FIITJEE

CBSE TERM - I

ALL XIITH STUDYING BATCHES

Part Test – I

PHYSICS

(29th October 2021)

Time: 1:30 Hours **Maximum Marks: 45**

General Instructions:

1. The question paper contains three sections A, B and C
2. Section A consists of 25 questions MCQ Single Option Correct, out of which students will attempt any 20 questions only. Each question carries +1 Mark.
3. Section B consists of 24 questions MCQ Single Option Correct, out of which 5 questions are Assertion-Reasoning type. Students will attempt any 20 questions only. Each question carries +1 Mark.
4. Section C consists of 6 questions MCQ Single Option Correct out of which 4 questions are based on case studies. Students will attempt any 5 questions only. Each question carries +1 Mark.
5. There is no negative marking.

Name of the Candidate : .....

Enroll Number : .....

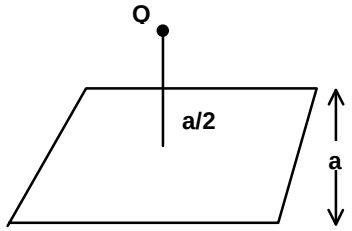
Date of Examination : .....

PHYSICS

SECTION – A

*This section contains **25 Multiple Choice Questions** number **1 to 25**. Each question has 4 choices (A), (B), (C) and (D), out of which **ONLY ONE** is correct.*

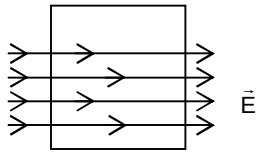
1. A charge Q is placed at a distance a/2 above the centre of a horizontal, square surface of edge a. Flux of the electric field through the square surface is



(A) $\frac{Q}{\varepsilon_0}$ (B) $\frac{Q}{2\varepsilon_0}$

(C) $\frac{Q}{6\varepsilon_0}$ (D) $\frac{Q}{3\varepsilon_0}$

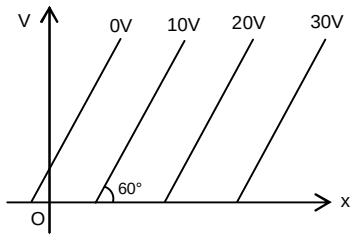
2. A square surface of side L metres is in the plane of the paper. A uniform electric field $\vec{E}$ (volt/m), also in the plane of the paper, is limited only to lower half of the square surface. The electric flux in SI units associated with the surface is



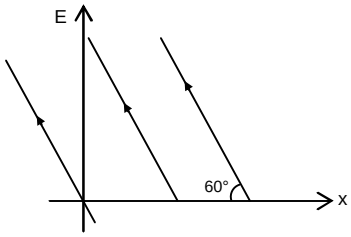
(A) EL^2 (B) $EL^2/2\varepsilon_0$

(C) $EL^2/2$ (D) zero

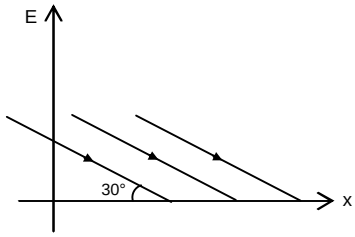
3. The E-x pattern for the given V-x pattern is:



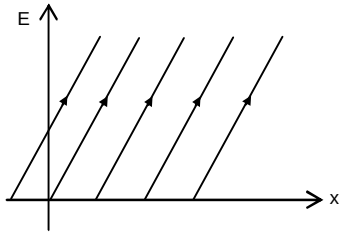
(A)



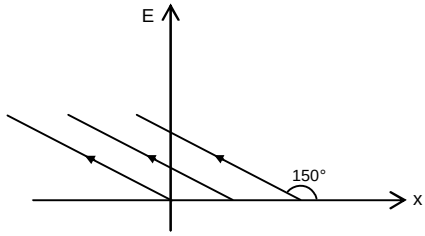
(B)



(C)



(D)



4. Two charges of 2μ C and 5 μC are placed 2.5 cm apart. The ratio of the Coulomb's force experienced by them is :

(A) 1 : 1 (B) 2 : 5

(C) $\sqrt{2}:\sqrt{5}$ (D) 4 : 25

5. In a parallel plate capacitor of plate area A, plate separation d and charge Q, the force of attraction between the plates is F.

(A) $F = \frac{Q^2}{2A\varepsilon_0}$ (B) $F = \frac{Q^2}{2d\varepsilon_0}$

(C) $F = \frac{Q^2}{A\varepsilon_0}$ (D) None

6. If the electric flux entering and leaving on enclosed surface respectively is ϕ_1 and ϕ_2, then electric charge inside the surface will be

(A) $(\phi_2 - \phi_1)\varepsilon_0$ (B) $(\phi_2 + \phi_1)/\varepsilon_0$

(C) $(\phi_2 - \phi_1)/\varepsilon_0$ (D) $(\phi_2 + \phi_1)\varepsilon_0$

7. The field at a distance r from a long string of charge per unit length λ is

(A) $k\frac{\lambda}{r^2}$ (B) $k\frac{\lambda}{r}$ (C) $k\frac{\lambda}{2r}$ (D) $k\frac{2\lambda}{r}$

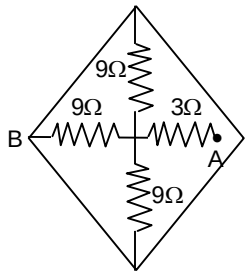
8. A dipole of moment $\vec{p} = 10^{-7}\left(5\hat{i} + \hat{j} - 2\hat{k}\right)$ cm is placed in an electric field $\vec{E} = 10^{-7}\left(5\hat{i} + \hat{j} - 2\hat{k}\right)$ V m^{-1}. Find the torque experienced ?

(A) 8.6 N – m (B) 5.6 N – m (C) 0 N – m (D) 6.8 N – m

9. The equivalent resistance between point A and B for the circuit shown is

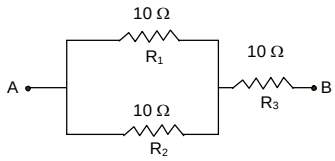
(A) 3Ω (B) 6Ω

(C) 9Ω (D) 12Ω



10. Three equal resistances each of 10 Ω are connected as shown in figure. The maximum power consumed by each resistor is 20 W. The maximum power consumed by the combination is

(A) 60 W
(B) 30 W
(C) 15 W
(D) none of these



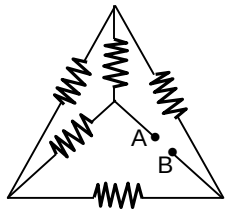
11. A steady current flows in a metallic conductor of nonuniform cross - section. The quantity/quantities that remains/remain constant along the length of conductor is/are

(A) current, electric field and drift speed (B) drift speed only

(C) current and drift speed (D) current only

12. A p.d. is applied across the ends of a uniform metallic wire. If the p.d. is doubled the drift velocity
(A) will be doubled (B) will be halved
(C) will become 4 times (D) remain unchanged

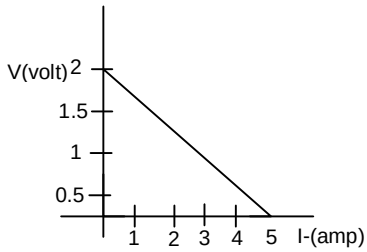
13. In the network shown in the figure, each resistance is equal to 2Ω. The resistance between the points A and B is



(A) $1\ \Omega$ (B) $4\ \Omega$
(C) $3\ \Omega$ (D) $2\ \Omega$

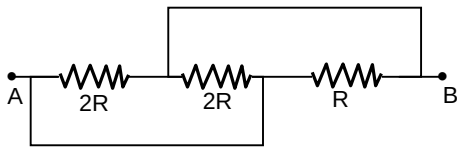
14. A wire of resistance R is stretched till its radius is half of the original value. Then the resistance of stretched wire is
(A) 2R (B) 4R
(C) 8R (D) 16R

15. For a cell, a graph is plotted between the potential difference V across the terminals of the cell and the current I drawn from the cell. The emf and internal resistance of the cell is E and r respectively



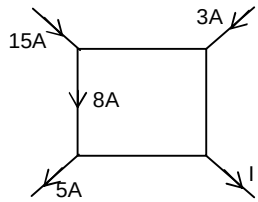
(A) $E = 2V,\ r = 0.5\Omega$
(B) $E = 2V,\ r = 0.4\Omega$
(C) $E > 2V,\ r = 0.5\Omega$
(D) $E > 2V,\ r = 0.4\Omega$

16. The equivalent resistance between points A and B of the circuit given below is



(A) R/2
(B) 2R
(C) R/4
(D) 3R/2

17. Value of I is



(A) 3 A (B) 13 A
(C) 23 A (D) 0 Amp

18. Two cells of emfs approximately 5 V and 10 V are to be accurately compared using a potentiometer of length 400 cm.
(A) The battery that runs the potentiometer should have voltage of 8 V.
(B) The battery of potentiometer can have a voltage of 15 V and R adjusted so that the potential drop across the wire slightly exceeds 10 V.
(C) The first portion of 50 cm of wire itself should have a potential drop of 10 V.
(D) Potentiometer is usually used for comparing resistances and not voltages.

19. A metal rod of length 10 cm and a rectangular cross-section of 1 cm x 1/2 cm is connected to a battery across opposite faces. The resistance will be
(A) maximum when the battery is connected across 1 cm x 1/2 cm faces.
(B) maximum when the battery is connected across 10 cm x 1 cm faces.
(C) maximum when the battery is connected across 10 cm x 1/2 cm faces.
(D) same irrespective of the three faces.

20. Which of the following characteristics of electrons determines the current in a conductor?
(A) Drift velocity alone
(B) Thermal velocity alone
(C) Both drift velocity and thermal velocity
(D) Neither drift nor thermal velocity

21. The work done in taking a charge q once round a circle of radius 'r' and having a charge Q at centre is:
(A) $\frac{q.Q}{4\pi\varepsilon_0(26r)}$ (B) $\frac{qQ}{4\pi\varepsilon_0 r}$ (C) $\frac{qQ}{4\pi\varepsilon_0 r^2}$ (D) zero

22. A spherical charged conductor has σ as the surface density of charge. The electric field just outside its surface is E. If the radius of the sphere is doubled keeping the surface density of charge unchanged, what will be the electric field just outside the surface of the new sphere?
(A) E/4 (B) E/2
(C) E (D) 2E

23. Two drops of a liquid are charged to the same potential of 100 volt. They are then merged into one large drop. The potential of the large drop is ($2^{1/3} = 1.26$)
(A) 172 volt (B) 193 volt
(C) 159 volt (D) 100 volt

24. The electric field at point (30, 30, 0) due to a charge 0.008 μC at origin will be (coordinates are in cm.)
(A) $400\sqrt{2}\left(\hat{i}+\hat{j}\right)NC^{-1}$ (B) $4000\sqrt{2}\left(\hat{i}+\hat{j}\right)NC^{-1}$
(C) $200\sqrt{2}\left(\hat{i}+\hat{j}\right)NC^{-1}$ (D) $800\left(\hat{i}+\hat{j}\right)$

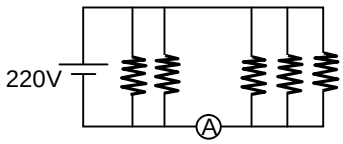
25. Two conducting sphere of radii r_1 and r_2 have same electric field near their surfaces. The ratio of their electric potential is
(A) $\frac{r_1}{r_2}$ (B) $\frac{r_2^2}{r_1^2}$ (C) $\frac{r_2}{r_1}$ (D) $\frac{r_1^2}{r_2^2}$

SECTION – B

*This section contains **24 Multiple Choice Questions** number **26 to 49, out of which 5 questions are Assertion-Reasoning type.** Each question has 4 choices (A), (B), (C) and (D), out of which **ONLY ONE** is correct.*

26. The ampere – sec is the unit of
(A) power (B) energy (C) current (D) charge

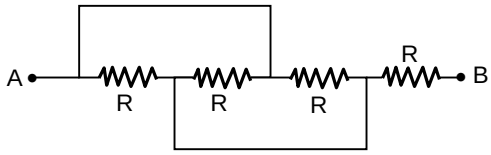
27. Five lamps each of r = 1100 ohms are connected to 220 volt as shown. Reading of the ideal ammeter A is



(A) $\frac{220}{1100}\times 5$ amp
(B) $\frac{220}{1100}\times 3$ amp
(C) $\frac{220}{1100}\times 1$ amp
(D) $\frac{220}{1100}\times 2$ amp

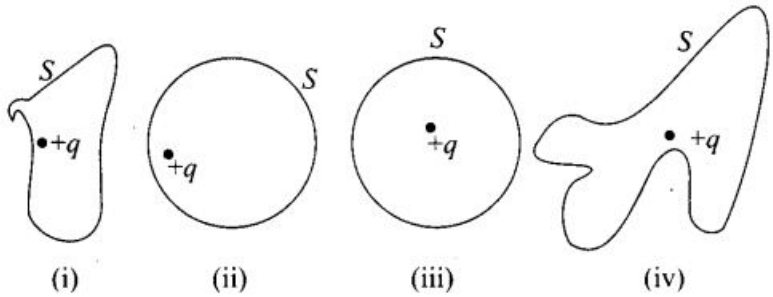
28. The resistance of a wire become 8 times when
(A) length is doubled (B) length is tripled
(C) length is doubled and radius is halved (D) length is halved and radius is doubled

29. Equivalent resistance between A and B is



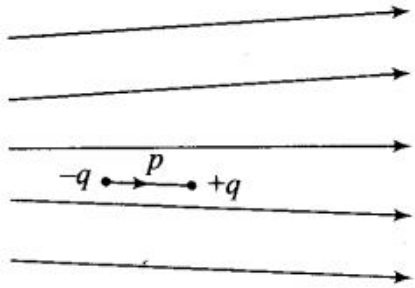
(A) $\frac{R}{3}$
(B) 4R
(C) $\frac{4R}{3}$
(D) $\frac{R}{4}$

30. The electric flux through the surface



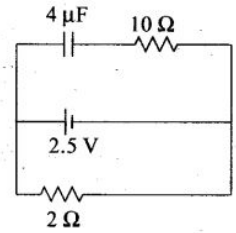
(A) in Fig. (iv) is the largest
(B) in Fig. (iii) is the least
(C) in Fig. (ii) is same as Fig. (iii) but is smaller than Fig. (iv)
(D) is the same for all the figures

31. Figure shows electric field lines in which an electric dipole P is placed as shown. Which of the following statements is correct?
(A) The dipole will not experience any force
(B)The dipole will experience a force towards right
(C)The dipole will experience a force towards left
(D)The dipole will experience a force upwards



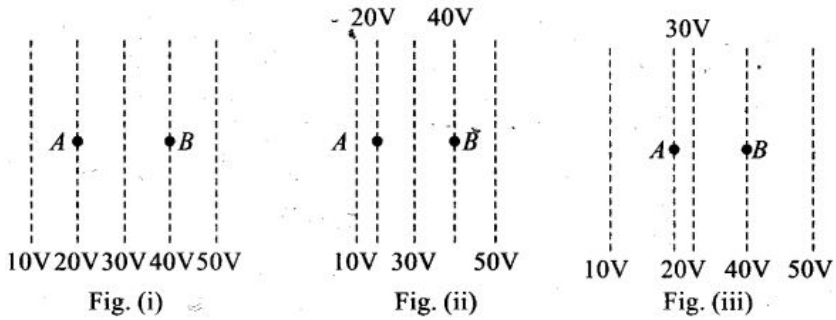
32. A point charge +q is placed at a distance d from an isolated conducting plane. The field at a point P on the other side of the plane is
(A) directed perpendicular to the plane and away from the plane
(B) directed perpendicular to the plane but towards the plane
(C) directed radially away from the point charge
(D) directed radially towards the point charge

33. A capacitor of 4 μF is connected as shown in the circuit. The internal resistance of the battery is 0.5 Ω. The amount of charge on the capacitor plates in steady state will be
(A) 0
(B) 4 Mc
(C) 16 μC
(D) 8 μC



34. A positively charged particle is released from rest in an uniform electric field. The electric potential energy of the charge
(A) remains a constant because the electric field is uniform
(B) increases because the charge moves along the electric field
(C) decreases because the charge moves along the electric field
(D) decreases because the charge moves opposite to the electric field

35. Figure shows some equipotential lines distributed in space. A charged object is moved from point A to point B.



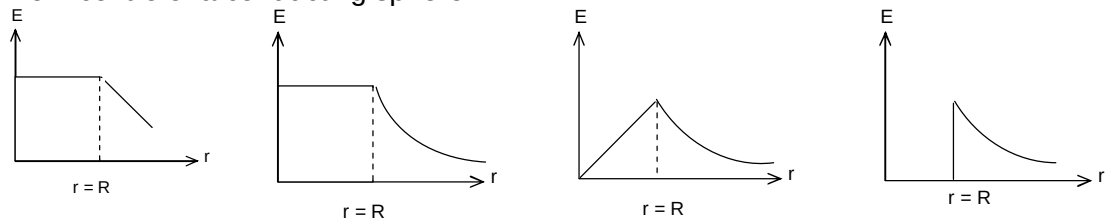
(A) The work done in Fig. (i) is the greatest.
(B) The work done in Fig. (ii) is least.
(C) The work done is the same in Fig. (i), Fig.(ii) and Fig. (iii).
(D) The work done in Fig. (iii) is greater than Fig. (ii) but equal to that in

36. Equipotentials at a great distance from a collection of charges whose total sum is not zero are approximately
(A) spheres (B) planes
(C) paraboloids (D) ellipsoids

37. A resistance R is to be measured using a meter bridge, a student chooses the standard resistance S to be 100 Ω He finds the null point at l_1 = 2.9 cm. He is told to attempt to improve the accuracy. Which of the following is a useful way?
(A) He should measure l_1, more accurately
(B) He should change S to 1000 Ω and repeat the experiment
(C) He should change S to 3 Ω and repeat the experiment
(D) He should have given up hope of a more accurate measurement with a meter bridge

38. In a parallel-plate capacitor of capacitance C, a metal sheet is inserted between the plates, parallel to them. The thickness of the sheet is half of the separation between the plates. The capacitance now becomes
(A) 4C (B) 2C (C) C/2 (D) C/4

39. Which of the following graphs show how the electric field strength E varies with distance 'r' from centre of a conducting sphere?



(A) (B) (C) (D)

40. A ring of radius 6 cm is given a charge 10 μC. How much work will be done in transporting a charge of 140nC from its centre to a point 8 cm along its axis?
(A) 63 mJ (B) 84 mJ (C) 105 mJ (D) 126 mJ

41. Three small spheres each carrying a charge q are placed on the circumference of a circle of radius R, forming an equilateral triangle. If we place another charge Q at the center of the circle, the force on Q is
(A) Zero (B) $\frac{qQ}{4\pi \in_0 R^2}$ (C) $\frac{2qQ}{4\pi \in_0 R^2}$ (D) $\frac{3qQ}{4\pi \in_0 R^2}$

42. In order to convert a miliammeter of range 1.0 mA and resistance 1.0 ohm into a voltmeter of range 10 V, a resistance of how many ohms should be connected with it and in what manner?
(A) 999 Ω in series (B) 999 Ω in parallel
(C) 9,999 Ω in series (D) 9,999 Ω in parallel

43. What is the value of shunt which pass 2% of main current through a galvanometer of 98Ω
(A) 9.8 Ω (B) 2 Ω (C) 4.9 Ω (D) 4 Ω

44. The electric flux from a cube of edge l is ϕ. What will be its value if edge of cube is made 2l and charge enclosed is halved?
(A) 4ϕ (B) 2ϕ
(C) $\phi/2$ (D) ϕ

45. **Assertion:**
The temperature coefficient of resistance is always positive only for metal.

Reason:
On increasing the temperature, the resistance of metals and alloys increases.
(A) **Assertion** is true, **Reason** is true, **Reason** is a correct explanation for **Assertion.**
(B) **Assertion** is true, **Reason** is true, **Reason** is not a correct explanation for **Assertion.**
(C) **Assertion** is true, **Reason** is false.
(D) **Assertion** is false, **Reason** is true.

46. **Assertion:**
At a point in space, the electric field points towards north. In the region surrounding this point the rate of change of potential will be zero along the east and west.

Reason:
Electric field due to a charge is the field all around the charge.
(A) **Assertion** is true, **Reason** is true, **Reason** is a correct explanation for **Assertion.**
(B) **Assertion** is true, **Reason** is true, **Reason** is not a correct explanation for **Assertion.**
(C) **Assertion** is true, **Reason** is false.
(D) **Assertion** is false, **Reason** is true.

47. **Assertion:**
The capacity of a conductor, under given circumstances, remains constant irrespective of the charge present on it.

Reason:
Capacity depends on size and shape of a conductor and also on the surrounding medium.
(A) **Assertion** is true, **Reason** is true, **Reason** is a correct explanation for **Assertion.**
(B) **Assertion** is true, **Reason** is true, **Reason** is not a correct explanation for **Assertion.**
(C) **Assertion** is true, **Reason** is false.
(D) **Assertion** is false, **Reason** is true.

48. **Assertion:**
Positive charge always moves from higher potential to lower potential point.

Reason:
Electric potential is a scalar quantity.
(A) **Assertion** is true, **Reason** is true, **Reason** is a correct explanation for **Assertion.**
(B) **Assertion** is true, **Reason** is true, **Reason** is not a correct explanation for **Assertion.**
(C) **Assertion** is true, **Reason** is false.
(D) **Assertion** is false, **Reason** is true.

49. **Assertion:**
Dielectric constant for metals is infinity.

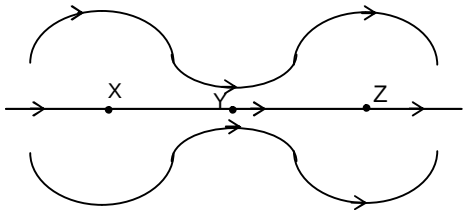
Reason:
When charged capacitor is filled completely with a metallic slab, its capacity becomes very large.

(A) **Assertion** is true, **Reason** is true, **Reason** is a correct explanation for **Assertion.**
(B) **Assertion** is true, **Reason** is true, **Reason** is not a correct explanation for **Assertion.**
(C) **Assertion** is true, **Reason** is false.
(D) **Assertion** is false, **Reason** is true.

SECTION – C

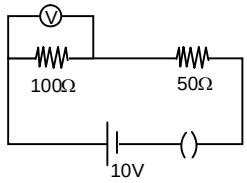
*This section contains **6 Multiple Choice Questions** number **50 to 55, out of which 4 questions are based on case studies.** Each question has 4 choices (A), (B), (C) and (D), out of which **ONLY ONE** is correct.*

50. In this figure, electric field lines in a certain region are shown. The figure suggest that



(A) $E_x = E_y = E_z$
(B) $E_x < E_y < E_z$
(C) $E_x > E_y > E_z$
(D) $E_x = E_z < E_y$

51. In the given circuit, the voltmeter records 5V. The resistance of the voltmeter (in ohms) is



(A) 200 (B) 100
(C) 10 (D) 50

Case Study
(52 – 55)

According to Ohm's law, the curent flowing through a conductor is directly proportional to the potential difference across the ends of the conductor i.e. $I \propto V \Rightarrow \frac{V}{I} = R,$ where R is resistance of the conductor. Electrical resistance of condcutor is the obstruction posed by the conductor to the flow of electric current through it. It depends upon length, area of cross-section, nature of material and temperature of the conductor. We can write, $R \propto \frac{1}{A}$ or $R = \rho\frac{\ell}{A},$ where ρ is electrical resistivity of the material of the conductor.

52. Dimensions of electric resistance is
(A) $[ML^2T^{-2}A^{-2}]$ (B) $[ML^2T^{-3}A^{-2}]$
(C) $[M^{-1}L^{-2}T^{-1}A]$ (D) $[M^{-1}L^2T^2A^{-1}]$

53. If 1 μA currents flow thorugh a conductor when potential difference of 2 volt is applied across its ends, then the resistance of the conductor is
(A) $2 \times 10^6\ \Omega$ (B) $3 \times 10^5\ \Omega$
(C) $1.5 \times 10^5\ \Omega$ (D) $5 \times 10^7\ \Omega$

54. Specific resistance of a wire depends upon
(A) length (B) cross-sectional area
(C) mass (D) none of these

55. The shape of the graph between potential difference and current through a conducor is
(A) a straight line (B) curve
(C) first curve then straight line (D) first straight line then curve