

SAMPLE QUESTION PAPER-1 (TERM 1) 2021-22

SUBJECT : PHYSICS

CLASS : XII

Time : 90 Min

Marks : 35

General Instructions :

The Question Paper contains three sections.

Section A has 25 questions. Attempt any 20 questions.

Section B has 24 questions. Attempt any 20 questions.

Section C has 6 questions. Attempt any 5 questions.

All questions carry equal marks.

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 number of questions are attempted, ONLY first 20 will be considered for evaluation.

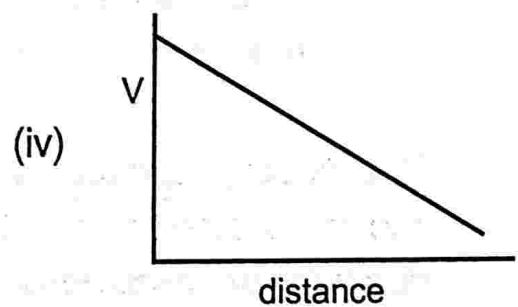
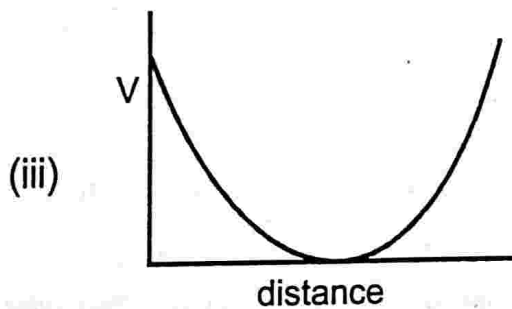
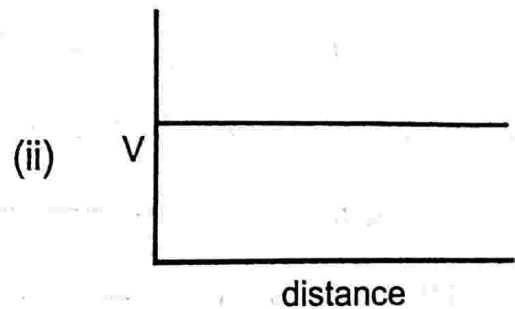
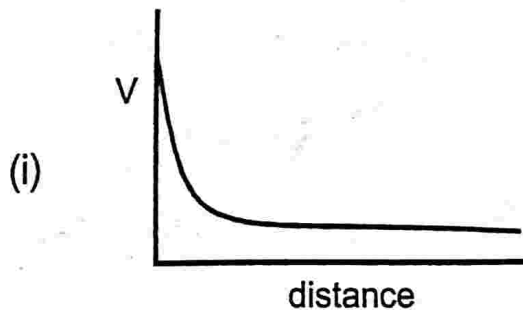
Which of the following statements is correct?

- i) An electric field is a scalar quantity
- ii) Electric field lines are at 45 degrees to the equipotential surfaces
- iii) The surface of a charged conductor is equipotential
- iv) Field lines due to a point charge are circular

Two point charges $+4q$ and $+q$ are kept at a distance of 30 cm from each other. At which point between them, the field intensity will be equal to zero?

- i) 15 cm away from the +4q charge
- ii) 20 cm away from the +4q charge
- iii) 7.5 cm away from the +q charge
- iv) 5 cm away from the +q charge

3. What is the correct diagram regarding the variation of an electric potential with distance from an electric dipole if the distance is very large than the dipole length?



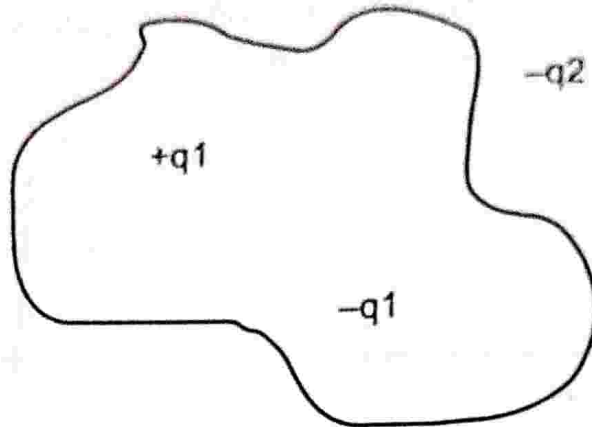
4. The total capacitance of capacitors connected in parallel is given by _____

- i) product of the individual capacitors in parallel
- ii) sum of all the individual capacitors in parallel
- iii) sum of their reciprocals
- iv) product of their reciprocals

5. Two equal balls having equal positive charge q C are suspended by two insulating strings of equal length. What would be the effect on the force F when a plastic sheet of Dielectric constant K is inserted between the two?

- i) reduces to $1/K$ times F
- ii) increases to K times F
- iii) F remains constant
- iv) reduces to $1/K^2$ times F

6. Electric field outside this Gaussian surface will be due to _____



- i) q_2
 - ii) Only due to positive charges
 - iii) Zero
 - iv) due to all the charges
7. A capacitor has some dielectric slab fully inserted between its plates, and the capacitor is connected to a dc source. After some time the battery is disconnected and then the dielectric is removed, then
- (i) capacitance will increase.
 - (ii) energy stored will decrease.
 - (iii) electric field will increase.
 - (iv) voltage will decrease.

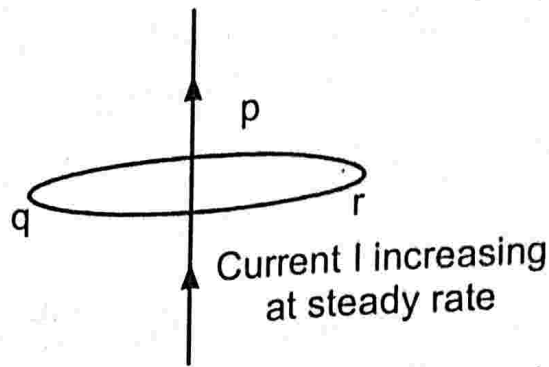
3. Potentiometer is often called the ideal voltmeter. Why?

- i) Potentiometer is highly sensitive
- ii) Potentiometer never draws current from the cell whose emf is to be measured

- iii) Potentiometer can measure very small potential differences.
- iv) All are correct.
9. If n cells each of emf μ and internal resistance r are connected in parallel, then the total emf and internal resistance will be
- (i) $\epsilon, \frac{r}{n}$
- (ii) ϵ, nr
- (iii) $n\epsilon, \frac{r}{n}$
- (iv) $n\epsilon, nr$
10. Which of the following relations is significant for metals when the temperature increases?
- i) Resistivity increases and conductivity decreases
- ii) Resistivity decreases and conductivity decreases
- iii) Resistivity and conductivity do not change with temperature
- iv) Temperature dependence of Resistivity is linear
11. Which of the following is an example of an Ohmic conductor?
- i) Nichrome
- ii) Silicon
- iii) Gallium Arsenide
- iv) Junction Diode
12. Calculate the number of units of electricity used if a bulb of 100 W is kept on for 5 hours.
- i) 1 unit
- ii) 0.1 unit
- iii) 5 unit
- iv) 0.5 unit

13. Predict the effect of length of conductor on drift velocity of electrons if the voltage is kept constant.
- Drift velocity varies linearly with the length of conductor
 - Drift velocity does not depend on the length of conductor
 - Drift velocity increases with the increasing length of conductor
 - Drift velocity decreases with the increasing length of conductor
14. Calculate the number of dry cells, each of emf 2V and internal resistance 1 Ω that is joined in series with a resistance of 30 ohms so that a current of 0.8A passes through it.
- 20
 - 10
 - 30
 - 40
15. Give the SI unit of magnetic permeability of free space.
- TA m⁻²
 - TA⁻² m
 - TA⁻¹ m
 - TA m²
16. The sensitivity of a moving coil galvanometer can be increased by decreasing :
- The number of turns in the coil
 - The area of the coil
 - The magnetic field
 - The couple per unit twist of the suspension
17. A charged particle is moving on circular path with velocity v in a uniform magnetic field B , if the velocity of the charged particle is doubled and strength of magnetic field is halved, then radius becomes :

- (i) 8 times
 - (ii) 4 times
 - (iii) 2 times
 - (iv) 16 times
18. At a given place on the Earth's surface, the horizontal component of Earth's magnetic field is 9×10^{-5} T and the resultant magnetic field is 180×10^{-6} . Calculate the angle of dip at this place.
- i) 45°
 - ii) 0°
 - iii) 60°
 - iv) 30°
19. Which of the following is the definition for the magnetic meridian of Earth?
- i) Vertical plane passing through the axis of a freely suspended or pivoted magnet
 - ii) Horizontal plane passing through the axis of a freely suspended or pivoted magnet
 - iii) Vertical plane passing through the geographical North Pole and South Pole at a given place
 - iv) Horizontal plane passing through the geographical North Pole and South Pole at a given place
20. Identify the factor on which self-inductance does not depend.
- i) Number of turns
 - ii) Area of cross-section
 - iii) Permeability of the core material
 - iv) The permittivity of the core material
21. What is the direction of Induced current in the coil ?



- i) The direction of induced current is along rpqr
- ii) The direction of induced current is along rqpr
- iii) The direction of induced current changes is along diameter p to q
- iv) The direction of induced current cannot be determined as there is no induced current

22. What is the relative permeability of an air-core inductor, if its self-inductance increases from 0.5 mH to 50 mH due to the introduction of an iron core into it?

- i) 100
- ii) 0.1
- iii) 10000
- iv) 0.0001

23. What will be the rms value of the voltage, if the sinusoidal value voltage is given as $E = 100 \sin 314t$ applied across a resistor of resistance 15 ohms?

- i) 200 V
- ii) 70.71V
- iii) 100 V
- iv) 33.87 V

24. An inductor coil joined to a 6V battery draws a steady current of 12A. This coil is connected in series to a capacitor and ac source of alternating emf 6 V. If the current in the circuit is in phase with the emf, find the rms current.

- i) 12 A
- ii) 15 A
- iii) 25 A
- iv) 19 A

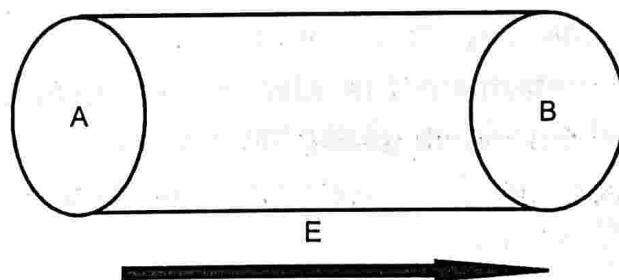
25. How will the capacitive reactance be affected if the frequency is doubled?

- i) Doubled
- ii) Insignificant
- iii) Remains the same
- iv) Halved

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.

26. What will be the total flux passing through the cylinder if the surface A and B have surface area S?



- i) ES
- ii) $-ES$
- iii) Zero
- iv) $\frac{ES}{\epsilon_0}$

27. An electron of charge e and mass m is kept in a vertical electric field of magnitude E . What must be the value of E so that the electron doesn't fall due to gravity?

i) $mg e$

ii) $\frac{e}{mg}$

iii) $\frac{mg}{e}$

iv) $\frac{1}{mge}$

28. Electric field inside a hollow conducting sphere_____?

i) Increases with distance from the center of the sphere

ii) Is zero

iii) Decreases with distance from the center of the sphere

iv) May increase or decrease with distance from the center

29. There are infinite number of charges, each equal to ' q ', which are placed along the X-axis at points $x = 1, x = 4, x = 16, x = 64, \dots$. Then, determine the electric potential due to this system of charges at the point $x = 0$?

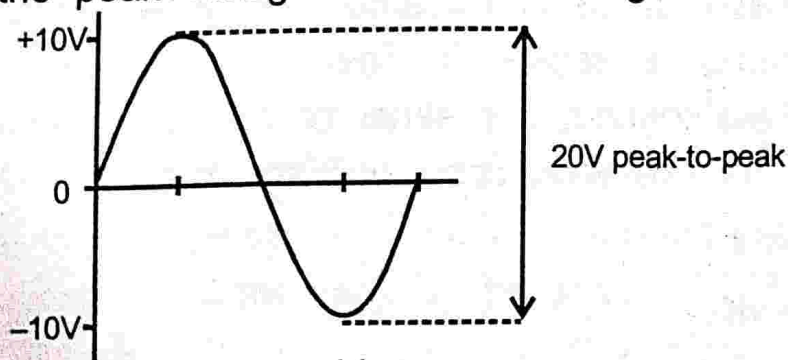
i) $V = \frac{16q}{3\pi\epsilon_0}$

ii) $V = \frac{3q}{4\pi\epsilon_0}$

iii) $V = \frac{4q}{8\pi\epsilon_0}$

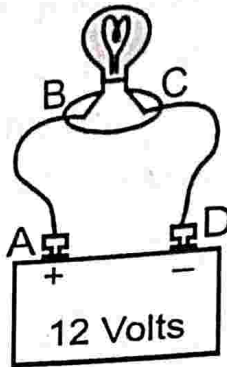
iv) $V = \frac{3q}{16\pi\epsilon_0}$

30. Initially the potential difference of a $8 \mu\text{F}$ capacitor is 30 V. Then it is changed to 40V. What is the increase in energy?
- $28 \times 10^{-4}\text{J}$
 - $18 \times 10^{-4}\text{J}$
 - $8 \times 10^{-4}\text{J}$
 - $24 \times 10^{-4}\text{J}$
31. Pick out the correct combination for a step-up transformer. In which n is the transformer turns ratio ; V_p , V_s and I_s , I_p are primary and secondary voltages and currents respectively; N_s, N_p are number of turns in transformer windings)
- $n < 1$; $V_s > V_p$, $I_s > I_p$, $N_s > N_p$
 - $n > 1$; $V_s > V_p$, $I_s < I_p$, $N_s > N_p$
 - $n > 1$; $V_s > V_p$, $I_s > I_p$, $N_s > N_p$
 - $n < 1$; $V_s < V_p$, $I_s > I_p$, $N_s > N_p$
32. The r.m.s value of an alternating current is given by steady (D.C) current which when flowing through a given circuit for a given time produces ?
- The more heat than produced by A.C when flowing through the same circuit
 - The less heat than produced by A.C when flowing through the same circuit
 - The same heat than produced by A.C when flowing through the same circuit
 - Zero amount of Heat always.
33. To find the peak voltage of a waveform given :



- i) Divide Peak to peak by two
- ii) Multiply Peak to Peak by 2
- iii) Divide peak by .707
- iv) Multiply Peak by .707

34. Energy is required to force a positive test charge to move ___?



- i) through the wire from point A to point B
- ii) through the light bulb from point B to point C
- iii) through the wire from point C to point D
- iv) through the battery from point D to point A

35. A potential difference of 100V is applied across a conductor of length 50cm. Calculate the drift velocity of electrons if the electron mobility is $9 \times 10^{-5} \text{ m}^2\text{V}^{-1} \text{ s}^{-1}$.

- i) 0.001 ms^{-1}
- ii) 1.800 ms^{-1}
- iii) 0.018 ms^{-1}
- iv) 0.180 ms^{-1}

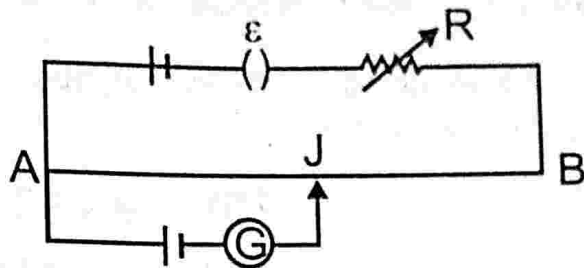
36. 'n' cells have emf 'e' and internal resistance 'r' and are connected to an external resistance 'R'. They pass the same current whether the cells are connected in series or in parallel to each other. Then which of the following conditions are true?

- i) $R = r$
- ii) $r = nR$

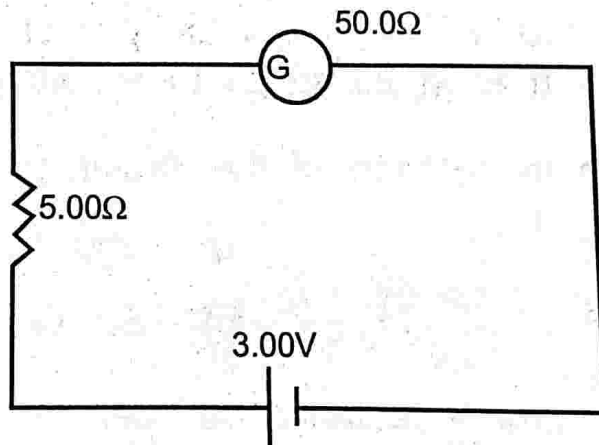
iii) $R = nr$

iv) $R = n^2r$

37. AB is a wire of potentiometer with the increase in the value of resistance R , the shift in the balance point J will be



- i) towards B
 ii) towards A
 iii) remains constant
 iv) first towards B then back towards A.
38. The galvanometer shown below has a resistance (R_G) of 50.00Ω . Now, this galvanometer is converted to an ammeter with the help of a shunt resistance (r_s) of 0.05Ω . Calculate the current passing through the galvanometer in both the cases.



- i) 0.0545 A, 0.594 A ii) 0.0545 A, 0.05 A
 iii) 0.0545 A, 0.06 A iv) 0.07 A, 0.05 A
39. Find the correct statement ?
- i) The force between two parallel current carrying wires is independent of the radii of the wires

- ii) The force between two parallel current carrying wires is independent of the length of the wires
- iii) The force between two parallel current carrying wires is independent of the magnitude of currents
- iv) The force between two parallel current carrying wires is independent of their distance of separation

40. Under which of these conditions, the torque acting on the current carrying loop is minimum?

- i) $\theta = 0^\circ$
- ii) $\theta = 90^\circ$
- iii) $\theta = 270^\circ$
- iv) $\theta = 450^\circ$

41. The magnetic flux in a closed circuit of resistance 20Ω varies with time t as $\phi = 4t^3 + 2t^2 - 15t + 3$. Calculate the magnitude of induced emf at $t = 1s$.

- i) 3 V
- ii) 1 V
- iii) 5 V
- iv) 6 V

42. 4. A resistor of 50Ω , an inductor of $\frac{20}{\pi}H$ and a capacitor of $\frac{5}{\pi}\mu F$ are connected in series to a voltage supply of $230V - 50Hz$. Find the impedance of the circuit.

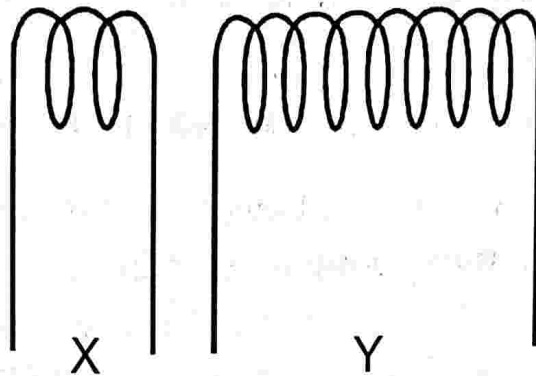
- i) 150Ω
- ii) 250Ω
- iii) 350Ω
- iv) 50Ω

43. Calculate the mutual inductance between two coils if a current 10 A in the primary coil changes the flux by 500 Wb per turn in the secondary coil of 200 turns.

- i) 10 H
- ii) 10^4 H
- iii) 1000 H

iv) 100 H

44. Two coils X and Y are arranged as shown in the diagram below.



One quarter of the magnetic flux produced by the current in X is linked with Y. The mutual inductance between the coils is M. What is the mutual inductance when Y is the primary coil?

- i) $\frac{M}{4}$
- ii) $\frac{M}{2}$
- iii) M
- iv) 4M

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

Assertion : A galvanometer can detect only small currents .Thus, to measure large currents it is converted into an ammeter.

Reason : Galvanometer can be converted into an ammeter by connecting a low resistance called shunt resistance in series to the galvanometer

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: Resistance of a metal increases with increase in temperature

Reason : In a meter bridge experiment, the null point for an unknown resistance is measured. Now, the unknown resistance is put inside an enclosure maintained at a higher temperature. The null point can be obtained at the same point as before by decreasing the value of the standard 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.

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

Asseron(A) : In a uniform electric field, the net force acting on an electric dipole is zero.

Reason(R) : In a uniform electric field, the net torque acting on an electric dipole may 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)

Asseron (A) : If an electron and proton enter a magnetic field with equal momentum, then the paths of both of them will be equally curved.

Reason (R) : The magnitude of charge on an electron is the same as that on a 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)

Asseron (A) : The true geographic north direction is found by using a compass needle.

Reason (R) : The magnetic meridian of the earth is along the axis of rotation of the earth.

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
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SECTION C

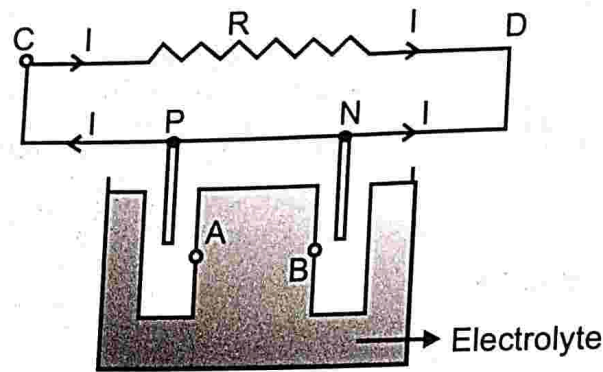
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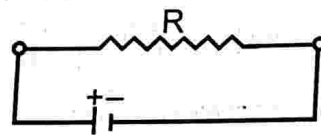
CASE STUDY

Read the paragraph and Answer the questions.

A cell has two electrodes, called the positive (P) and the negative (N), as shown in Fig below.



(a)



Symbol
(b)

They are immersed in an electrolytic solution. Dipped in the solution, the electrodes exchange charges with the electrolyte. The positive electrode has a potential difference V_+ ($V_+ > 0$) between itself and the electrolyte solution immediately adjacent to it marked A in the figure. Similarly, the negative electrode develops a negative potential $-V_-$ ($V_- \geq 0$) relative to the electrolyte adjacent to it, marked as B in the figure.

50. When there is no current, the electrolyte has the same potential throughout, so that the potential difference between P and N is equal to

i) $V_+ - (-V_-)$

ii) $V_- - (-V_+)$

iii) $V_+ + (-V_-)$

iv) Zero

51. This difference is called the _____ of the cell?

i) Electrical energy

ii) Electromotive Force

iii) Electric Potential

iv) Terminal Potential

52. $V =$ Potential difference between P and A + Potential difference between A and B + Potential difference between B and N = ϵ

Then emf μ can be called as the potential difference between the positive and negative electrodes in an _____ circuit ?

i) Running circuit

ii) Closed circuit

iii) Infinite external resistance

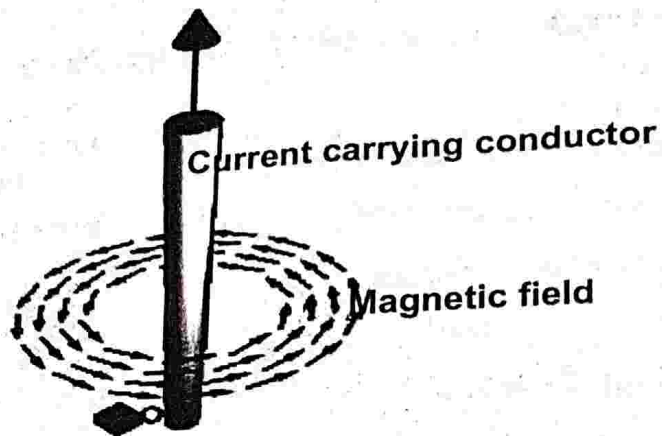
iv) Zero external resistance circuit

CASE STUDY

According to Right hand Thumb rule to find the direction of magnetic field due to current carrying straight conductor Grasp the wire in your right hand with your extended thumb pointing in the direction of the current. Your fingers will curl around in the direction of the magnetic field.

When there is a system with a symmetry such as for a straight infinite current-carrying wire in, the Ampere's law enables an easy evaluation of the magnetic field, much the same way Gauss' law helps in determination of the electric field The boundary of the loop chosen is a circle and magnetic field is tangential to the circumference of the circle.

We find that the magnetic field at a distance r outside the wire is tangential and given by $B \times 2\pi r = \mu_0 I$ or $B = \mu_0 I / (2\pi r)$



53. The intensity of the magnetic field, as we move away from the current carrying conductor will
- Decrease
 - Increase then decrease
 - Increases
 - Remains the same
54. A horizontal overhead power line carries a current of 100A in east to west direction. What is the magnitude and direction of the magnetic field due to the current, 2m below the line?
- $3 \times 10^{-5} \text{ T}$
 - $2 \times 10^{-5} \text{ T}$
 - $1 \times 10^{-5} \text{ T}$
 - $4 \times 10^{-5} \text{ T}$
55. Which of the following is not a point of similarity between Biot-Savart law in magnetic effect of current and Coulomb's law.
- Both fields depend inversely on the square of the distance from the source to the point of observation
 - They are not a universal law
 - The principle of superposition does not apply to both
 - Both are long-range fields.

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CLASS : XII

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Marks : 35

General Instructions:

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SECTION A

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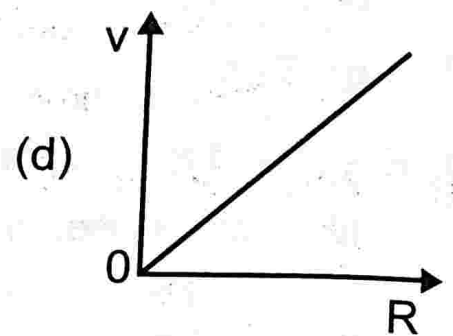
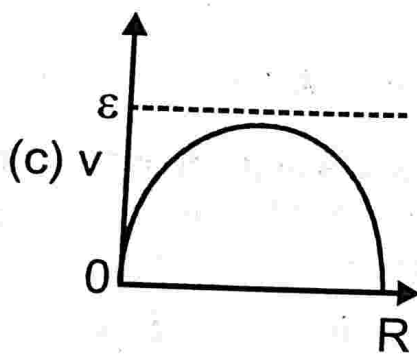
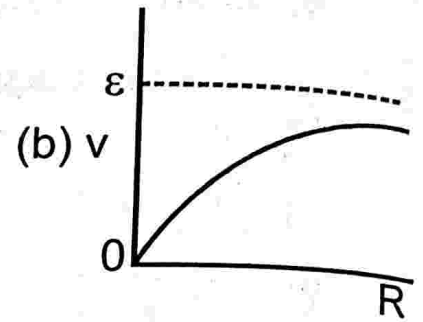
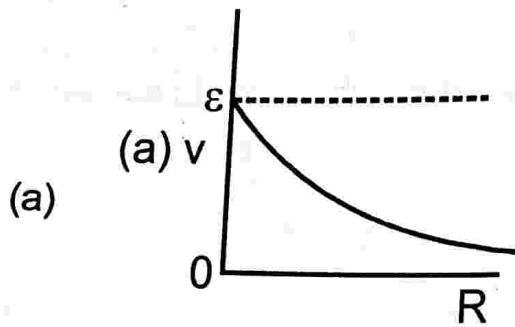
1. An electric dipole when placed in a uniform electric field will have minimum potential energy, if the angle between dipole moment and electric field is:

- | | |
|----------|--------------------|
| a) Zero | b) $\frac{\pi}{2}$ |
| c) π | d) $\frac{\pi}{3}$ |

2. There are two charges $+ 1\mu\text{c}$ and $+ 2\mu\text{c}$ kept at certain separation. The ratio of electrostatic forces acting on them will be in the ratio of-

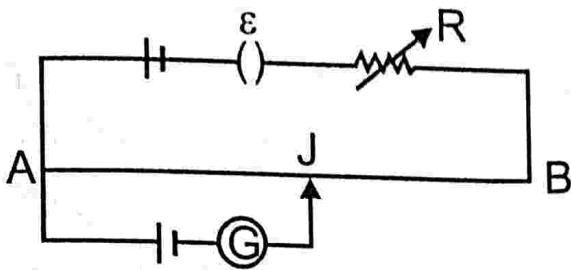
- a) 1: 2
b) 2: 1
c) 1: 1
d) 1: 4
3. What is the electric flux through a cube, which encloses an electric dipole?
- a) q / ϵ_0
b) $q / 6\epsilon_0$
c) $q / 4\pi\epsilon_0$
d) Zero
4. Equipotential surfaces
- (a) are closer in regions of large electric fields compared to regions of lower electric fields.
(b) will be more crowded near sharp edges of a conductor.
(c) will always be equally spaced.
(d) both (a) and (b) are correct.
5. In a parallel plate capacitor, the capacity increases if
- (a) area of the plate is decreased.
(b) distance between the plates increases.
(c) area of the plate is increased.
(d) dielectric constant decreases.
6. Two spherical conductors each of capacity C are charged to potential V and $-V$. These are then connected by means of a fine wire. The loss of energy is:
- (a) zero
(b) $1/2CV^2$
(c) CV^2
(d) $2 CV^2$

7. A cell having an emf E and internal resistance r is connected across a variable external resistance R . As the resistance R is increased, the plot of potential difference V across R is given by:

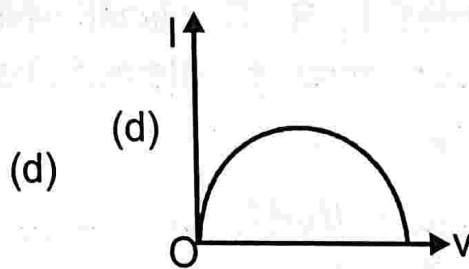
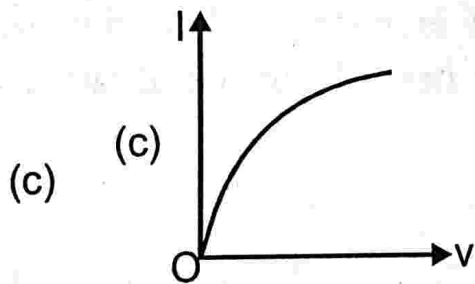
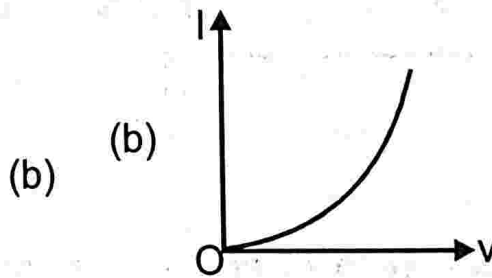
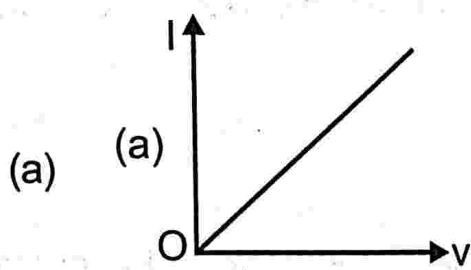


8. If n cells each of emf ε and internal resistance r are connected in parallel, then the total emf and internal resistance will be
- (a) $\varepsilon, \frac{r}{n}$ (b) ε, nr
- (c) $n\varepsilon, \frac{r}{n}$ (d) $n\varepsilon, nr$
9. When a metal conductor connected to left gap of a meter bridge is heated, the balancing point
- (a) shifts towards right
- (b) shifts towards left
- (c) remains unchanged
- (d) remains at zero

10. AB is a wire of potentiometer. With the increase in the value of resistance R, the shift in the balance point J will be



- (a) towards B
 (b) towards A
 (c) remains constant
 (d) first towards B then back towards A.
11. Which of the following I-V graph represents ohmic conductors?



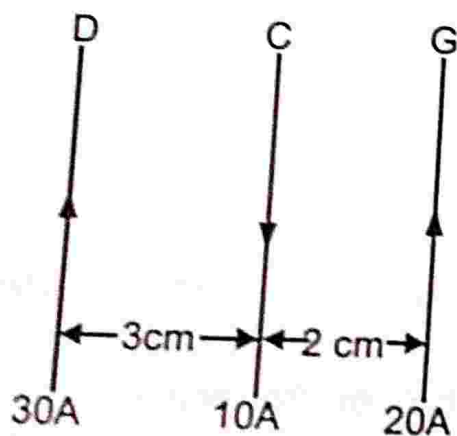
12. The resistivity of alloy manganin is

- (a) Nearly independent of temperature
 (b) Increases rapidly with increase in temperature
 (c) Decreases with increase in temperature
 (d) Increases rapidly with decrease in temperature

13. Name the physical quantity that is conserved in Kirchhoff's loop rule:
- Charge
 - mass
 - Energy
 - Momentum
14. In an AC circuit, current is lagging from the applied voltage then circuit can have:
- Resistance and inductor
 - Resistance and capacitor
 - Both (a) and (b)
 - None of the above
15. The peak voltage in a 220 V, AC source is:
- 220 V
 - About 160 V
 - About 310 V
 - 440 V.
16. In a series L, R, C, circuit which is connected to a.c. source. When resonance is obtained then net impedance Z will be
- $Z = R$
 - $Z = \omega L - 1/\omega C$
 - $Z = \omega L$
 - $Z = 1/\omega C$
17. An alternating current having peak value 14 A is used to heat a metal wire. To produce the same heating effect, a constant current i can be used where i is:
- 14 A

- (b) about 20 A
(c) 7 A
(d) about 10 A
18. A charge 'Q' is supplied to a hollow metallic conductor. Which of the following is true?
- Electric field inside it is same as on the surface
 - Electric potential inside is zero
 - Electric potential inside it is constant
 - Electric potential on the surface is zero
19. When current in a coil changes from 5 A to 2 A in 0.1 s, average voltage of 50 V is produced. The self-inductance of the coil is:
- 1.67 H
 - 6 H
 - 3 H
 - 0.67 H
20. A circular coil of radius 4 cm and of 20 turns carries a current of 3 amperes. It is placed in a magnetic field of intensity of 0.5 weber/m². The magnetic dipole moment of the coil is-
- 0.15 ampere-m²
 - 0.3 ampere-m²
 - 0.45 ampere-m²
 - 0.6 ampere-m²
21. The maximum current that can be measured by a galvanometer of resistance 40 Ω is 10 mA. It is converted into voltmeter that can read upto 50 V. The resistance to be connected in the series with the galvanometer is
- 2010 Ω
 - 4050 Ω

- (c) 5040Ω
 (d) 4960Ω
22. If the beams of electrons and protons move parallel to each other in the same direction, then they
- attract each other.
 - repel each other.
 - no relation.
 - neither attract nor repel.
23. Three long, straight parallel wires, carrying current are arranged as shown in the figure. The force experienced by a 25 cm length of wire C is



- 10^{-3} N
 - $2.5 \times 10^{-3} \text{ N}$
 - zero
 - $1.5 \times 3 \text{ N}$
24. Angle of dip is 90° at
- poles.
 - equator.
 - both at equator and poles.
 - tropic of cancer.

25. The best material for the core of a transformer is
- (a) stainless steel
 - (b) mild steel
 - (c) hard steel
 - (d) soft iron

SECTION B

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

26. Two parallel large thin metal sheets have equal surface densities $26.4 \times 10^{-12} \text{ C/m}^2$ of opposite signs. The electric field between these sheets is-
- (a) 1.5 N/C
 - (b) $1.5 \times 10^{-16} \text{ N/C}$
 - (c) $3 \times 10^{-10} \text{ N/C}$
 - (d) 3 N/C
27. Electric field on the axis of a small electric dipole at a distance r is E_1 and E_2 at a distance of $2r$, on a line of perpendicular bisector. Then, (E_1 / E_2) is:
- a) 2
 - b) 4
 - c) 8
 - d) 16
28. At a given place on the Earth's surface, the horizontal component of Earth's magnetic field is $9 \times 10^{-5} \text{ T}$ and the resultant magnetic field is $180 \times 10^{-6} \text{ T}$. Calculate the angle of dip at this place.

- a) 45°
- b) 0°
- c) 60°
- d) 30°

29. When is the angle of dip at a place equal to 45° ?

- a) When the vertical and horizontal components of earth's magnetic field are equal
- b) When the vertical component is twice the horizontal component of earth's magnetic field
- c) When the vertical component is half the horizontal component of earth's magnetic field
- d) When either the vertical component or the horizontal components of earth's magnetic field is equal to zero

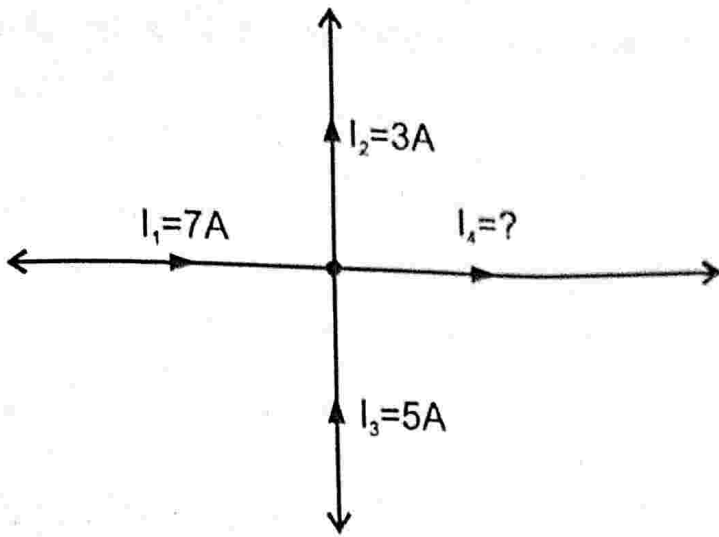
30. Give the SI unit of magnetic permeability of free space.

- a) $T A m^{-2}$
- b) $T A^{-2} m$
- c) $T A^{-1} m$
- d) $T A m^2$

31. A positive charge is moving vertically upwards. When it enters a region of magnetic field directed towards north, what is the direction of the force on the charge?

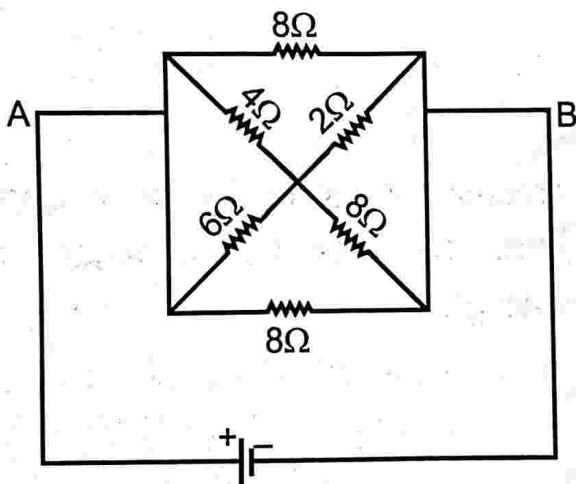
- a) Up
- b) Down
- c) Left
- d) Right

32. Calculate the value of current I_4 .



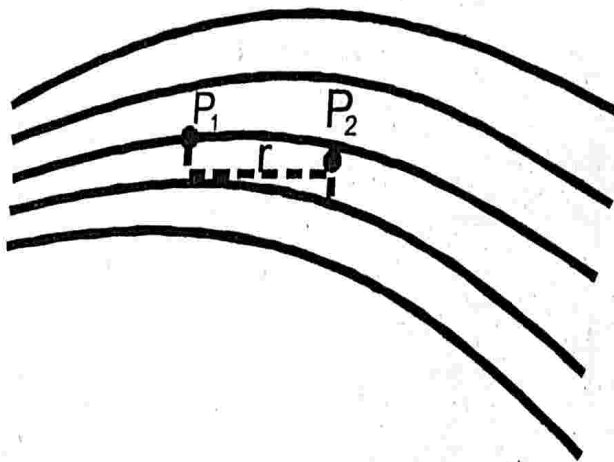
- a) -9A
- b) 9A
- c) 5A
- d) 1A

33 Calculate resultant resistance between the points A and B in the circuit shown in the figure below.



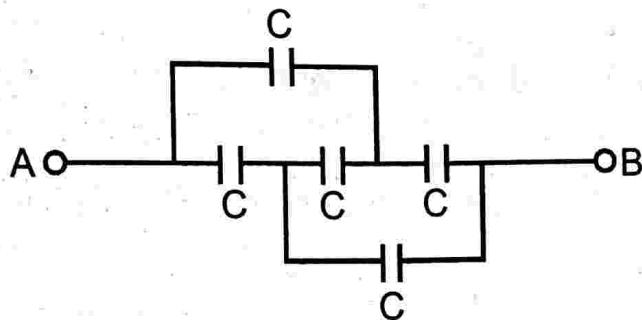
- a) 4 ohms
- b) 2 ohms
- c) 8 ohms
- d) 6 ohms

34. The best instrument for accurate measurement of EMF of a cell is-
- Potentiometer
 - metre bridge
 - Voltmeter
 - ammeter and voltmeter
35. Two point charges each of $20 \mu\text{C}$ are placed 50 cm apart in air. What is the electric field intensity at the mid-point on the line joining the centre of two point charges?
- $5 \times 10^6 \text{ NC}^{-1}$
 - $18 \times 10^6 \text{ NC}^{-1}$
 - Zero
 - None of these
36. The figure here shows electric field lines. The electric field strength at P_1 is E_1 and that at P_2 is E_2 . If distance between P_1 , P_2 is r , then which of the following statement is true?



- $E_1 > E_2$
- $E_1 < E_2$
- $E_2 = r E_1$
- $E_2 = E_1/r^2$

37. Two insulated charged spheres of radii 20 cm and 25 cm respectively and having an equal charge q are connected by a copper wire and then they are separated.
- Both spheres will have the same charge q .
 - Charge on sphere of radius 20 cm will be more than that of radius 25 cm.
 - Charge on sphere of radius 20 cm will be lesser than that of 25 cm.
 - Charge on each will be q .
38. Five equal capacitors, each with capacitance C are connected as shown. The equivalent capacitance between A and B is.



- $5 C$
 - C
 - $C/5$
 - $3C$.
39. When a charged particle moves perpendicular to a uniform magnetic field, its:
- Energy and momentum both change.
 - Energy and momentum both don't change.
 - Energy changes but momentum remains unchanged.
 - Momentum changes but energy remains unchanged.
40. A circular coil of radius R carries a current I . The magnetic field

at its centre is B . At what distance from the centre on the axis of the coil, the magnetic field will be $B/8$?

- (a) $\sqrt{2}R$
- (b) $\sqrt{3}R$
- (c) $2R$
- (d) $3R$

41. The unit of pole strength is:

- (a) Am^{-1}
- (b) Am
- (c) Am^{-2}
- (d) Am^2

42. Which of the following is based on the law of conservation of energy?

- (a) Faraday's law
- (b) Lenz's law
- (c) Ampere
- (d) Biot-Savart's law.

43. The motional e.m.f. is the induced e.m.f.

- (a) in a circuit due to variation in its own current.
- (b) in a circuit due to variation of current in the neighbouring circuit.
- (c) in a coil due to the motion of the magnet near it.
- (d) across the ends of a wire moving in a magnetic field

44. What voltage is developed across the axle of the wheels of a train, when it moves with a speed of 72 km/h ? The horizontal component of earth's magnetic field is $0.40 \times 10^{-4} \text{ T}$ and the angle of dip is 30° . The length of the axle is 1.5 m .

- (a) 0.8 mv

- (b) 0.4 mv
- (c) 0.2 mv
- (d) 0.7 mv

ASSERTION-REASONING TYPE QUESTIONS

Read the following questions and choose any of the following four responses.

- (A) If both Assertion and Reason are true and the Reason is the correct explanation of the Assertion.
- (B) If both Assertion and Reason are true and the Reason is not a correct explanation of the Assertion.
- (C) If Assertion is true but the Reason is false
- (D) If both Assertion and Reason are false

45. **Assertion:** Two adjacent conductors, carrying the same positive charge have no potential difference between them.

Reason: The potential of a conductor does not depend upon the charge given to it

46. **Assertion:** One may have zero potential but non-zero electric field at a point in space.

Reason: Electric potential is a scalar quantity.

47. **Assertion :** If the distance between parallel plates of a capacitor is halved and dielectric constant is three times, then the capacitance becomes 6 times.

Reason : Capacity of the capacitor does not depend upon the nature of the material.

48. **Assertion:** Induced emf will always occur whenever there is change in magnetic flux.

Reason: Current always induces whenever there is change in magnetic flux.

49 **Assertion:** Lenz's law does not violate the principle of conservation of energy.

Reason : Induced emf always opposes the change in magnetic flux responsible for its production.

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.

50. An a.c. generator consists of a coil of 100 turns and cross-sectional area of 3 m^2 , rotating at a constant angular speed of 60 rad s^{-1} in a uniform magnetic field 0.04 T . The resistance of the coil is 500Ω . Calculate the maximum current drawn from the generator.
- a) 2500 A
 - b) 1.44 A
 - c) 6.25 A
 - d) 0.55 A
51. A galvanometer has resistance of 10 ohms and a full scale deflection is produced by 50 milli-amperes. What is the value of resistance that should be connected in series with it in order to enable it to read 2V?
- a) 20Ω
 - b) 10Ω
 - c) 40Ω
 - d) 30Ω

CASE STUDY

EXPERIMENT:

According to Faraday's law of electromagnetic induction, there will be an EMF induced in the second winding. If the circuit of this secondary winding is closed, then a current will flow through it. This is the basic working principle of a transformer. A transformer that increases voltage between the primary to secondary windings is defined as a step-up transformer. Conversely, a transformer that decreases voltage between the primary to secondary windings is defined as a step-down transformer. Ideal transformer is not very practical. This is because in the open air only a very tiny portion of the flux produced from the first coil will link with the second coil. So the current that flows through the closed circuit connected to the secondary winding will be extremely small (and difficult to measure). The rate of change of flux linkage depends upon the amount of linked flux with the second winding. So ideally almost all of the flux of primary winding should link to the secondary winding. This is effectively and efficiently done by using a core type transformer. This provides a low reluctance path common to both of the windings.

52. If the supply frequency of a transformer increases, the secondary output voltage of the Transformer-
- (a) Increase
 - (b) Decrease
 - (c) Remains the same
 - (d) any of the above
53. Which quantity is increased in step-down transformer?
- (a) resistance
 - (b) power
 - (c) current
 - (d) charge
54. The voltage in the secondary coil of a transformer does not depend upon-

- (a) Frequency of the source
 - (b) Voltage in Primary
 - (c) Ratio of no. of turns in the two coils
 - (d) Both (b) and (c)
- 55 The primary winding of transformer has 500 turns whereas its secondary has 5000 turns. The primary is connected to an ac supply of 20 V, 50 Hz. The secondary will have an output of
- (a) 200 V, 50 Hz
 - (b) 2 V, 50 Hz
 - (c) 200 V, 500 Hz
 - (d) 2 V, 5 Hz

Time : 90 Min

General Instructions :

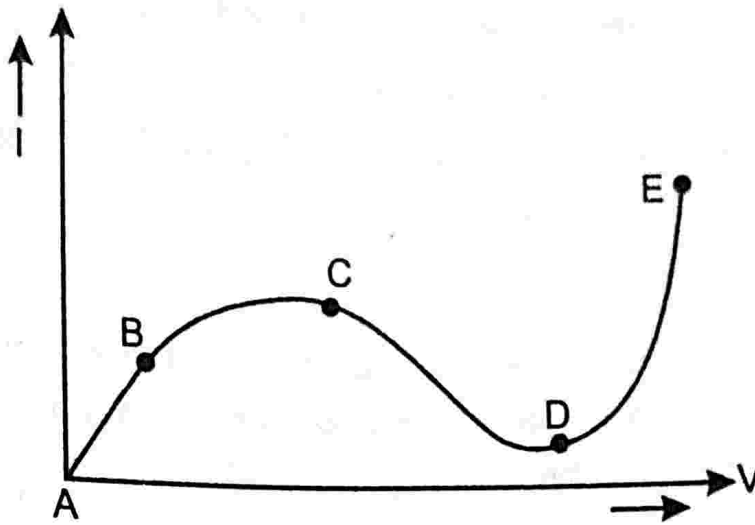
1. The Question Paper contains three sections.
2. Section A has 25 questions. Attempt any 20 questions.
3. Section B has 24 questions. Attempt any 20 questions.
4. Section C has 6 questions. Attempt any 5 questions.
5. All questions carry equal marks.
6. There is no negative marking.

SECTION-A

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

1. One metallic sphere A is given positive charge whereas another identical metallic sphere B of exactly same mass as of A is given equal amount of negative charge. Then :
 - (a) mass of A and mass of B still remain equal
 - (b) mass of A increases
 - (c) mass of B decreases
 - (d) mass of B increases
2. Force between two identical charges placed at a distance of r in vacuum is F . Now a slab of dielectric of dielectric constant four is inserted between these two charges. If the thickness of the

11. From the graph between current I and voltage V shown below, identify the portion corresponding to negative resistance :



- | | | | |
|---|----|---|----|
| a | AB | b | BC |
| c | CD | d | DE |
12. Sensitivity of potentiometer can be increased by
- a Increasing the e.m.f of the cell
 - b Increasing the length of the potentiometer
 - c Decreasing the length of the potentiometer wire
 - d None of these
13. Which device will have the least resistance?
- a Ammeter of range 1A
 - b Ammeter of range 10A
 - c Voltmeter of range 1V
 - d Voltmeter of range 10V
14. A proton and an α particle enter in a uniform magnetic field with the same velocity. The period of rotation of the α -particle will be :
- a four times that of the proton.
 - b three times that of the proton.

- a passing either a direct or alternating current through the plate.
- b placing in a time varying magnetic field.
- c placing in a space varying magnetic field, but does not vary with time.
- d both (a) and (b) are correct.

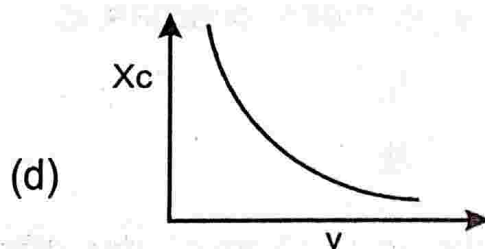
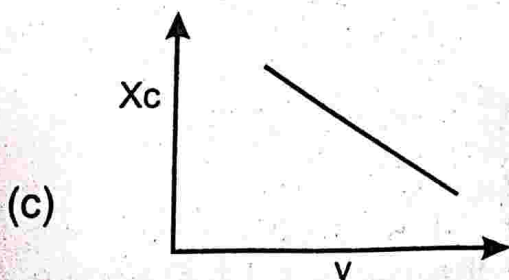
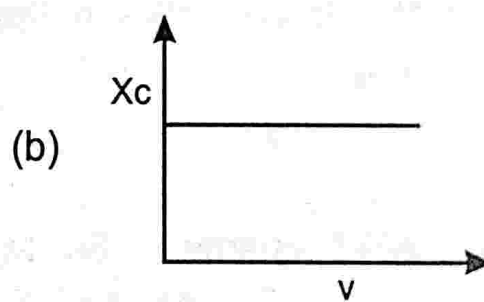
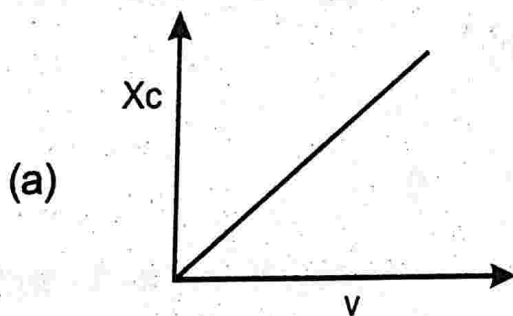
21 When current in a coil change from 5 A to 2 A in 0.1 s, average voltage of 50V is produced. The self-inductance of the coil is

- a 1.67H
- b 6H
- c 3H
- d 0.67H

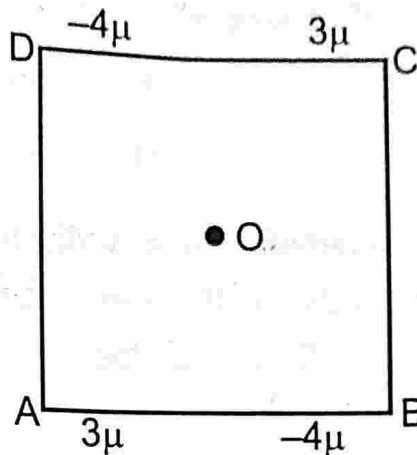
22 The expression for the induced e.m.f. contains a negative sign $e = -d\phi/dt$. What is the significance of the negative sign?

- a The induced e.m.f. is produced only when the magnetic flux decreases.
- b The induced e.m.f. opposes the change in the magnetic flux.
- c The induced e.m.f. is opposite to the direction of the flux.
- d None of the above.

23. The correct variation of capacitive reactance of a capacitor with frequency is represented by :



of side 10 cm, as shown in figure. The force on a charge of $1 \mu\text{C}$ placed at the center of square is:



- | | | | |
|---|-----|---|------|
| a | 7N | b | 12N |
| c | 18N | d | Zero |

29. Two positive point charges are 3 m apart and their combined charge is $20 \mu\text{C}$. If the force between them is 0.075 N, then the charges are:

- | | | | |
|---|----------------------------------|---|---------------------------------|
| a | $10 \mu\text{C}, 10 \mu\text{C}$ | b | $15 \mu\text{C}, 5 \mu\text{C}$ |
| c | $12 \mu\text{C}, 8 \mu\text{C}$ | d | $14 \mu\text{C}, 6 \mu\text{C}$ |

30. A capacitor is charged by a battery. The battery is removed and another identical uncharged capacitor is connected in parallel. The total electrostatic energy of resulting system

- | | | | |
|----|------------------|----|---------------|
| a. | becomes 4 times | b. | becomes half |
| c | remains the same | d | becomes twice |

31. Three capacitors of capacitances $1\mu\text{f}$, $2\mu\text{F}$ & $3\mu\text{F}$ are connected in series and a potential difference of 11V is applied across the combination then the potential difference across the plates of $1\mu\text{F}$ capacitor is

- | | | | |
|---|-----|---|-----|
| a | 2 V | b | 4 V |
| c | 1 V | d | 6 V |

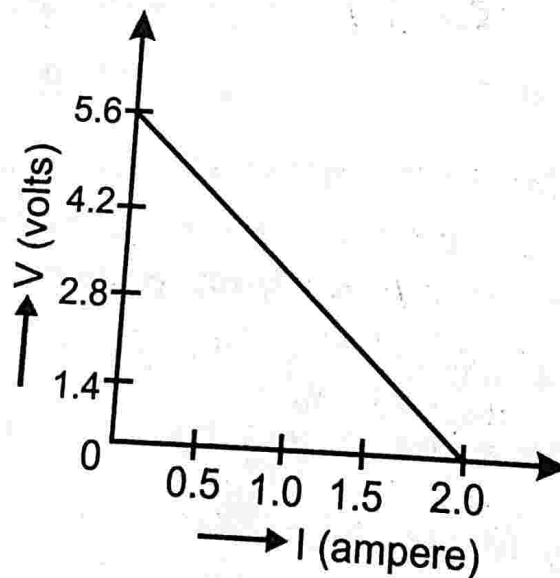
32. A parallel plate capacitor is charged by a battery. Once it is charged battery is removed. Now a dielectric material of dielectric constant K is inserted between the plates of the capacitor, how does electric potential change?

- a. becomes $1/K$ times b. becomes K times
c. remains same d. becomes $K/2$ times

33. The work done in increasing the voltage across the plates of a capacitor from $5V$ to $10V$ is W . The work done in increasing the voltage from $10V$ to $15V$ will be

- a. W
b. $4W/3$
c. $5W/3$
d. $2W$

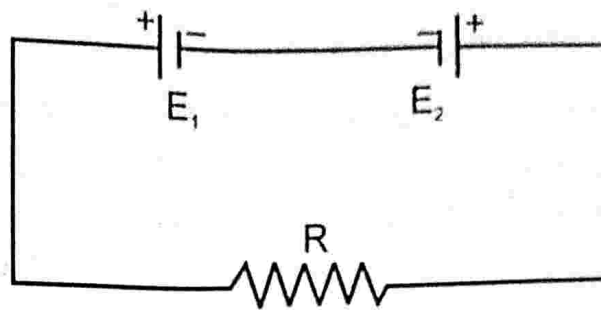
34. A straight line plot showing the terminal potential difference (V) of a cell as a function of current (I) drawn from it, is internal resistance of the cell would be then :



- a. 2.8 ohms
b. 1.4 ohms
c. 1.2 ohms
d. zero

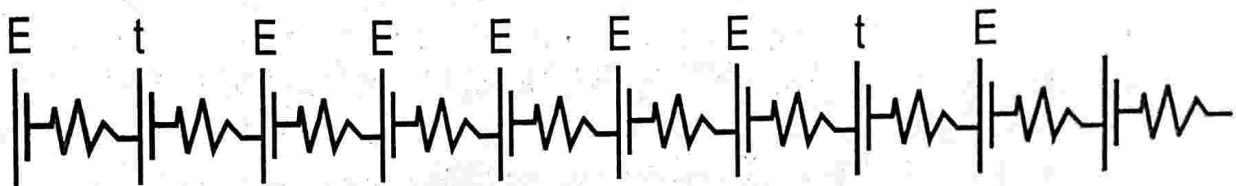
35. In the circuit shown, the emf of the cells are: $E_1 = 10V$, $E_2 = 40V$,

$R = 15\Omega$; internal resistances are $r_1 = 1\Omega$, $r_2 = 2\Omega$. Calculate the current through R .



- a $4/3$ A b $2/3$ A
 c $5/3$ A d $7/3$ A

36 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 $8E, r/10$

37. A circular loop of radius R carries a current I . The magnetic field at its centre is B . At what distance from the centre on the axis of the coil, the magnetic field will be $B/8$?

- (a) $\sqrt{2}R$ (b) $\sqrt{3}R$
 (c) $2R$ (d) $3R$

38 The maximum current that can be measured by a galvanometer of resistance 40Ω is 10 mA. It is converted into voltmeter that can read upto $50V$. The resistance to be connected in the series with the galvanometer is

- a 2010Ω

b 4050Ω

c 5040Ω

d 4960Ω

39 A thin circular wire carrying a current I , has a magnetic moment M . The shape of a wire is changed to a square and it carries the same current. It will have a magnetic moment :

a $\frac{4M}{\pi^2}$

b M

c $\frac{\pi M}{4}$

d $\frac{4M}{\pi}$

40 At a given place on earth's surface the horizontal component of earth's magnetic field is $2 \times 10^{-5} \text{ T}$ and resultant magnetic field is $4 \times 10^{-5} \text{ T}$. The angle of dip at this place is

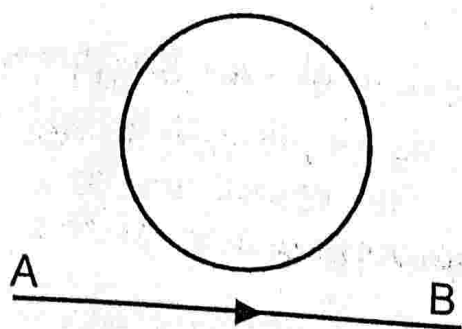
a 30°

b 60°

c 90°

d 0°

41 In the given figure current from A to B in the straight wire is decreasing. The direction of induced current in the loop is A



- a clockwise
 - b anticlockwise
 - c changing
 - d nothing can be said
42. An aircraft with a wingspan of 40m flies with a speed of 1080 km/hr in the eastward direction at a constant altitude in the northern hemisphere, where the vertical component of the earth's magnetic field $1.75 \times 10^{-5} \text{T}$. Then the emf developed between the tips of the wings is
- a 5V
 - b 34V
 - c 0.21V
 - d 2.1V
43. The role of inductance is equivalent to :
- a Inertia
 - b force
 - c energy
 - d momentum
44. A bulb connected in series with a solenoid is lit by an AC source. If a soft iron core is introduced in the solenoid then
- a the bulb will glow brighter
 - b the bulb will glow dimmer
 - c there will be no effect on the light produced by the bulb
 - d bulb may glow more brighter or dimmer

Question no 46 to 49 are Assertion (A) and Reason (R) type questions. Two statements labelled as Assertion (A) and Reason (R)

Select the most appropriate answer from the options given below:

- 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.

45 **Assertion(A)** : A point charge is brought in an electric field, the field at a nearby point will increase or decrease, depending on the nature of charge.

Reason(R) : The electric field is independent of the nature of charge. Select the most appropriate answer from the options given below :

- a Both A and R are true and R is the correct explanation 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

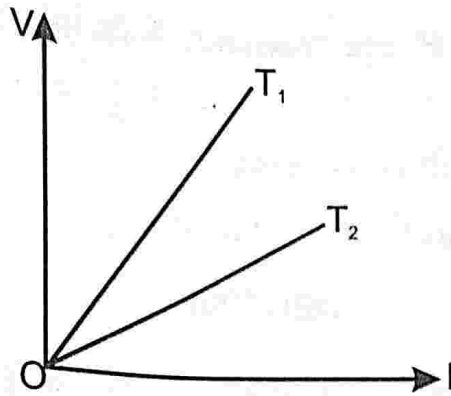
46 **Assertion(A)** : The potential difference between any two points in an electric field depends only on initial and final position.

Reason(R) : Electric field is a conservative field so the work done per unit positive charge does not depend on path followed. Select the most appropriate answer from the options given below:

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

47 **Assertion (A)**: In the graph shown below, temperature $T_1 > T_2$.

Reason (R) : The slope of V-I graph gives resistance of a conductor at a given temperature. Select the most appropriate answer from the options given below :



- a Both A and R are true and R is the correct explanation 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)** : A charge, whether stationary or in motion produces a magnetic field around it.

Reason (R) : Moving charges produce only electric field in the surrounding space. Select the most appropriate answer from the options given below:

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

49 **Assertion (A)** : Acceleration of a magnet falling through a long solenoid decreases.

Reason (R) : The induced current produced in a circuit always flow in such direction that it opposes the change to the cause that produced it. Select the most appropriate answer from the options given below :

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

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.

50. An electric bulb marked 40W– 200V is used in a circuit of supply voltage 100V. Now its power is :
- a 10 W
 - b 20 W
 - c 40 W
 - d 100 W
51. A magnetic needle, free to rotate in a vertical plane, orients itself with its axis vertical at a certain place on the earth. The angle of dip at this place is
- a 90°
 - b 0°
 - c 30°
 - d 60°

CASE STUDY

Read the following paragraph and answers the questions.

For many purposes, it is necessary to change (or transform) an alternating voltage from one to another of greater or smaller value. This is done with a device called *transformer* using the principle of mutual induction. A transformer consists of two sets of coils, insulated from each other. They are wound on a soft-iron core, either one on top of the other as in or on separate limbs of the core. One of the coils called the *primary coil* has N_p turns. The other coil is called the *secondary coil*; it has N_s turns. Often the primary coil is the input coil and the secondary coil is the output

coil of the transformer. When an alternating voltage is applied to the primary, the resulting current produces an alternating magnetic flux which links the secondary and induces an emf in it. The value of this emf depends on the number of turns in the secondary. We consider an ideal transformer in which the primary has negligible resistance and all the flux in the core links both primary and secondary windings

If the primary coil of a transformer has 100 turns and the secondary has 200 turns, $N_s/N_p=2$. Thus, a 220V input at 10A will

- a step-up to 440V output at 5.0 A.
- b step-up to 660V output at 5.0 A
- c step-down to 220V output at 15.0 A
- d step-down to 110V output at 15.0 A

If the secondary coil has less turns than the primary ($N_s < N_p$), we will have

- a Step-Up Transformer
- b Step-Down Transformer
- c Neither Step-Up Transformer nor Step-Down Transformer
- d Both Step-Up Transformer and Step-Down Transformer

In actual transformers, small energy losses do occur due to the

- a Flux Leakage
- b Resistance of the windings
- c Eddy currents
- d All the above

The transformer ratio in the step-up transformer is

- a one
- b greater than one
- c less than one
- d the ratio greater or less than one depends on the other factor

MARKING SCHEME PAPER-1 (TERM 1) 2021-22

SUBJECT : PHYSICS

CLASS : XII

Time : 90 Min

Marks : 35

1. Which of the following _____?

Ans. (iii)

Explanation: In conductors, charges are equally distributed over the surface of the conductor. Therefore the potential throughout the surface is the same, i.e. equipotential. The electric field is a vector quantity and the field lines cut the equipotential surfaces at 90 degrees. The field lines due to a point charge are radial.

Correct option is

(iii) The surface of a charged conductor is equipotential

2. Two point charges $+4q$ and $+q$ _____?

Ans.2 (ii)

The electric field at a distance of r from a charge q is equal to

$$\frac{q}{4\pi\epsilon_0 r^2}$$

Let the electric field intensity will be zero at a distance of x cm from $+4q$ charge, so the fields due to the two charges will balance each other at that point.

$$\text{Therefore } \frac{4q}{4\pi\epsilon_0 x^2} = \frac{q}{4\pi\epsilon_0 (30-x)^2}$$

Solving this we get $x=20$ cm.

Therefore the point will be 20cm away from the $+4q$ charge.

Correct option is (ii) 20cm away from the $+4q$ charge

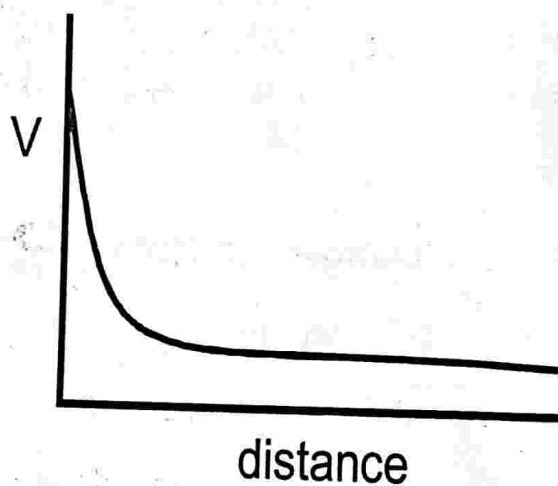
3. What is the correct diagram _____?

Ans. (i)

If the distance of a point from the dipole is very small, we can simply neglect the l^2 term compared to the r^2 term in the potential

expression
$$V = \frac{p}{(r^2 - l^2)}$$

Therefore, the expression becomes
$$V = \frac{p}{r^2}$$



Correction option is (i)

4. The total capacitance _____?

Ans.4 (ii)

The equivalent capacitance of the capacitors connected in parallel is given by sum of their individual capacitances, that is if there are n capacitors in parallel the total capacitance is given by, $C = C_1 + C_2 + C_3 + C_4 + \dots + C_n$

Correct option is (ii) sum of all the individual capacitors in parallel

5. Two equal balls having equal _____?

Ans.5 (i)

The force between two balls decreases because

$$K_{\text{plastic}} > 1 \text{ and } F \propto \frac{1}{K}$$

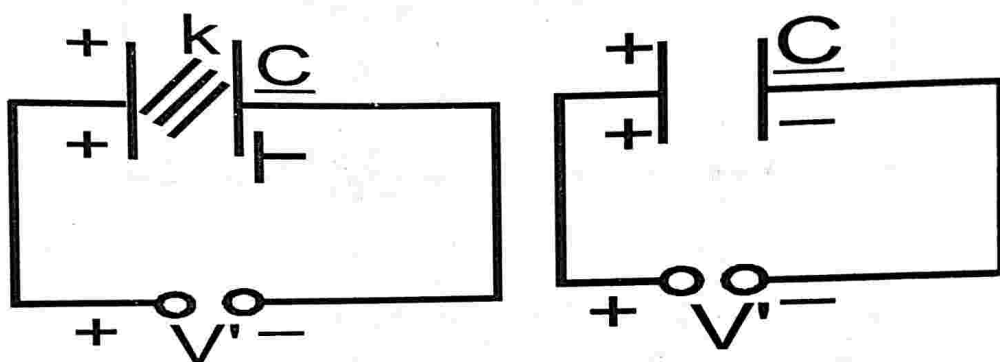
Correct option is (i) reduces to $1/K$ times F

6. Electric field _____?

Ans.6 (iv)

7. A capacitor has some dielectric between _____?

Ans. (iii)



Battery is disconnected and dielectric slab is removed

Let the Electric Field between the plates when connected to battery is E

After battery is removed E remains same but when dielectric is removed then E increases by k

$$\text{As } k = \frac{E_{\text{free space}}}{E_{\text{medium}}}$$

$$\text{Here } E_{\text{medium}} = E \text{ therefore, } E_{\text{free space}} = kE$$

Correct option is (iii) electric field will increase

Ans.8 (iv)

Potentiometer is highly sensitive

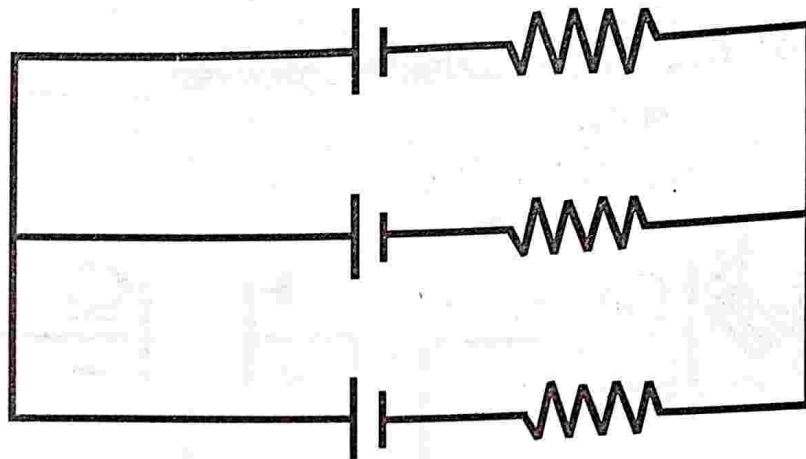
Potentiometer never draws current from the cell whose emf is to be measured as we use balanced condition when deflection of Galvanometer is zero. And it can measure very small potential

differences.

Correct option is (iv) All are correct

8. If n cells each of emf ε and _____?

Ans.(i)



$$\frac{1}{r_{\text{equivalent}}} = \frac{1}{r} + \frac{1}{r} + \dots + \frac{1}{r} \text{ n times} = \frac{n}{r}$$

$$\text{or } r_{\text{equivalent}} = \frac{r}{n}$$

Since it is a parallel connection equivalent e.m.f remains same as ε

Correct option is (i) $\varepsilon \frac{r}{n}$

9. Which of the following relation is significant _____?

Ans.10 (i)

The resistivity of a metal increases and the conductivity decreases with the increase in temperature. With an increase in temperature, the free electrons collide more frequently with the metal ions. The mean collision time also decreases.

Correct option is

(i) Resistivity increases and conductivity decreases

10. Which of the following is an _____?

Ans.11 (i)

Most of the metals obey Ohm's law and they are called ohmic conductors.

Whereas semiconductors are non-ohmic. Nichrome metal is an ohmic conductor in which the V-I characteristic has a straight line passing through the origin.

Correct option is (i) Nichrome

11. Calculate the number of units _____?

Ans.12 (iv)

The number of units of electricity consumed is

$$n = \frac{\text{total wattage} \times \text{time in hour}}{1000}$$

Total wattage = 100 W, Time in hour = 5 hours

$$\text{Therefore, } n = \frac{100 \times 5}{1000} = 0.5 \text{ units}$$

So, the number of units of electricity consumed is 0.5 units.

Correct option is (iv) 0.5 unit

12. Predict the effect of length _____?

Ans. (iv)

The drift velocity of electrons decreases when the length of the conductor is increased.

$$\text{Drift Velocity} = \frac{\text{Potential difference}}{(\text{number of electrons} \times \text{charge of electron} \times \text{length of conductor} \times \text{resistivity})}$$

Correct option is

(iv) Drift velocity decreases with the increasing length of conductor.

13. Calculate the number of dry cells _____

Ans. 14 (i)

$$\text{Emf} = 2\text{V}; r = 1 \text{ ohm}; I = 0.8\text{A}; R = 30 \text{ ohms}$$

$$\text{The required equation : } I = \frac{n\varepsilon}{(nr + R)}$$

$$0.8 = \frac{n \times 2}{(n \times 1 + 30)}$$

$$0.8n + 24 = 2n$$

$$1.2n = 24$$

$$n = \frac{24}{12}$$

Therefore, the number of dry cells required are 20.

14. Give the SI unit of magnetic _____?

Ans. (iii)

$$\text{Using } B = \text{magnetic Flux, } \phi = \vec{B} \cdot \vec{A} = \frac{\mu_0 NiA}{l}$$

$$= \mu_0 = \frac{\omega l}{NiA} = \frac{\text{weber} \times \text{metre}}{\text{ampere} \times \text{metre}^2} = \text{weber ampere}^{-1} \text{ metre}^{-1}.$$

The SI unit of permeability is weber ampere⁻¹ metre⁻¹ (Wb A⁻¹ m⁻¹) or tesla ampere⁻¹ meter (T A⁻¹ m)

Correct option is (iii) $TA^{-1} m$

15. The sensitivity of a moving coil _____?

Ans. (iv)

$$I_{\text{sensitivity}} = \frac{\theta}{I} = \frac{NAB}{K}$$

$$\therefore I_{\text{sensitivity}} \propto NAB \text{ and } I_{\text{sensitivity}} \propto \frac{1}{K}$$

where K is couple per unit twist of suspension

N is the number of turns in the coil

A is the area of the coil and B is the magnetic field

Correct option is

(iv) The couple per unit twist of the suspension

16. A charged particle is moving _____?

Ans. 17 (ii)

When a particle is moving in a circular path in the presence of magnetic field B then centripetal force is provided by Lorentz Force with v making angle 90 with B

We have

$$qvB = \frac{mv^2}{r} \therefore r = \frac{mv}{qB}$$

Given B is reduced to half = $B/2$

And v is doubled = $2v$

Putting these values we get new radius

$$r = \frac{m2v}{\frac{qB}{2}}$$

$$r = \frac{4mv}{qB} = 4r$$

Correct option is (ii) 4 times

17. At a given place on the Earth's surface _____?

Ans.18 (iii)

Given: $H = 9 \times 10^{-5}$; $R = 180 \times 10^{-6} = 18 \times 10^{-5}$

The required equation $\rightarrow H = B_e \cos \delta$

$$\cos \delta = \frac{H}{B_e} = \frac{9 \times 10^{-5}}{18 \times 10^{-5}} = 12$$

Therefore, $\delta = \cos^{-1} 12 = 60^\circ$

Thus, the angle of dip is 60° .

Correct option is (iii) 60°

18. Which of the following is the _____?

Ans. (i)

A vertical plane passing through the axis of a freely suspended or pivoted magnet is known as magnetic meridian of Earth. The vertical plane passing through the geographical North Pole and South Pole at a given place is known as the geographical meridian of that place.

Correct option is (i) Vertical plane passing through the axis of a freely suspended or pivoted magnet

19. Identify the factor on _____?

Ans.20 (iv)

Self-inductance is directly proportional to the number of turns and the area of cross-section. The self-inductance of a solenoid increases μ_r times if it is wound over an iron core of relative permeability μ_r .

Correct option is (iv) The permittivity of the core material.

20. What is the direction_____?

Ans.21 (iv)

No current is induced since the magnetic field lines are lying in the plane of the closed loop.

Since $\varepsilon = \frac{d\phi}{dt} = 0$ as $\psi = \vec{B} \cdot \vec{A} = 0$

Correct option is (iv) The direction of induced current cannot be determined as there is no induced current.

21. What is the relative permeability of an air-core_____?

Ans.22 (i)

Since $\mu_r = \frac{\mu}{\mu_0}$

$\mu_r = L/L_0$

$\mu_r = 50 / 0.5$

$\mu_r = 100$

Correct option is (i) 100

22. What will be the rms value of _____?

Ans.23 (ii)

$E = E_0 \sin \omega t$

$E_{\text{rms}} = E_0 / \sqrt{2}$

$E_{\text{rms}} = 100 / \sqrt{2}$

$E_{\text{rms}} = 70.71 \text{ V}$

Correct option is (ii) 70.71V

23. An inductor coil joined to a 6V_____?

Ans.24 (i)

$$R = V/I = 6/12 = 0.5\Omega$$

$$\text{Impedance} = Z = R = 0.5\Omega$$

$$I_{rms} = E_{rms} / Z$$

$$I_{rms} = 6 / 0.5$$

$$I_{rms} = 12A$$

Correct option is (i) 12 A.

24. How will the capacitive reactance _____?

Ans.25 (iv)

If the frequency is doubled, the capacitive reactance is halved and consequently, the current is doubled. This is because, when capacitive reactance, being a resistance, is lowered, the current can flow more easily through the circuit.

Correct option is (iv) Halved

25. What will be the total _____?

Ans.26 (iii)

The electric field is directed from left to right

Therefore, net flux coming in the surface A is ES and the net flux coming out of the surface B is ES .

But there is no flux along the curved surface area of the cylinder because the area vector is perpendicular to the field direction. Hence the net flux linked to the cylinder is zero.

Correct option is (iii) zero

26. An electron of charge e and mass _____?

Ans.27 (iii)

Gravitational force on the electron is $m \times g$ (weight of the electron). Electrical force on the body is $e \times E$. If the electron doesn't fall then these two forces balance each other, so $mg = eE$. Therefore

$$\frac{mg}{e}$$

Correct option is

(iii) $\frac{mg}{e}$

27. Electric field inside _____?

Ans.28 (ii)

According to Gauss's law, if there is no charge inside a closed surface, the field inside the closed surface will always be zero. We know the charge is distributed on the outer surface of a conducting hollow sphere because the charges want to maintain maximum distance among them due to repulsion. So there is no charge inside the sphere and hence no electric field.

Correct option is (ii) zero

28. There are infinite number _____?

Ans. (iv)

We know electric potential (V) due to charge 'q' is $V = k/qr$.

Electric potential (V) is a scalar quantity, so, the total potential at $x = 0$ is the sum of all the individual charges

$$V = [(kq/1) + (kq/4) + (kq/16) + (kq/64)] + \dots$$

$$V = kq (1/(1-1/4)) \longrightarrow \text{sum of infinite G.P} = a/(1-r)$$

$$V = (q / 4\pi \epsilon_0) \times (3/4)$$

$$V = 3q / 16\pi \epsilon_0$$

Correct option is (iv) $V = \frac{3q}{16\pi \epsilon_0}$

29. Initially the potential difference _____?

Ans.30 (i)

The required equation for the increase in energy is given by:

$$\begin{aligned}U_2 - U_1 &= 12 \times C (V_2^2 - V_1^2) \\&= 12 \times 8 \times 10^{-6} \times (40^2 - 30^2) \\&= 12 \times 8 \times 10^{-6} \times 700 \\&= 4 \times 700 \times 10^{-6} \\&= 2800 \times 10^{-6} \\&= 28 \times 10^{-4} \text{ J}\end{aligned}$$

Therefore, the increase in energy is $28 \times 10^{-4} \text{ J}$.

Correct option is (i) $28 \times 10^{-4} \text{ J}$

30. Pick out the correct combination _____?

Ans. (ii)

For a step-up transformer, the voltage at the second terminal is greater than the primary terminal, i.e. $\rightarrow V_s > V_p$. Similarly, the current in the secondary coil is lesser than that current flowing the primary coil, i.e. $\rightarrow I_s < I_p$. Also, the number of turns in the secondary winding is greater than that in the primary winding, i.e. $\rightarrow N_s > N_p$. So the transformation ratio will be greater than 1. So, the correct combination is given as :

$$n > 1; V_s > V_p, I_s < I_p, N_s > N_p$$

Correct option is (ii) $n > 1; V_s > V_p, I_s < I_p, N_s > N_p$

31. The r.m.s value of an alternating _____?

Ans.32 (iii)

The r.m.s value of an alternating current is given by steady (D.C) current which when flowing through a given circuit for a given time

produces the same heat than produced by A.C when flowing through the same circuit

Correct option is (iii)

32. To find the peak voltage_____?

Ans.33 (i)

Dividing peak to peak value which is $20/2 = 10V$

Correct option is (I) Divide Peak to peak by two

33. Energy is required_____?

Ans.34 (iv)

Work is done in moving a positive test charge in a cell against the Electrostatic Force from one electrode to another called asemf. Hence Energy is required to force a positive test charge to move through the battery from point D to point A

Correct option is (iv)

34. A potential difference of 100 V_____?

Ans.35 (iii)

Drift velocity = Mobility \times Electric field.

It can be rearranged as,

Drift velocity = (mobility \times Potential difference)/length.

Drift velocity = $(9 \times 10^{-5} \times 100)/0.5 = 0.018 \text{ ms}^{-1}$.

Correct option is (iii) 0.018 ms^{-1}

35. 'n' cells have emf 'e' and internal resistance_____?

Ans.36 (i)

Current passed through the external resistance when the cells are connected in series: $I_1 = ne/(R+nr)$

Current passed through the external resistance when the cells are connected in parallel:

$$I_2 = ne/(nR+r)$$

Given: $I_1 = I_2$

$$ne/(R+nr) = ne/(nR+r)$$

$$R + nr = nR + r$$

$$R - nR = r - nr$$

$$R(1 - n) = r(1 - n)$$

$$R = r$$

Correct option is

(i) $R = r$

36 AB is a wire of potentiometer with the _____?

Ans.37 (i)

As R increases current flowing through potentiometer wire decreases lowering the value of potential gradient hence balance point shift towards B

Correct option is (i) towards B

37. The galvanometer shown below _____?

Ans.38 (i)

$$R_G = 50.00\Omega; r_S = 0.05\Omega; V = 3.00\text{ V}; R = 5.00\Omega$$

First case \rightarrow Current (I) = $V/(R_G+R)$

$$= 3/(50+5) = 3/55 = 0.0545\text{ A}$$

Second case \rightarrow Resistance = $(r_S \times R_G)/(r_S+R_G)$

$$= (0.05 \times 50.00)/(0.05+50.00) = 0.0499 = 0.05\Omega$$

Total resistance = $5 + 0.05 = 5.05 \Omega$

Therefore, current = $3/5.05 = 0.594 \text{ A}$

Correct option is (i) 0.0545 A, 0.594 A

38. Find the correct statement ?

Ans.39 (i)

The force between two parallel current carrying wires is independent of the radii of the wires.

From Ampere's circuital law, the magnitude of the field due to the first conductor can be given by :

$$B = [\mu_0 I_1 I_2 / 2\pi d]$$

The force between the parallel plates is given by:

$$B = [\mu_0 I_1 I_2 / 2\pi d]L$$

From this equation, we understand that the force between the parallel current carrying wires does not depend on the 'radii'.

Correct option is (i) The force between two parallel current carrying wires is independent of the radii of the wires

39. Under which of these _____?

Ans.40 (i)

When, $\theta = 0^\circ \rightarrow \tau = 0$.

The torque is minimum when the plane of the loop is perpendicular to the magnetic field, so the angle, should be 0°

Correct option is (i) $\theta = 0^\circ$

40. The magnetic flux in a closed circuit _____?

Ans.41 (ii)

Given : Resistance = 20Ω ; $\phi 4t^3 + 2t^2 - 15t + 3$

Required equation $\rightarrow \varepsilon = -d\phi / dt$

$$\varepsilon = -\frac{d}{dt} [(4t^3 + 2t^2 - 15t + 3)] = - (12t^2 + 4t - 15 + 0)$$
$$= -12 - 4 + 15 \quad (\text{Since } t = 1\text{s}) = -1\text{V}$$

Therefore, the magnitude of induced emf is 1V.

Correct option is (ii)

41. A resistor of 50Ω , an inductor ___?

Ans.42 (iv)

$$X_L = 2\pi fL$$

$$X_L = 2\pi \times 50 \times (20/\pi) = 2000 \Omega.$$

$$X_C = 1/2\pi fC$$

$$X_C = 2000\Omega$$

$$Z = \sqrt{(R^2 + (X_L - X_C)^2)}$$

$$Z = \sqrt{50^2 + (2000 - 2000)^2}$$

$$Z = 50\Omega.$$

Correct option is (iv) 50Ω

42. Calculate the mutual inductance ___?

Ans.43 (ii)

$$N\phi = MI$$

$$200 \times 500 = M \times 10$$

$$M = 10^4 \text{ H}$$

Correct option is (ii) 10^4 H

43. Two coils \times and _____?

Ans.44 (iii)

Mutual Inductance is linked with both the coils it does not change when primary and secondary coils are interchanged

Correct option is (iii)

44. Given below are two statements _____?

Ans.45 (iii)

A galvanometer can detect only small currents. Thus, to measure large currents it is converted into an ammeter. It can be converted into an ammeter by connecting a low resistance called shunt resistance in parallel to the galvanometer.

Correct option is (iii) A is true but R is false.

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

Ans. (iii)

With an increase in temperature ,the resistance of metal wire increases, but balance conduction will not change.

Correct option is (iii) A is true but R is false.

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

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

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

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

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

Correct option is (iv) A is false and R is also false

49. When there is no current_____?

Correct option is (i) Infinite external resistance

As emf is defined when no current is drawn from the cell. The terminal p.d.

$$V = IR = \frac{E}{r+R} R = \frac{E}{1 + \frac{r}{R}}$$

On increasing R, V increases.

When $R \rightarrow \infty$, $V = E$.

50. (ii)

51. (iii)

52. The intensity of the mag_____?

Ans.53 (i)

since

$$B = \frac{\mu_0 I}{2\pi r} \therefore B \propto \frac{1}{r}$$

Correct option is (i) decrease

53. A horizontal overhead_____?

Ans.54 (iii)

Given: $i = 100\text{A}$; $r = \mu_0 / 4\pi = 10^{-7}$

The required equation $\rightarrow B = \left(\frac{\mu_0}{4\pi}\right) \times \frac{2i}{r}$

$$B = 10^{-7} \times 2 \times 100/2$$

$$B = 10^{-7} \times 100$$

$$B = 1 \times 10^{-5} \text{ T}$$

Therefore, the magnitude of the magnetic field is $1 \times 10^{-5} \text{ T}$ and the direction of the magnetic field is south.

Correct option is (iii) $1 \times 10^{-5} \text{ T}$

54. Which of the following is not a _____?

Ans.55 (iii)

The principle of superposition applies to both fields. This is because the magnetic field is linearly related to its source, namely, the current element and the electrostatic field is related linearly to its source, the electric charge.

Correct option is

(iii) The principle of superposition does not apply to both

MARKING SCHEME PAPER-2 (TERM 1) 2021-22

SUBJECT : PHYSICS

CLASS : XII

Time : 90 Min

Marks : 35

- | | | | |
|---------|---------|---------|---------|
| 1. (a) | 2. (c) | 3. (d) | 4. (d) |
| 5. (c) | 6. (c) | 7. (b) | 8. (a) |
| 9. (a) | 10. (b) | 11. (a) | 12. (a) |
| 13. (c) | 14. (a) | 15. (c) | 16. (a) |
| 17. (d) | 18. (c) | 19. (a) | 20. (b) |
| 21. (d) | 22. (b) | 23. (c) | 24. (a) |
| 25. (d) | 26. (d) | 27. (d) | 28. (c) |
| 29. (a) | 30. (c) | 31. (c) | 32. (b) |
| 33. (b) | 34. (a) | 35. (c) | 36. (a) |
| 37. (c) | 38. (b) | 39. (d) | 40. (b) |
| 41. (b) | 42. (b) | 43. (d) | 44. (d) |
| 45. (d) | 46. (b) | 47. (c) | 48. (c) |
| 49. (a) | 50. (b) | 51. (d) | 52. (c) |
| 53. (c) | 54. (a) | 55. (a) | |

MARKING SCHEME PAPER-3 (TERM 1) 2021-22

SUBJECT : PHYSICS

CLASS : XII

Time : 90 Min

Marks : 35

SECTION A

This section consists of 25 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.

1. (d) Negative charge means excess of electrons which increases the mass of sphere B, whereas positive charge on sphere A is given by removal of electrons

2. (d)
$$F = \frac{1}{4\epsilon\pi_0} \frac{q^2}{r^2} \dots\dots(i)$$

Suppose, force between the charges is same when charges are r^2 distance apart in dielectric.

$$\therefore F' = \frac{1}{4\pi\epsilon_0} \frac{q^2}{kr^{+2}} \dots\dots(ii)$$

From (i) and (ii),

$$Kr^{+2} = r^2 \Rightarrow r = \sqrt{kr^2}$$

In the given situation, force between the charges would be,

$$F' = \frac{1}{4\pi\epsilon_0} \frac{q^2}{\left(\frac{r}{2} + \sqrt{4} \frac{r}{2}\right)^2}$$

$$= \frac{4}{9} \frac{q^2}{4\pi\epsilon_0 r^2} = \frac{4}{9} F \dots \left(\because F = \frac{q^2}{4\pi\epsilon_0 r^2} \right)$$

3. (d) Electric field inside the sphere will be zero.
4. (b) $E \propto 1/r^2$
5. (d) both (a) and (b) are correct.
6. (b) Since potential inside the hollow sphere is same as that on the surface
7. (c) Vm
8. (c) The electric field between the plates
9. (b) Law of conservation of energy
10. (c) $vd \propto E$
11. (c) CD
12. (b) increasing the length of the potentiometer
13. (b) Ammeter of range 10 A
14. (c) two times that of the proton
15. (b) parallel currents attract and antiparallel currents repel.
16. (a) 1 : 2
17. (c) remains unaffected
18. (d) vary from place to place on the earth's surface
19. (b) Induced e.m.f. $\mu = -L \frac{dI}{dt} = -5 \times 2 = -10V$
20. (d) both (a) and (b) are correct
21. (d)
22. (b)

23. (d)
 24. (b) 141.4 ohm
 25. (b) 1.44 A

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.

26. (d) zero $F = K \times \frac{q_1 q_2}{r^2}$, $F = 9 \times 10^9 \times (3+3) \mu\text{C} \times (3-3) \mu\text{C} / r^2$
 $F = 0$
27. (c) 2L
28. (d) Forces of repulsion on $1 \mu\text{C}$ charge at O due to $3 \mu\text{C}$ charge, at A and C are equal and opposite. So they cancel each other. Similarly, forces of attraction of $1 \mu\text{C}$ charge at O due to $-4 \mu\text{C}$ charges at B and D are also equal and opposite. So they also cancel each other. Hence the net force on the charge of $1 \mu\text{C}$ at O is zero.
29. (b)
30. (b) Using, $V_c = V/2$, $U_i = CV^2/2$.
 $U_f = 2C \cdot (V/2)^2/2 = 2CV^2/8 = CV^2/4 = U_i/2$
31. (d) $C = 6/11 \mu\text{F}$. $Q = 6/11 \cdot 11 \cdot 10^{-6}$, $V = Q/C = 6\text{V}$
32. (a) decreased by K times
33. (c) $5W/3$ $W = C(100-25)/2$; $W_1 = C(225-100)/2$; $W_1 = 5W/3$
34. (a) 2.8 ohms
35. (c)
36. (c)

37. (b) $\sqrt{3}R$
38. (d) 4960Ω
39. (c) $\pi M/4$
40. (b) 60°
41. (b) anticlockwise
42. (c) $e=Blv$, $0.21V$
43. (a) inertia
44. (b) the bulb will glow dimmer
45. (c) A is true but R is false.
46. (a) Both A and R are true and R is the correct explanation of A.
47. (a) Both A and R are true and R is the correct explanation of A.
48. (d) A is false and R is also false
49. (a) Both A and R are true and R is the correct explanation of A.

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.

50. (a) $10W$
51. (a) 90°
52. (a) step-up to $440 V$ output at $5.0 A$.
53. (b) Step-Down Transformer
54. (d) all the above
55. (b) greater than 1