same distance along the equatorial line

   $\therefore E_a = 2E_q$

2. **(c)** conductor

   Explanation: Earth is a conducting sphere of large capacitance.

   $V = \frac{q}{C}$

   As C is very large, so V $\times$ 0 for all finite charges.

3. **(d)** 75 cm

   Explanation: If the battery has e.m.f E, resistance of the potentiometer is R and the internal resistance of the battery is r, then the current I flowing in the potentiometer wire is given by,

   $I = \frac{E}{(R+r)}$

   $I = \frac{2}{(4+1)}$

   I = 0.4 A

   The potential difference V across the potentiometer

   $V = I \times R$

   $\Rightarrow V = 0.4 \times 4$

   V = 1.6V

   The potential gradient = (potential drop across the potentiometer)/ length of the potentiometer wire)

   $= \frac{V}{l}$

   $= \frac{1.6}{1}$

   $\Rightarrow$ Potential gradient = 1.6V/m

   The emf of the cell

   $E_1 = (Potential\ gradient \times Balancing\ length)$

   $\Rightarrow L = \frac{E_1}{Potential\ gradient} = \frac{1.2}{1.6}$

   L = 0.75 m

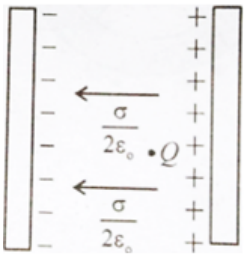
   or L = 75 cm

4. **(b)** Attract each other.

   Explanation: Rubbing a rod with certain materials causes the loss of electron and it will cause the rod to become charged. If a plastic rod rubbed with fur becomes negatively charged and a glass rod rubbed with silk becomes positively charged.

5. **(d)** $\frac{\sigma}{\varepsilon_0}$

   Explanation:

   Field due to a parallel infinite non conducting sheet is given by $E = \frac{\sigma}{2\epsilon_0}$

   As two plates are placed parallel, at a point between them field due to positively charged plate will be along the negative plate and due to negatively charged plate field is also towards negatively charged plate.

   Thus total field E = $\frac{\sigma}{2\epsilon_0} + \frac{\sigma}{2\epsilon_0} = \frac{\sigma}{\epsilon_0}$ towards left.

6. **(b)** The algebraic sum of changes in potential around any closed loop must be zero.
Explanation: Kirchhoff's loop rule is based on the principle of conservation of energy. Since work done in transporting a charge in a closed loop is zero. The algebraic sum (since potential differences can be both positive and negative) of potential differences around any closed loop is always zero.

7. **(a)** $\frac{\pi}{2}$
Explanation: $E = E_0 \sin \omega t$
$i = i_0 \sin\left(\omega t - \frac{\pi}{2}\right)$

8. **(b)** 327° C
Explanation: $\frac{\chi_2}{\chi_1} = \frac{T_2}{T_1}$
$T_2 = \frac{\chi_1}{\chi_2} \cdot T_1 = \frac{\chi}{\chi/2}$(273 + 27)K = 600 K = 327° C

9. **(b)** -10 V
Explanation: The induced e.m.f.
$= -L(\frac{dl}{dt}) = -5 \times 2$ = -10V

10. **(a)** 5 s and 0.2 A
Explanation: Time constant of LR-circuit,
$\tau = \frac{L}{R} = \frac{50}{10}$ = 5 s
$I_0 = \frac{V}{R} = \frac{2}{10}$ = 0.2 A

11. **(b)** 0.1 Ω
Explanation: $S = \frac{I_g G}{I - I_g}$
$= \frac{10^{-3} \times 10}{(100-1) \times 10^{-3}} = \frac{10}{99} = 0.1\Omega$

12. **(c)** 0.1 A
Explanation: The two cells are connected oppositely.
Total emf = 5 - 2 = 3 V
Total resistance = 10 + 20 = 30 Ω
Current = $\frac{3\ \text{V}}{30\Omega}$ = 0.1 A

13. **(b)** $\frac{L}{R}$
Explanation: $L_1 = \left(\frac{\eta}{\eta+1}\right) L, R_1 = \left(\frac{\eta}{\eta+1}\right) R$
$L_2 = \left(\frac{1}{\eta+1}\right) L, R_2 = \left(\frac{1}{\eta+1}\right) R$
$L_{net} = \frac{L_1 L_2}{L_1 + L_2} = \frac{\eta L L}{(\eta+1)(\eta L + L)}$
Similarly, $R_{net} = \frac{R_1 R_2}{R_1 + R_2} = \frac{\eta R R}{(\eta+1)(\eta R + R)}$
$\tau_L = \frac{L_{net}}{R_{net}} = \frac{L}{R}$

14. **(a)** 200 V - 50 Hz
Explanation: $\varepsilon_s = \frac{N_s}{N} \cdot \varepsilon_p$
$= \frac{5000}{500} \times 20 = 200$ V
frequency remains the same.

15. **(d)** 6.25×10^{18}
Explanation: n = $\frac{q}{e} = \frac{1\text{C}}{1.6 \times 10^{-19}\text{C}}$
= 6.25×10^{18}

16. **(c)** 10%
Explanation: Let original Current In lamp = I
Resistance of Lamp = R
Then power P = I^2R
According to question,

New Current $I_n = I - I \times \frac{5}{100} = \frac{19}{20} I$

Resistance = R

New power $P_n = I_n^2 R = (\frac{19}{20} I)^2 R = \frac{361}{400} I^2 R$

Power decrease = $I^2 R - \frac{361}{400} I^2 R = \frac{39}{400} I^2 R$

% Decrease = $\frac{change\ in\ power}{original\ power} \times 100$

$= \frac{\frac{39}{400} I^2 R}{I^2 R} \times 100 = \frac{39 I^2 R}{400 I^2 R} \times 100$

$= \frac{39}{4} = 9.75\% \approx 10\%$

17. **(a)** 2.11×10^{-5} T

Explanation: From $\mathbf{r} = \frac{\mathbf{mv}}{\mathbf{qB}}$ we find

$\mathbf{B} = \frac{\mathbf{m_e v}}{\mathbf{er}}$

$= \frac{(9.11 \times 10^{-31}\ \text{kg})(1.30 \times 10^{6}\ \text{m/s})}{(1.60 \times 10^{-19}\text{C})(0.350\ \text{m})}$

= 2.11×10^{-5} T.

18. **(d)** Option (ii)

Explanation: In a d.c. circuit, an inductor can conduct but not a capacitor. An inductor offers zero resistance to d.c.

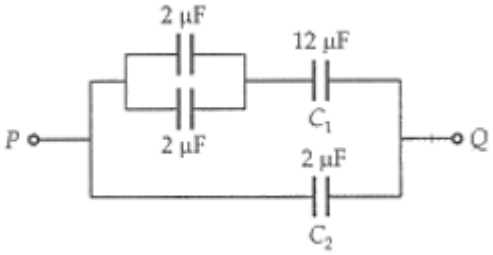
19. **(b)** the magnetic field on the tape

Explanation: A tape is coated with tiny magnet particles. These particles get magnetized when the electric signal passes through them. Thus, a tape recorder records sound in the form of a magnetic field on the tape.

20. **(b)** 5 μF

Explanation:

The equivalent circuit is



C' = 2 μF + 2 μF = 4 μF

C' and C_1 are in series with effective capacitance,

$C'' = \frac{C' \times C_1}{C' + C_1} = \frac{4 \times 12}{4 + 12} = \frac{48}{16} = 3\mu\text{F}$

The effective capacitance between P and Q

C = C'' + C_2 = 3 + 2 = 5 μF

21. **(d)** Electrons flow from the conductor to the earth

Explanation: After earthing a positively charged conductor electrons flow from earth to conductor and if a negatively charged conductor is earthed then electrons flows from conductor to earth.

22. **(c)** $ML^2T^{-3}I^{-2}$

Explanation: Impedance has the same dimensions as the resistance.

$[Z] = [R] = \frac{V}{I} = \frac{ML^2\ T^{-3}I^{-1}}{I^{-1}} = \left[ML^2\ T^{-3}I^{-2}\right]$

23. **(b)** $8.04 \times 10^{-4} T$

Explanation: The magnetic induction at the end of the solenoid on its axis

$B = \frac{1}{2}\mu_0 Ni$

$\mu_0 = 4\pi \times 10^{-7}$ N/A^2

N = 800 turns/meter

i = 1.6 amp

$B = \frac{1}{2} \times 4\pi \times 10^{-7} \times 800 \times 1.6 = 8.04 \times 10^{-4}$T

24. **(a)** magnetic induction
Explanation: magnetic induction

25. **(d)** 4×10^5 m/second
Explanation: $v = \frac{F}{qB\sin\theta}$
$= \frac{6.5\times10^{-17}}{1.6\times10^{-19}\times2.6\times10^{-3}\times\sin 23^\circ}\text{ms}^{-1}$
$= \frac{6.5\times10^{5}}{1.6\times2.6\times0.39}\text{ ms}^{-1}$
= 4×10^5 m/second

Section B

26. **(d)** move in a circular path with a uniform speed
Explanation: The perpendicular magnetic force continuously deflects the charge from its path making it move along a circular path with a uniform speed.

27. **(c)** $-(6\hat{i} + 5\hat{j} + 2\hat{k})$
Explanation: $\vec{E} = -\frac{\partial V}{\partial x}\hat{i} - \frac{\partial V}{\partial y}\hat{j} - \frac{\partial V}{\partial z}\hat{k}$
$\vec{E} = -(6y)\hat{i} - (6x - 1y + 2z)\hat{j} - (2y)\hat{k}$
At the point (1, 1, 0),
$\vec{E} = -6\hat{i} - 5\hat{j} - 2\hat{k} = -(6\hat{i} + 5\hat{j} + 2\hat{k})\text{NC}^{-1}$

28. **(b)** Execute oscillation but not SHM
Explanation: Direction of net electric field due to both the charges at any point on +X axis will be along -X axis, hence the positive charge will experience force in negative X-axis direction.
When it reaches origin, net electric field will become zero, but due to its kinetic energy, positive charge will continue moving in the -X direction, but now the direction of electric field and hence force on positive charge will be in the +X axis direction, which will tend to bring it back towards origin. So the charge will oscillate about origin. Since force and hence acceleration is not proportional to displacement, its not SHM.

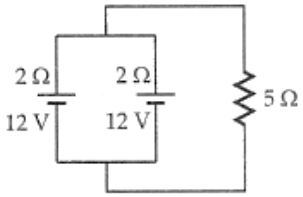
29. **(a)** 3 A
Explanation: $\eta = \frac{\text{Output}}{\text{Input}}$
$\frac{80}{100} = \frac{20\times120}{1000\times I}$
I = $\frac{20\times120\times100}{1000\times80}$ = 3A

30. **(b)** the resistance of the coil
Explanation: Because induced e.m.f. is given by $E = -N\frac{d\varphi}{dt}$

31. **(c)** poles
Explanation: The angle of dip is 90° at poles.

32. **(c)** become double
Explanation: $\varepsilon_{ind} = \frac{-d(NAB\cos\theta)}{dt} = NAB\sin\theta\frac{d\theta}{dt} = NAB\omega\sin\theta$

33. **(b)** 2 A
Explanation:
The equivalent circuit is shown below:



I = $\frac{n\varepsilon}{nR+r}$
= $\frac{2\times 12}{2\times 5+2} = \frac{24}{12}$ = 2 A

34. **(c)** 70 V
Explanation: The potential at any point inside the charged hollow metallic sphere is the same as that on its surface.

35. **(a)** 40 cm
Explanation: Meter bridge works on the principle of wheat stone bridge. When in balanced state,
$\frac{R_1}{R_2} = \frac{l}{(100-l)}$
Given,
$\frac{R}{8} = \frac{60}{(100-60)} = \frac{60}{40}$
When resistors are interchanged balance condition will be,
$\frac{8}{R} = \frac{40}{60}$
Hence new balance point will be 40 cm from left.

36. **(a)** average value of current of complete cycle is zero
Explanation: The average value of alternating current over a complete cycle is zero

37. **(c)** 2.52 V
Explanation: $\varepsilon = Blv$
$= 0.9 \times 0.4 \times 7$ V
= 2.52 V

38. **(b)** Absolute Permittivity
Explanation: Absolute Permittivity

39. **(a)** 600 Ω, 200 Ω and 500Ω
Explanation: Given that
$R = 300\Omega$
$L = 60mH = 60 \times 10^{-3}H$
$C = 0.5\mu F = 0.5 \times 10^{-6}F$
V = 50 volt
$\omega = 10000rad/s$
Inductive reactance, $X_L = \omega L = 10000 \times 60 \times 10^{-3} = 600\Omega$
Capacitive reactance, $X_C = \frac{1}{\omega C} = \frac{1}{10000\times 0.5\times 10^{-6}} = 200\Omega$
Impedance, $Z = \sqrt{R^2 + (X_L - X_C)^2} = \sqrt{300^2 + (600-200)^2} = \sqrt{300^2+400^2} = 500\Omega$

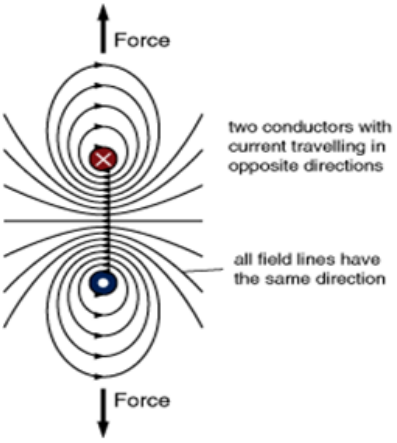
40. **(a)** 2 A
Explanation: The two resistances of 6 Ω each are in parallel with the 3 Ω resistance
$\therefore R_{aq} = \frac{12\times 3}{12+3} = \frac{36}{15} = \frac{12}{5}\Omega$
I = $\frac{E}{R_{eq}} = \frac{4-8}{\frac{12}{5}}$ = 2.0 A

41. **(b)** $\frac{R}{4}$
Explanation: As the power rating of the bulb is same in both cases,
$\frac{v_1^2}{R_1} = \frac{v_2^2}{R_2}$
or $\frac{220\times 220}{R_1} = \frac{110\times 110}{R_2}$
or $R_2 = \frac{1}{4}R_1 = \frac{1}{4}R$ [$\because R_1 = R$]

42. **(a)** 1.0×10^{-4}Nm
Explanation: $\tau = pEsin\theta = 4\times 10^{-9} \times 5 \times 10^4 sin\ 30^0 = 1 \times 10^{-4}Nm$

43. **(a)** twice the field due to each wire alone
Explanation:

Magnetic field due to a current carrying wire is given by B = $\frac{\mu_0 I}{2\pi r}$,and for direction, point the thumb along the direction of current then curl the fingers around will represents the direction of the magnetic field. When two wires carry currents in the opposite direction, the magnetic field lines at any point midway between them have the same direction. The magnitudes of the fields add up. If the current in the wires are the same, the magnetic field at the midpoint will have twice the magnitude of the field produced by each wire.



44. **(a)** F
Explanation: $F\alpha\frac{q_m q'_m}{r^2}$
Hence $\frac{F'}{F} = (\frac{2q_m 2q'_m}{4r^2})/\frac{q_m q'_m}{r^2} = 1$
or F' = F

45. **(c)** A is true but R is false.
Explanation: The electric potential of the earth is taken zero because its capacitance C is very large and so, $V = \frac{q}{C} \to 0$ for all finite charges.

46. **(b)** Both A and R are true but R is not the correct explanation of A.
Explanation: Both A and R are true but R is not the correct explanation of A.

47. **(d)** A is false and R is also false
Explanation: A is false and R is also false

48. **(c)** A is true but R is false.
Explanation: Faraday's laws of electromagnetic induction are consequences of the conservation of energy. It involves only the transformation of energy into electrical energy. In a purely resistive circuit, current and voltage are in the same phase.

49. **(a)** Both A and R are true and R is the correct explanation of A.
Explanation: Both A and R are true and R is the correct explanation of A.

Section C

50. **(c)** Q = -q
Explanation:
Potential at the centre O is
$V = k\left[\frac{-Q}{a/\sqrt{2}} + \frac{-q}{a/\sqrt{2}} + \frac{2q}{a/\sqrt{2}} + \frac{2Q}{a/\sqrt{2}}\right] = 0$
$\Rightarrow$ Q - q + 2q + 2Q = 0

$\Rightarrow$ Q + q = 0
$\Rightarrow$ Q = -q

51. **(a)** shall increase along the positive x-axis.
Explanation: The total force acting on a given charge is given by the vector sum of individual forces acting on that charges.Net force on charge q_1, by other charges q_2 and q_3 is along the + x-direction, so nature of force between q_1 and q_2 and q_1 and q_3 is attractive. This is possible when charge q_1 is negative.
Now, if a positive charge Q is placed at (x, 0), then, the force on q_1 shall increase. The direction will be along the positive x-axis.

52. **(c)** diode
Explanation: diode

53. **(c)** scalar quantity
Explanation: scalar quantity

54. **(a)** zero
Explanation: zero

55. **(b)** conventional current
Explanation: conventional current