Sample Question Paper 2021-22
Term 1
Subject: Physics (042)

Time: 90 Minutes **Max. 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

This section consists of 25 multiple choice questions with overall choice to attempt any 20 questions. In case more than desirable numberof questions are attempted, ONLY first 20 will be considered for evaluation.

Q1.Which of the following is NOT the property of equipotential surface?

(i) They do not cross each other.

(ii) The rate of change of potential with distance on them is zero.

(iii) For a uniform electric field they are concentric spheres.

(iv) They can be imaginary spheres.

Q2. Two point charges +8q and -2q are located at x=0 and x=L respectively. The point on x axis at which net electric field is zero due to these charges is-

(i) 8L

(ii) 4L

(iii) 2 L

(iv) L

Q3. An electric dipole of moment p is placed parallel to the uniform electric field. The amount of work done in rotating the dipole by 90° is-

(i) 2pE

(ii) pE

(iii) pE/2

(iv) Zero

Q4. Three capacitors 2μF, 3μF and 6μF are joined in series with each other. The equivalent capacitance is-

(i) 1/2μF

(ii) 1μF

(iii) 2μF

(iv) 11μF

Q5. Two point charges placed in a medium of dielectric constant 5 are at a distance r between them, experience an electrostatic force 'F'. The electrostatic force between them in vacuum at the same distance r will be-

(i) 5F

(ii) F

(iii) F/2

(iv) F/5

Q6. Which statement is true for Gauss law-

(i) All the charges whether inside or outside the gaussian surface contribute to the electric flux.

(ii) Electric flux depends upon the geometry of the gaussian surface.

(iii) Gauss theorem can be applied to non-uniform electric field.

(iv) The electric field over the gaussian surface remains continuous and uniform at every point.

Q7.A capacitor plates are charged by a battery with 'V' volts. After charging battery is disconnected and a dielectric slab with dielectric constant 'K' is inserted between its plates, the potential across the plates of a capacitor will become

(i) Zero

(ii) V/2

(iii) V/K

(iv) KV

Q8.The best instrument for accurate measurement of EMF of a cell is-

(i) Potentiometer

(ii) metre bridge

(iii) Voltmeter

(iv) ammeter and voltmeter

Q9.An electric current is passed through a circuit containing two wires of same material, connected in parallel. If the lengths and radii of the wires are in the ratio of 3:2 and 2:3, then the ratio of the current passing through the wire will be

(i) 2:3

(ii) 3:2

(iii) 8:27

(iv) 27:8

Q10.By increasing the temperature, the specific resistance of a conductor and a semiconductor-

(i) increases for both.

(ii) decreases for both.

(iii) increases for a conductor and decreases for a semiconductor.

(iv) decreases for a conductor and increases for a semiconductor.

Q11.We use alloys for making standard resistors because they have

(i) low temperature coefficient of resistivity and high specific resistance

(ii) high temperature coefficient of resistivity and low specific resistance

(iii) low temperature coefficient of resistivity and low specific resistance

(iv) high temperature coefficient of resistivity and high specific resistance

Q12. A constant voltage is applied between the two ends of a uniform metallic wire, heat 'H' is developed in it. If another wire of the same material, double the radius and twice the length as compared to original wire is used then the heat developed in it will be-

(i) H/2

(ii) H

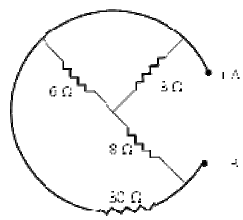
(iii) 2H

(iv) 4H

Q13.If the potential difference V applied across a conductor is increased to 2V with its temperature kept constant, the drift velocity of the free electrons in a conductor will -

(i) remain the same.
(ii) become half of its previous value.
(iii) be double of its initial value.
(iv) become zero.

Q14.The equivalent resistance between A and B is-



(i) 3 ohms

(ii) 5.5 ohms

(iii) 7.5 ohms

(iv) 9.5 ohms

Q15. The SI unit of magnetic field intensity is

(i) AmN^{-1}
(ii) $NA^{-1}m^{-1}$

(iii) $NA^{-2}m^{-2}$

(iv) $NA^{-1}m^{-2}$

Q16.The coil of a moving coil galvanometer is wound over a metal frame in order to

(i) reduce hysteresis
(ii) increase sensitivity
(iii) increase moment of inertia
(iv) provide electromagnetic damping

Q17.Two wires of the same length are shaped into a square of side 'a' and a circle with radius 'r'. If they carry same current, the ratio of their magnetic moment is

(i) $2 : \pi$
(ii) $\pi : 2$
(iii) $\pi : 4$
(iv) $4 : \pi$

Q18. The horizontal component of earth's magnetic field at a place is √3 times the vertical component. The angle of dip at that place is

(i) π/6
(ii) π/3
(iii) π/4
(iv) 0

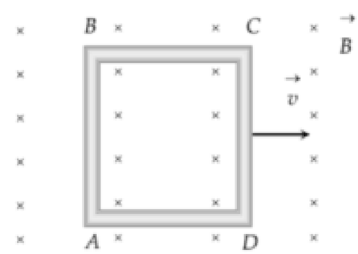
Q19. The small angle between magnetic axis and geographic axis at a place is-

(i) Magnetic meridian
(ii) Geographic meridian
(iii) Magnetic inclination
(iv) Magnetic Declination

Q20.Two coils are placed close to each other. The mutual inductance of the pair of coils depends upon the

(i) rate at which current change in the two coils
(ii) relative position and orientation of the coils
(iii) rate at which voltage induced across two coils
(iv) currents in the two coils

Q21. A conducting square loop of side 'L' and resistance 'R' moves in its plane with the 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 shown in the figure. The current induced in the loop is



(i) BLv/R Clockwise

(ii) BLv/R Anticlockwise

(iii) 2BLv/R Anticlockwise

(iv)Zero

Q22. The magnetic flux linked with the coil (in Weber) is given by theequation –

$\Phi = 5t^2 + 3t + 16$

The induced EMF in the coil at time, t=4 will be-

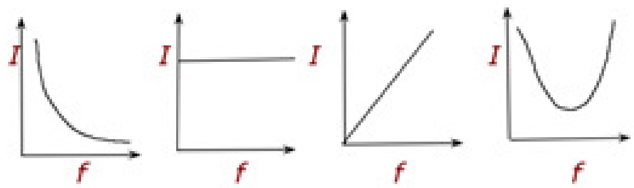
(i) -27 V

(ii) -43 V

(iii) -108 V

(iv) 210 V

Q23. Which of the following graphs represent the variation of current(I) with frequency (f) in an AC circuit containing a pure capacitor?



(i) (ii) (iii) (iv)

Q24. A 20 volt AC is applied to a circuit consisting of a resistance and a coil with negligible resistance. If the voltage across the resistance is 12 volt, the voltage across the coil is-

(i) 16 V

(ii) 10 V

(iii) 8 V

(iv) 6 V

Q25. The instantaneous values of emf and the current in a series ac circuit are-

E = Eo Sin ωt and I= Io sin(ωt+π/3) respectively, then it is

(i) Necessarily a RL circuit

(ii) Necessarily a RC circuit

(iii)Necessarily a LCR circuit

(iv) Can be RC or LCR circuit

SECTION B

This section consists of 24 multiple choice questions with overall choice to attempt any 20 questions. In case more than desirable number of questions are attempted, ONLY first 20 will be considered for evaluation.

Q26. A cylinder of radius r and length l is placed in an uniform electric field parallel to the axis of the cylinder. The total flux for the surface of the cylinder is given by-

(i) zero

(ii) πr^2

(iii) $E \pi r^2$

(iv))2 $E\pi r^2$

Q27. Two parallel large thin metal sheets have equal surface densities

26.4×10^{-12} C/$m^2$of opposite signs. The electric field between these sheets is-

(i) 1.5N/C

(ii) 1.5×10^{-16} N/C

(iii) 3×10^{-10}N/C

(iv) 3N/C

Q28. Consider an uncharged conducting sphere. A positive point charge is placed outside the sphere. The net charge on the sphere is then,

(i) negative and uniformly distributed over the surface of sphere

(ii) positive and uniformly distributed over the surface of sphere

(iii) negative and appears at a point the surface of sphere closest to point charge.

(iv) Zero

Q29. Three Charges 2q, -q and -q lie at vertices of a triangle. The value of E and V at centroid of triangle will be-

(i) E#0 and V#0

(ii) E=0 and V=0

(iii) E#0 and V=0

(iv) E=0 and V#0

Q30. Two parallel plate capacitors X and Y, have the same area of plates and same separation between plates. X has air and Y with dielectric of constant 2 , between its plates. They are connected in series to a battery of 12 V. The ratio of electrostatic energy stored in X and Y is-

(i) 4:1

(ii) 1:4

(iii) 2:1

(iv) 1:2

Q31.Which among the following, is not a cause for power loss in a transformer-

(i) Eddy currents are produced in the soft iron core of a transformer.

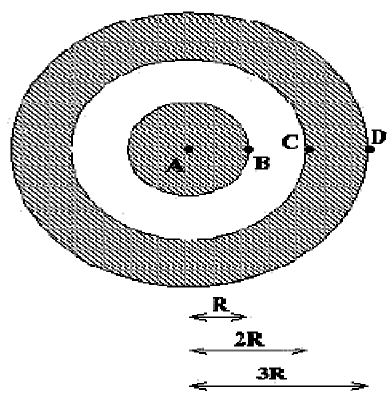
(ii) Electric Flux sharing is not properly done in primary and secondary coils.

(iii) Humming sound produed in the tranformers due to magnetostriction.
(iv) Primary coil is made up of a very thick copper wire.

Q32. An alternating voltage source of variable angular frequency ‘w’ and fixed amplitude ‘V’ is connected in series with a capacitance C and electric bulb of resistance R(inductance zero). When ‘w’ is increased-

(i) The bulb glows dimmer.
(ii) The bulb glows brighter.
(iii) Net impedance of the circuit remains unchanged.
(iv) Total impedance of the circuit increases.

Q33. A solid spherical conductor has charge +Q and radius R. It is surrounded by a solid spherical shell with charge -Q, innerradius 2R, and outer radius 3R. Which of the following statements is true?



(i)The electric potential has a maximum magnitude at C and the electric field has a maximum magnitude at A

(ii) The electric potential has a maximum magnitude at D and the electric field has a maximum magnitude at B.

(iii) The electric potential at A is zero and the electric field has a maximum magnitude at D.

(iv). Both the electric potential and electric field achieve a maximum magnitude at B.

Q34. A battery is connected to the conductor of non-uniform cross section area. The quantities or quantity which remains constant is-

(i) electric field only

(ii) drift speed and electric field

(iii)electric field and current

(iv) current only

Q35. Three resistors having values R_1, R_2, and R_3 are connected in series to a battery. Suppose R_1 carries a current of 2.0 A, R_2 has a resistance of 3.0 ohms, and R_3 dissipates 6.0 watts of power. Then the voltage across R_3 is-

(i) 1V

(ii) 2V

(iii) 3V

(iv) 4V

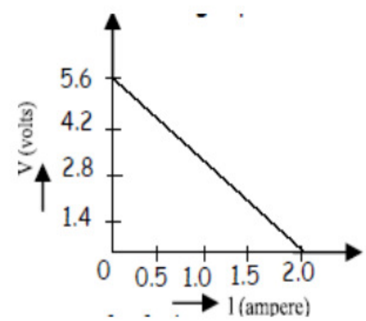
Q36.A straight line plot showing the terminal potential difference (V) of a cell as a function of current (I) drawn from it, is shown in the figure. The internal resistance of the cell would be then-

(i) 2.8 ohms

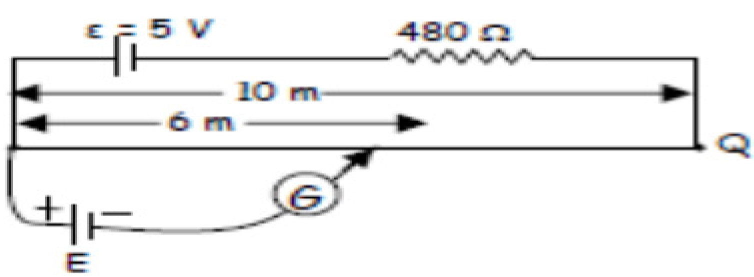
(ii) 1.4 ohms

(iii) 1.2 ohms

(iv) zero



Q37. A 10 m long wire of uniform cross-section and 20 Ω resistance is used in a potentiometer. The wire is connected in series with a battery of 5 V along with an external resistance of 480 Ω. If an unknown emf E is balanced at 6.0 m length of the wire, then the value of unknown emf is-



(i) 1.2 V

(ii) 1.02 V

(iii) 0.2 V

(iv) 0.12 V

Q38.The current sensitivity of a galvanometer increases by 20%. If its resistance also increases by 25%, the voltage sensitivity will

(i) decrease by 1%

(ii) increased by 5%

(iii) increased by 10%

(iv) decrease by 4%

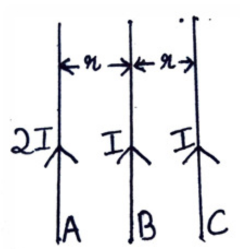
Q39. Three infinitely long parallel straight current carrying wires A, B and C are kept at equal distance from each other as shown in the figure . The wire C experiences net force F .The net force on wire C, when the current in wire A is reversed will be

(i) Zero

(ii) F/2

(iii) F

(iv) 2F



Q40. In a hydrogen atom the electron moves in an orbit of radius 0.5 A° making 10 revolutions per second, the magnetic moment associated with the orbital motion of the electron will be

(i) 2.512×10^{-38} Am^2

(ii) 1.256×10^{-38} Am^2

(iii) 0.628×10^{-38} Am^2

(iv) zero

Q41. An air-cored solenoid with length 30 cm, area of cross-section 25 cm^2 and number of turns 800, carries a current of 2.5 A. The current is suddenly switched off in a brief time of 10^{-3}s. Ignoring the variation in magnetic field near the ends of the solenoid, the average back emf induced across the ends of the open switch in the circuit would be

(i) zero

(ii)3.125 volts

(iii) 6.54 volts

(iv) 16.74 volts

Q42. A sinusoidal voltage of peak value 283 V and frequency 50 Hz is applied to a series LCR circuit in which R = 3 Ω, L = 25.48 mH, and C = 796 µF, then the power dissipated at the resonant condition will be-

(i)39.70 kW

(ii) 26.70 kW

(iii)13.35 kW

(iv)Zero

Q43. A circular loop of radius 0.3cm lies parallel to much bigger circular of radius 20 cm. The centre of the small loop is on the axis of the bigger loop. The distance between their centres is 15 cm. If a current of 2.0 A flows through the smaller loop, then the flux linked with the bigger loop is

(i) 3.3×10^{-11} weber

(ii) 6×10^{-11} weber

(iii) 6.6×10^{-9} weber

(iv) 9.1×10^{-11} weber

Q44.If both the number of turns and core length of an inductor is doubled keeping other factorsconstant, then its self-inductance will be-

(i) Unaffected
(ii) doubled
(iii) halved
(iv) quadrupled

45. Given below are two statements labelled as Assertion (A) and Reason (R)

Assertion (A): To increase the range of an ammeter, we must connect a suitable high resistance in series to it.

Reason (R): The ammeter with increased range should have high resistance.

Select the most appropriate answer from the options given below:

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

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

(iii)A is true but R is false.

(iv) A is false and R is also false.

46. Given below are two statements labelled as Assertion (A) and Reason (R)

Assertion (A): An electron has a high potential energy when it is at a location associated with a more negative value of potential, and a low potential energy when at a location associated with a more positive potential.

Reason (R): Electrons move from a region of higher potential to region of lower potential.

Select the most appropriate answer from the options given below:

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

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

(iii)A is true but R is false.

(iv) A is false and R is also false.

47. Given below are two statements labelled as Assertion (A) and Reason (R)

Assertion(A): A magnetic needle free to rotate in a vertical plane, orients itself (with its axis) vertical at the poles of the earth.

Reason (R): At the poles of the earth the horizontal component of earth's magnetic field will be zero.

Select the most appropriate answer from the options given below:

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

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

(iii)A is true but R is false.

(iv) A is false and R is also false.

48. Given below are two statements labelled as Assertion (A) and Reason (R)

Assertion(A): A proton and an electron, with same momenta, enter in a magnetic field in a direction at right angles to the lines of the force. The radius of the paths followed by them will be same.

Reason(R): Electron has less mass than the proton.

Select the most appropriate answer from the options given below:

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

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

(iii)A is true but R is false.

(iv) A is false and R is also false.

49. Given below are two statements labelled as Assertion (A) and Reason (R)

Assertion (A): On Increasing the current sensitivity of a galvanometer by increasing the number of turns, may not necessarily increase its voltage sensitivity.

Reason(R): The resistance of the coil of the galvanometer increases on increasing the number of turns.

Select the most appropriate answer from the options given below:

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

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

(iii)A is true but R is false.

(iv) A is false and R is also false.

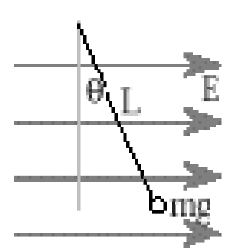
SECTION C

This section consists of 6 multiple choice questions with an overall choice to attempt any 5. In case more than desirable number of questions are attempted, ONLY first 5 will be considered for evaluation.

Q50. A small object with charge q and weight mg is attached to one end of a string of length 'L' attached to a stationary support. The system is placed in a uniform horizontal electric field 'E', as shown in the accompanying figure. In the presence of the field, the string makes a constant angle θ with the vertical. The sign and magnitude of q-

(i) positive with magnitude mg/E

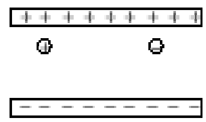
(ii) positive with magnitude (mg/E)tanθ



(iii) negative with magnitude mg/E tanθ

(iv) positive with magnitude E tanθ/mg

Q51.A free electron and a free proton are placed between two oppositely charged parallel plates. Both are closer to the positive plate than the negative plate.



Which of the following statements is true?

I. The force on the proton is greater than the force on the electron.

II. The potential energy of the proton is greater than that of the electron.

III. The potential energy of the proton and the electron is the same.

(i) I only

(ii) II only

(iii) III and I only

(iv)II and I only

Case study :

Read the following paragraph and answers the questions:

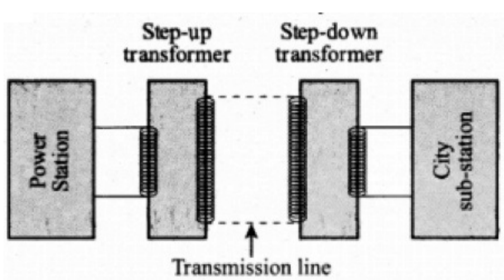


Figure: Long distance power transmissions

The large-scale transmission and distribution of electrical energy over long distances is done with the use of transformers. The voltage output of the generator is stepped-up. It is then transmitted over long distances to an area sub-station near the consumers. There the voltage is stepped down. It is further stepped down at distributing sub-stations and utility poles before a power supply of 240 V reaches our homes.

Q52. Which of the following statement is true?

(i) Energy is created when a transformer steps up the voltage

(ii) A transformer is designed to convert an AC voltage to DC voltage

(iii) Step–up transformer increases the power for transmission

(iv) Step–down transformer decreases the AC voltage

Q53. If the secondary coil has a greater number of turns than the primary,

(i) the voltage is stepped-up ($V_s > V_p$) and arrangement is called a step-up transformer

(ii) the voltage is stepped-down ($V_s < V_p$) and arrangement is called a step-down transformer

(iii) the current is stepped-up ($I_s > I_p$) and arrangement is called a step-up transformer

(iv) the current is stepped-down ($I_s < I_p$) and arrangement is called a step-down transformer

Q54. We need to step-up the voltage for power transmission, so that

(i) the current is reduced and consequently, the I^2R loss is cut down

(ii) the voltage is increased , the power losses are also increased

(iii) the power is increased before transmission is done

(iv) the voltage is decreased so V^2/R losses are reduced

Q55. A power transmission line feeds input power at 2300 V to a step down transformer with its primary windings having 4000 turns. The number of turns in the secondary in order to get output power at 230 V are

(i) 4

(ii) 40

(iii) 400

(iv) 4000

Physics
Marking Scheme
For SQP – 45
XII – I Term

Q.1 Which of the_____________________

Ans. 1 (iii)

As all other statements are correct. In uniform electric field equipotential surfaces are never concentric spheres but are planes ⊥ to Electric field lines.

Q.2 Two Point charges_____________________

Ans. 2 (iii)

Let P is the observation point at a distance r from -2q
and at (L+r) from +8q.
Given Now, Net EFI at P = 0

∴ $\vec{E_1}$ = EFI (Electric Field Intensity) at P due to +8q

$\vec{E_2}$ = EFI (Electric Field Intensity) at P due to -2q

$$\left|\vec{E_1}\right| = \left|\vec{E_2}\right|$$

$$\therefore \quad \frac{k(8q)}{(L+r)^2} = \frac{k(2q)}{r^2}$$

$$\therefore \quad \frac{4}{(L+r)^2} = \frac{1}{(r)^2}$$

$$4r^2 = (L+r)^2$$

$$2r = L+r$$

$$r = L$$

∴ P is at x = L + L = 2L from origin

∴ Correct Option is (iii) 2L

Q3. An electric_____________________

Ans. 2 (ii)

$W = pE(\cos\theta_1 - \cos\theta_2)$

$\theta_1 = 0^o$

$\theta_2 = 90^o$

W = pE (cos 0^o - cos 90^o)

= pE (1 – 0) = pE

Q4. Three Capacitors_______________

Ans.4. (ii)

$$\frac{1}{C_{series}} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3}$$

$$\frac{1}{C_{series}} = \frac{1}{2} + \frac{1}{3} + \frac{1}{6}$$

$$\frac{3+2+1}{6} = \frac{6}{6}$$

$$C_{series} = 1\mu F$$

Q5. Two Point Charges____________________

Ans.5. (i)

Q_1 ———— r ———— Q_2 K = 5

$$F = \frac{1}{4\pi\varepsilon o k} \frac{Q_1 Q_2}{r^2}$$

Q_1 ———————— Q_2 Force in the charges in the air is

$$F^- = \frac{1}{4\pi\varepsilon o} \frac{Q_1 Q_2}{r^2}$$

= K F

= 5 F

Q6. Which statement is true_________________

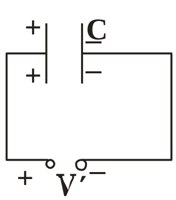
Ans.6. (iv)

All other statements except (iv) are in correct

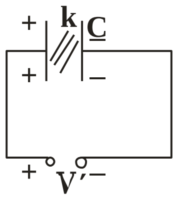
The electric field over the Gaussian surface remains continuous and uniform at every point.

Q7. A capacitor plates

Ans.7. (iii)



Battery is disconnected`′



Q = Charge remains context

$C' = K\,C$

$Q' = C'\,V'$

$Q = C'\,V'$

$Q = K\,C\,V'$

$V' = \frac{Q}{K\,C} = \frac{V}{K}$

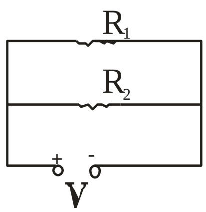
Q.8. The best instrument for__________________

Ans.8. (i)

Potentiometer

Q9. An electric current____________________

Ans.9. (iii) 8:27



$l_1 : l_2 = 3 : 2$
$r_1 : r_2 = 2 : 3$
$I_1 : I_2 = ?$

$$R_1 = \rho \frac{l_1}{\pi r_1^2}$$

$$R_2 = \rho \frac{l_2}{\pi r_2^2}$$

$$\frac{R_1}{R_2} = \frac{l_1}{l_2}\;\frac{\pi r_2^2}{\pi r_1^2} = \frac{l_1}{l_2} \times \frac{r_2^2}{r_1^2}$$

$$= \frac{3}{2} \times \left(\frac{3}{2}\right)^2 = \frac{(3)^3}{(2)^3} = \frac{27}{8}$$

$$\therefore \frac{I_1}{I_2} = \frac{V/R_1}{V/R_2} = \frac{R_2}{R_1} = 8/27$$

Q.10. By increasing the temperature____________________

Ans. 10. (iii) Specific resistance of a conductor increases and for a semiconductor decreases with increase in temperature because for a conductor, a temperature.

coefficient of resistivity $\alpha = +$ ve
and for a semiconductor, $\alpha =$ -ve

Q.11. We use alloys____________________

Ans. 11 (i) Alloys have low temperature coefficient of resistivity and high specific resistance. If $\alpha =$ low, the value of 'R' with temperature will not change much and specific resistance is high then required length of the wire will be less.

Q.12. A constant Voltage____________________

Ans. 12. (iii)

$$R = \rho \frac{l}{A} \quad \Big| \quad R' = \rho \frac{2l}{\pi(2r)^2}$$

$$R = \rho \frac{l}{\pi r^2} \quad \Big| \quad R' = \rho \frac{2l}{\pi 4r^2}$$

$$H = \frac{V^2}{R} t \quad \& \quad H' = \frac{V^2}{R^1} t$$

$\because$ V = constant

$$\frac{H'}{H} = \frac{V^2}{R'} \; \frac{R}{V^2} \; \frac{t}{t}$$

$$= \frac{R}{R'} = \rho \frac{l}{\pi r^2} \quad \frac{2\pi r^2}{\rho l}$$

$$\frac{H'}{H} = \frac{2}{1}$$

$$H' = 2H$$

Correct option is (iii)

Q.13. If the potential diff____________________

Ans.13. We know

$$V_d = \frac{eE}{ml} \bar{\tau}$$

$$= e \frac{V}{ml} \bar{\tau}$$

If temperature is kept constant, relaxation time $\bar{\tau}$ - will remain constant, and e, m are also constants.

$V_d \propto V$

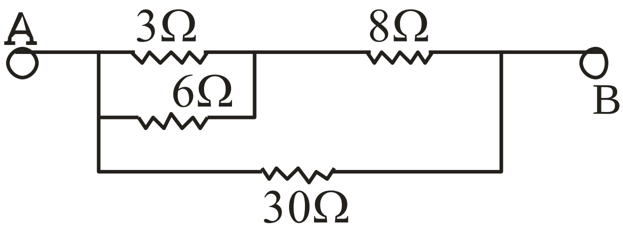
$V_d \propto 2V$

Correct option is (ii)

Q.14. The equivalent resistance ________________

Ans. 14. (iii)

Redrawing the circuit, we get



3Ω & 6Ω are in parallel.

$$\therefore R_1 = \frac{3 \times 6}{3+6} = \frac{18}{9} = 2\Omega$$

Now R_1 and 8Ω in series

$$\therefore R_2 = R_1 + 8 = 2 + 8 = 10\Omega$$

Now R_2 and 30Ω in parallel

$$Rep = \frac{R_2 \times 30}{R_2 + 30} = \frac{10 \times 30}{10+30}$$

$$= \frac{300}{40} = \frac{30}{4} = \frac{15}{2}$$

$= 7.5\Omega$ (iii) correct option

Q.15. The SI unit of magnetic field intensity is ______________

Ans.15. We know

$$B = \frac{F}{Il \sin\theta}$$

$$\text{SI Unit of B} = \frac{N}{Am} = NA^{-1}m^{-1}$$

Correct option is (ii)

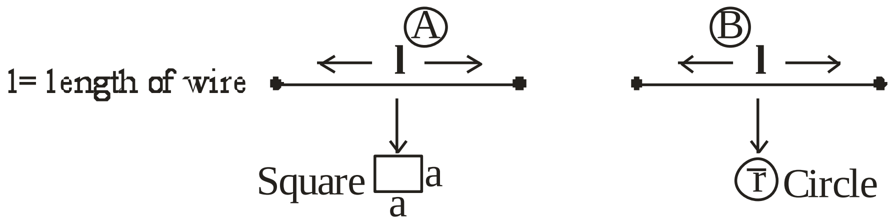
Q16. The coil of _____________________

Ans. (iv) Correct Option

The coil of a moving coil galvanometer is wound over metallic frame to provide electromagnetic damping so it becomes dead beat galvanometer.

Q.17. Two wires of____________________

Ans.17. Correct option (iii)



Area of a Square	**Area of a Circle**
$= a^2$	$= \pi r^2$
Also here l = 4a	Also here, $2\pi r = l$
$a = \dfrac{l}{4}$	$r = \dfrac{l}{2\pi}$
$\therefore$ Area $= \dfrac{l^2}{16}$	Now Area $= \pi \left(\dfrac{l}{2\pi}\right)^2$
$A_1 = \dfrac{l^2}{16}$	$A_2 = \dfrac{l^2}{4\pi}$

Now Magnetic moment = I A

$\therefore M_1 = IA$, & $M_2 = I A_2$

Since I (current) is same in both

$$\therefore \frac{M_1}{M_2} = \frac{A_1}{A_2} = \frac{l^2}{16} = \frac{4\pi}{l^2} = \frac{\pi}{4}$$

$M_1 \; M_2 = \pi : 4$

Correct option is (iii)

Q.18. The horizontal comp__________________

Ans.18. Correct option (i)

Target law $B_v = B_H \tan\delta$

$\tan\delta = \frac{B_V}{B_H}$

Given $B_H = \sqrt{3}\, B_v$

$$\tan\delta = \frac{Bv}{\sqrt{3}\ Bv} = \frac{1}{\sqrt{3}}$$

$$\delta = 30^0 \text{ or } \frac{\pi}{6} \text{radians.}$$

Q.19. The small____________________

Ans. 19. Correct option is Magnetic declination or Angle of declination. It is the small angle between geographic axis & magnetic axis.

Q.20. Two coils____________________

Ans.20. Correct option is (ii)

Mutual inductance of a pair of two coils depends on the relative position and orientation of two coils, other statements are incorrect.

Q.21. A conducting___________________

Ans. 21. Correct option is (iv)

$$\text{Current induced is } I = \frac{lel}{R}$$

$$\text{Now } lel = \frac{d\phi}{dt}$$

But there is no change of flux with time, as $\vec{B}$, $\vec{A}$ & θ all remain constant with time.

$\therefore$ No current is induced

Q22. The magnetic flux____________

Ans.22.

$\phi = 5t^2 + 3t + 16$

$|e| = \frac{d\phi}{dt}$

$= \frac{d}{dt}\left[5t^2 + 3t + 16\right]$

$= 10t + 3$

$|e|_{t=4} = 10(4)+3 = 43V$

e = -43Volts

Correct option is (ii)

Q23 Which of the following________________

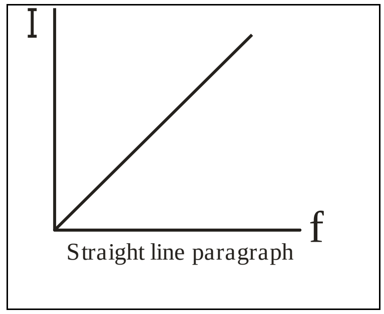
Ans.23. Correct option is (iii)

$$I = \frac{V}{X_C} \quad \text{in Pure Capacitor}$$

$$= \frac{V}{\frac{1}{2\pi fc}} = V\, 2\pi fc$$

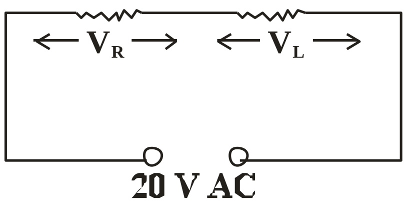
$$\Rightarrow \; I \,\alpha\, f$$

other parameters kept cosntant



Q24. A 20 Volt AC_________________

Ans.24. Correct option is (i)



V_R = Effective Voltage across R

$\therefore \; V_R = I_{eff}\; R$

V_L = Effective Voltage across L

$$V_L = I_{eff} \times L$$

$$\text{Net } \; V = \sqrt{V_R^2 + V_L^2}$$

$$= \sqrt{I_{eff}^2 R^2 + I_{eff}^2 \times L^2}$$

$$20 = \sqrt{(12)^2 + V_L^2}$$

$$(20)^2 = (12)^2 + V_L^2$$

$$400 = 144 + V_L^2$$

$$V_L = \sqrt{400 - 144} = \sqrt{256} = 16 \text{ Volts}$$

Q25. The instantaneous__________________

Ans. 25.

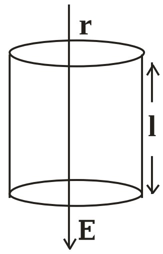
$$E = E_0 \sin \omega t$$

$$I = I_0 \sin \left(\omega t + \pi/3\right)$$

Correct option is (iv)
as I can lead the Voltage in RC and LCR circuit, so it can be RC or LCR circuit.
(iv) is correct option.

Section - B

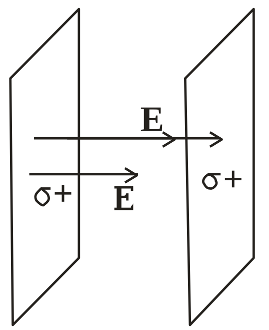
Q26.



Correct option is (i)
Since –ve electric flux
= + ve flux electric flux enclosed with a cylinder here
∴ Total Electric
Flux = 0.

Q27. Two Parallel_______________________

Ans. 27. (iv) Correct option.



Surface Charge density, $\sigma = 26.4\times10^{-12}\ \frac{C}{m^2}$

$$E = \frac{\sigma}{2\varepsilon_0} + \frac{\sigma}{2\varepsilon_0}$$

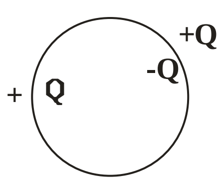
$$= \frac{2\sigma}{2\varepsilon_0} = \frac{\sigma}{\varepsilon_0}$$

$$= \frac{26.4\times10^{-12}}{8.85\times10^{-12}}\ \frac{N}{C}$$

$$= 3\ \frac{N}{C}$$

Correct option is (iv)

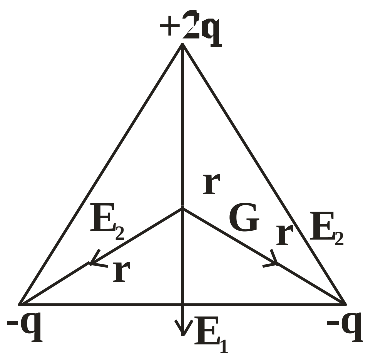
Q28. Consider___________________



Ans.28. Equal and Opposite charges appear on the nearby conductor due to induction, but still net charge on the conductor is zero. Correct option (iv)

Q29. Three Charges________________

Ans.29.



Net E F I at G $\neq$ O

Net Potential at G,

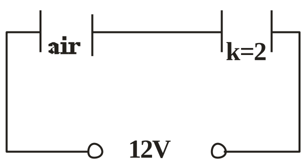
$$V = \frac{K2Q}{r} - \frac{KQ}{r} - \frac{KQ}{r}$$

$$= 0$$

Correct option is (iii)

Q30. Two parallel______________

Ans.30.



A = Same
d = Same

Q = Same in Series

$$C_x = \frac{\varepsilon_0 A}{d} \quad C_y = \frac{2\varepsilon_0 A}{d}$$

$$U_x = \frac{Q^2}{2C_x} \quad U_y = \frac{Q^2}{2C_y}$$

$$\therefore \frac{U_x}{U_y} = \frac{C_y}{C_x} = \frac{2C_x}{C_x} = \frac{2}{1}$$

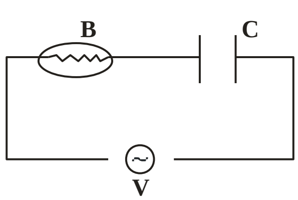
Correct Option is (iii)

Q31. Which among________________

Ans.31. Correct statement is option (iv) as Primary coil made of Thick Coper wire has very less R. Therefore negligible power loss. Rest all options are reasons for power losses in a transformer.

Q32. An alternating Voltage_______________

Ans.32.



$\omega \uparrow$

$X_c = \dfrac{1}{2\pi fc} = \dfrac{1}{\omega c} \downarrow$ i.e. $X_c \downarrow$

$I \uparrow \quad \therefore$ Brightness of the bulb will $\uparrow$.

Correct option is (ii)

Q.33. A solid Sphere_______________

Ans.33. Correct option is (4)

As all other statements seem incorrect in context with the given figure.

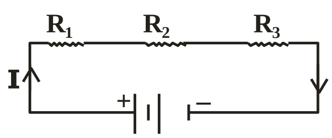
Q. 34. A battery is connected .....

Ans. Correct option is **(iv)**.

Rest all quantities change with area of cross-section of a conductor.

Q. 35. Three resistors......

Ans.



Given

$I = 2$ A, $R_2 = 3\ \Omega$, $P_3 = 6$ W

$$\text{Power across } R_3 = V_3 I$$

$$6\text{ W} = I^2 R_3$$

$$\frac{6}{4} = R_3 = \frac{3}{2} = 1.5\ \Omega$$

$$V_3 = I R_3 = 2\,(1.5) = \mathbf{3\ V}$$

Correct option is **(iii)**.

Q. 36. A straight line......

Ans. $I = O$, $V = E$, $\therefore E = 5.6$ V

$$r = \frac{E}{I} = \frac{5.6}{2.0} = 2.8\,\Omega$$

Correct option is **(i)**.

Q. 37. A 10 m long potentiometer …..

Ans. Let PQ is a potentiometer wore of length 10m,

$$I = \frac{E}{R+R'} = \frac{5}{480+20} = \frac{5}{500}$$

$$= \frac{1}{100} = 0.01\,\text{A}$$

$$V_{PQ} = I\,R_{PQ} = 0.01 \times 20$$

$$= 0.2\text{ V}$$

If 10 m potentiometer wire balances $\Rightarrow$ 0.2 V

Then 1 m potentiometer wire balances $\Rightarrow \frac{0.2}{10}$ V

Then 6 m potentiometer wire balances $\frac{0.2}{10} \times 6\,\text{V}$

$$= \frac{1.2}{10} = 0.12\text{ V}$$

Correct option is **(iv)**.

Q. 38. The current sensitivity……

Ans. Given,

$$I'_g = I_g + \frac{20}{100} I_g$$

$$= \frac{120}{100} I_g = 1.2 I_g$$

$$R' = R + \frac{25}{100} R = \frac{125}{100} R$$

$$= 1.25\,R$$

$$V'_g = ?$$

$$V'_g = \frac{I'_g}{R'} = \frac{1.2 I_g}{1.25 R}$$

$$= \frac{120}{125} V_g = \frac{25}{25} V_g$$

$$\% \text{ change} = \frac{V_g' - V_g}{V_g} \times 100$$

$$= \frac{\left(\frac{24}{25}V_g - V_g\right)}{V_g} \times 100$$

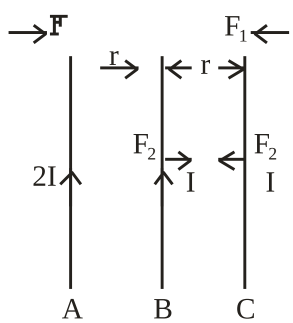
$$= \frac{(24-25)}{25} \times 100$$

$$= \frac{-1}{25} \times 100 = 4\%$$

Decrease by 4%. Correct option is **(iv)**.

Q. 39. Three infinitely long parallel .....

Ans.



Let F_1 is force per unit, length between A & C

$$\therefore \quad i.e. \; F_1 = \frac{\mu_0}{4\pi} \frac{2I \times I}{2r}$$

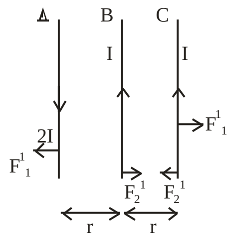
And F_2 is force per unit, length between B & C

$$\therefore \quad F_2 = \frac{\mu_0}{4\pi} \frac{I \times I}{r}$$

Now net force on 'C' is per unit length

$$F_1 + F_2 = \frac{\mu}{4\pi} \frac{I^2}{r} (1+1)$$

$$= \frac{2\mu_0}{4\pi} \frac{I^2}{r} = F \text{ (given)}$$

Now Fig.  b

$$F_1' = \text{Repulsive force between A \& C}$$

$$= \frac{\mu_0}{4\pi}\frac{2I^2}{2r}$$

$$F_2' = F_2 = \text{A reactive force between B \& C}$$

∴ Net force on 'C' $F_1' - F_2' = 0$

∵ $$F_1' = F_2' = \frac{\mu}{4\pi}\frac{2I^2}{2r}$$

∴ Net Force on 'C' is zero.

Correct option is **(i)**.

Q. 40. In a H-atom ....

Ans. $R = 0.5$ A°

$$\omega = 10 \text{ rps} = 10 \times 2\pi \text{ rad/s}$$

$$\nu = 10 \text{ Hz}$$

$$M = I\,A = e\,\nu\,\pi\,r^2$$

$$= 1.6 \times 10^{-19} \times 10 \times 3.14 \times 0.5 \times 0.5 \times 10^{-10} \times 10^{-10}$$

$$= 1.256 \times 10^{-38} \text{ Am}^2$$

Ans. (ii).

Q. 41. An air-cored solenoid .....

Ans. Magnetic field inside a solenoid

$$B = \mu_0 \frac{N}{l} I'$$

Flux linked with 'N' turns

Initial flux $$\phi_1 = N\,B\,A = N\mu_0 \frac{N}{l} I\,A$$

$$= \mu_0 \frac{N^2}{l} I A$$

$$= \frac{4\pi \times 10^{-7} \times 800 \times 800 \times 2.5 \times 2.5 \times 10^{-4}}{0.30}$$

$$= 16.74 \times 10^{-3} \text{ Wb}$$

Final flux $\phi_2 = 0$

Average back emf $\quad |e| = \frac{d\phi}{dt} = \frac{16.74 \times 10^{-3} - 0}{10^{-3}}$

$$= 16.74 \text{ V}$$

Correct option is **(ii)**.

Q. 42. $\quad V_o = 283$ V, $f = 50$ Hz

$R = 3\ \Omega$, $L = 25.48$ mH

$C = 796\ \mu$F

$P|_{\text{at resonance}} = ?$

Power dissipated $\quad P = I^2 R$

$$I = \frac{I_0}{\sqrt{2}} = \frac{1}{\sqrt{2}}\left(\frac{283}{3}\right)$$

$$= 66.7 \text{ A}$$

$$P = I^2 R$$

$$= (66.7)^2\, 3$$

$$= 13.35 \text{ kW}$$

Correct option is **(iii)**.

Q. 43. A circular loop .....

Ans. Let flux linked with smaller loop is ϕ_1 and with bigger loop is ϕ_2.

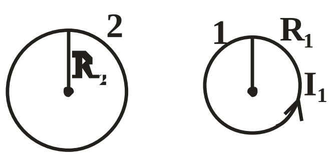


Fig.

Given $\quad R_2 = 0.2$ m

$$R_1 = 0.003 \text{ m}$$

$$x = 15 \text{ cm} = 0.15 \text{ m}$$

Now $$\phi_1 = B_2 A_1$$

$$= \frac{\mu_0}{4\pi}\left[\frac{2\pi R_2^2 I_2}{(R_2^2 + x^2)^{3/2}}\right]\pi R_1^2$$

$$M = \frac{\phi_1}{I_2} = \frac{\mu_0}{4\pi}\frac{2\pi R_2^2 \pi R_1^2}{(R_2^2 + x^2)^{3/2}}$$

Now $$\phi_2 = M I_1$$

$$= \frac{\mu_0}{4\pi}\frac{2\pi R_2^2 \pi R_1^2}{(R_2^2 + x^2)^{3/2}}.I_1$$

$$= 9.1 \times 10^{-11} \text{ Weber}$$

Correct answer is **(iv)**.

Q. 44. If both the no. of turns.....

Ans. $$L = \mu_0 \frac{N^2}{l} A$$

$$L' = \mu_0 \frac{(2N)^2}{2l} A$$

$$= 2\mu_0 \frac{N^2}{l} A = 2L$$

Correct answer is (ii). Doubted.

Q.45. Given below____________________
To increase the range

Ans. 45. Correct option is (iv) as both statements are false. To increase the range of an ammeter, suitable low R (or shunt) should be connected in parallel to it. The ammeter with increased range has low resistance.

Q.46. An electron_____________________

Ans.46. Correct option is (iii)

Statements correct but reason is wrong because electrons move from a region of low potential to high potential.

Q. 47. A magnetic needle ……..

Ans. The given statement is correct and reason is the correct explanation of the above statement. At poles, magnetic needle orients itself vertically because horizontal components of earth's field is zero there. (correct option is (i))

Q. 48. A proton and an electron, …….

Ans. we know $\frac{mv^2}{r} = Bqvsin\,\theta = Bqv\ Sin\,\theta$

Centripetal force = magnetic Lorentz force

$\sin\theta = \sin 90^{\theta} = 1$ ($\angle$ between $\vec{V}$ & $\vec{B} = 90°$)

$\frac{mv^2}{r} = Bqv$

$\frac{mv}{r} = Bq$

$r = \frac{mv}{Bq} = \frac{p}{Bq} = \frac{linear\ momentum}{Bq}$

Since $r = \frac{p}{Bq}$

Given p, B are same

Also q for proton & electron is same except its sign

$\therefore$ Radius is same. So statement is correct but

reason is not the correct explanation of the given assertion.

correct option is (ii)

Q. 49. On increasing………….

Ans. 49. When we increase current sensitivity by increasing no. of turns, then resistance of coil also increases. So increasing current sensitivity does not necessarily imply that voltage sensitivity will increase because $V_g = \frac{I_g}{R}$

$\therefore$ if $I_g \uparrow$ & $R \uparrow$ by different amounts, then V_g may increase or decrease.

Correct option is (i).

Q.50. A small object………

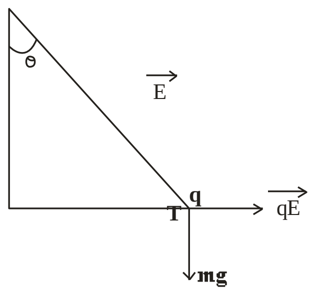
Ans. 50. Ans is (ii)

$F_e = mg\ tan\theta$

$qE = mg\ tan\theta$

$q = \left(\frac{mg}{E}\right)\tan\theta$

$\tan\theta = \frac{F_e}{mg}$



Correct ans. is (ii)

Q. 51. A free electron…………

Ans. 51. Correct ans. (ii) i.e. II only

$\because F_p = F_e$ $\because F = qE$

$E = same$

$'q' = same$

Now, $P\varepsilon = q\,V(r)$

$(P.\varepsilon)_p > (P.\varepsilon)_e$

Q. 52. Correct ans is (iv) i.e. step down transformer decreases the ac voltage.

Q.53. correct ans is (i)

i.e. $\frac{N_s}{N_p} = \frac{E_s}{E_p}$

i.e. if no. of turns in secondary coil are more than no. of turns in primary, then voltage is increased or stepped up in secondary, so called step up transformer.

Q.54 Correct ans. is (i).

i.e. current is reduced if voltage is stepped – up so corresponding I^2R losses are cut down.

Q. 55. Correct ans is (iii)

Given $E_i = 2300V$

$E_o = 230V$

$N_p = 4000$

$N_s = ?$

$\frac{E_i}{E_o} = \frac{N_p}{N_s}$

$\frac{2300}{230} = \frac{4000}{x}$

$x = 400 = N_s$ = No of turns in secondary coil