FIITJEE

CBSE TERM - I

ALL XIITH STUDYING BATCHES

Full Test – I

PHYSICS

(16th November 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

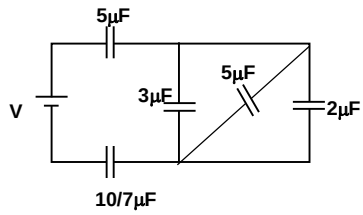
SECTION – A

*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 particle having charge –q, located at A at rest, is forced to move by an external agent in the presence of a point charge +Q fixed at B. Let C be a point such that ABC forms an equilateral triangle and if it is known that while passing through C, particle acquires a speed v, then work done by electrical force from A to C is

(A) $-\frac{1}{4\pi\varepsilon_o}\frac{Qq}{a}$ (B) $-\frac{1}{2\pi\varepsilon_o}\frac{Qq}{a}$ (C) zero (D) $\frac{1}{2}mv^2$

2. If potential difference across 3μF is 4V, then total energy stored in all capacitors is



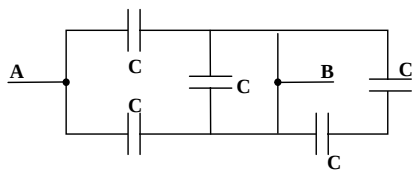
(A)400 μJ
(B)800 μJ
(C)1200 μJ
(D)cannot be calculated as emf of cell is not given.

3. An electric dipole is placed in an electric field generated by two point charges +q and –q, kept at a separation much-much larger than the separation of dipole charges.
(A)The net electric force on the dipole must be zero.
(B)The net electric force on the dipole may be zero.
(C)The torque on the dipole due to the field may be zero.
(D)The torque on the dipole due to the field can never be zero.

4. An electron travelling in a region of electrostatic potential V_1 passes into a region of higher potential V_2. If we compare the velocity of the electron in the region of higher potential V_2 to that of its earlier velocity in the region of V_1 , that will
(A) not change
(B) a change in direction but not in magnitude
(C) no change in its component parallel to the interface between regions
(D) decrease.

5. A proton has a mass $1.67 \times 10^{--27}$ kg and charge $+1.6 \times 10^{-19}$ C. If the proton is accelerated through a potential difference of one million volts, then the kinetic energy is
(A) 1.6×10^{-15} J (B) 1.6×10^{-13} J (C) 1.6×10^{-25} J (D) 3.2×10^{-13} J

6. The equivalent capacitance between the points A and B of a combination shown in the figure is



(A) C (B) 2C
(C) C/2 (D) none of these

7. A cylinder of radius R and length L is placed in a uniform electric field $\vec{E}$ parallel to the cylinder axis. The total flux for the surface of cylinder is

(A) $2\pi R^2E$ (B) $\frac{2\pi R^2}{E}$ (C) $\frac{\pi R^2}{E}$ (D) zero

8. The electric potential at the surface of an atomic nucleus (z=50) of radius 9.0×10^{-15} m is

(A) 80 V (B) 8×10^6 V (C) 9 V (D) 9×10^5 V

9. A hollow spherical conductor of radius r is given a charge Q. Work done in moving a charge q from its centre to surface is

(A) $\frac{Qq}{4\pi\varepsilon_0 R}$ (B) $\frac{Qq}{2\pi\varepsilon_0 R}$ (C) $\frac{Qq}{\pi\varepsilon_0 R}$ (D) zero

10. An electric dipole is placed inside a sphere of radius R. Then the flux through the sphere is

(A) zero. (B) $\frac{q}{\varepsilon_o}$ (B) $\frac{2q}{\varepsilon_o}$ (D) Data insufficient

11. n identical cells each of emf ε and internal resistance r are joined in series so as to form a closed circuit. The P.D. across any one cell is

(A) zero (B) ε (C) ε/n (D) $\frac{n-1}{n}\varepsilon$

12. A millimeters of range 10 mA has a coil of resistance 1 Ω. To use it as an ammeter of range 1 A, the required shunt must have a resistance of

(A) $\frac{1}{101}\Omega$ (B) $\frac{1}{100}\Omega$ (C) $\frac{1}{99}\Omega$ (D) $\frac{1}{9}\Omega$

13. If a copper wire is stretched to make it 0.1% longer. The percentage change in its resistance is

(A) 0.2 % increase (B) 0.2 % decrease
(C) 0.1 % increase (D) 0.1 % decrease

14. A galvanometer having a coil resistance 100Ω gives a full scale deflection when a current of 1 mA is passed through it. What is the value of the resistance which can convert this galvanometer into a voltmeter giving full scale deflection for a potential difference of 10 V?

(A) R = 10.9 k Ω (B) R = 9.9 kΩ
(C) R = 8.9 k Ω (D) all of these

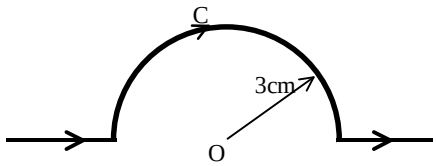
15. If radius of a wire carrying current is doubled, the drift velocity of the electrons will be

(A) Unchanged (B) halved (C) One Fourth (D) Times

16. An electron moving in a circular path of radius r makes n rotation per seconds. The magnetic field produced at the centre has the magnitude

(A) zero (B) $\frac{\mu_0 ne}{2r}$ (B) $\frac{\mu_0 ne}{2\pi r}$ (D) $\frac{\mu_0 n^2 e}{2r}$

17. The conductor ABCDE carries a current of 4 A. The field at the centre O of the circular part of it is



(A) $16\pi/9 \times 10^{-5}$ T

(B) $4\pi/3 \times 10^{-5}$ T

(C) $16\pi/9 \times 10^{-4}$ T

(D) $4\pi/3 \times 10^{-4}$ T

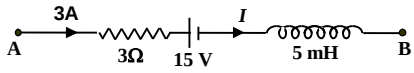
18. A coil of inductance L = 300mH and resistance R = 140 mθ is connected to a constant voltage source. Current in the coil will reach to 50% of its steady state value after t is equal to

(A) 15 s (B) 0.75 s
(C) 0.15 s (D) 1.5 s

19. An average emf of 0.2V is induced in coil, when current of 5.0 Amp is changed to 20 Amp in $\frac{1}{4}$ seconds. The coefficient of self induction will be

(A) 4H (B) 0.4 H (C) 0.4 mH (D) None of these

20. In the given part of a circuit. If the current is increasing at a rate of 3 mA/s, then $V_A - V_B$ =



(A) 39 V (B) 30 V (C) 15 V (D) none of these

21. A coil of resistance 10 ohm has a flux change of 0.05 Wb to 0.55 Wb in 0.1 sec. What is the induced current?

(A) 5 A (B) 0.5 A (C) 0.05 A (D) 50 A

22. A train is moving from south to north with a velocity of 90 km/h. The vertical component of earth's magnetic induction is 0.4×10^{-4} Wb/m^2. If the distance between the two rails is 1 m, what is the induced e.m.f. in its axle?

(A) 1 mV (B) 0.1 mV (C) 10 mV (D) 100 mV

23. Flux (in weber) in a closed circuit of resistance 10Ω varies with time t (in seconds) according to the equation $\Phi = 6t^2 - 5t + 1$. What is the magnitude of the induced current at t = 0.25 second

(A) 1.2 Amp (B) 0.8 Amp (C) 0.6 Amp (D) 0.2 Amp

24. The primary of a transformer has 240 turns. When an input voltage of 20V is applied, the output voltage is 2.5V. The number of turns in the secondary is

(A) 250 (B) 100 (C) 30 (D) 5

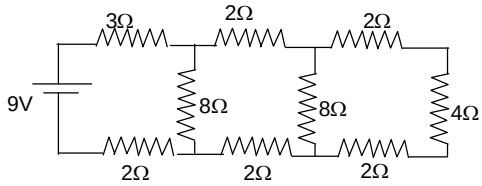
25. A long horizontal metallic rod with length along the east-west direction is falling under gravity. The potential difference between it's two ends will be

(A) zero (B) constant
(C) increase with time (D) decrease with time

SECTION – B

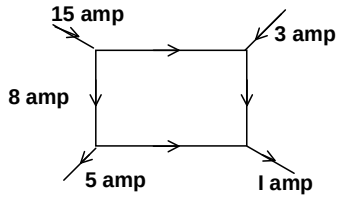
*This section contains **24 Multiple Choice Questions** number **26 to 49, out of which 5 questions are Assertion-Reasoning type.** Each question has 4 choices (A), (B), (C) and (D), out of which **ONLY ONE** is correct.*

26. In the circuit shown in figure below the current through
(A) the 3 Ω resistor is 1 A
(B) the 3 Ω resistor is 0.2 A
(C) the 4 Ω resistor is 0.50 A
(D) the 4 Ω resistor is 0.25 A



27. Three bulbs of ratings 40 W, 60 W, and 100 W are designed to work on 220 V mains. Which bulbs will burn most brightly if they are connected in series across 220 V mains?
(A) 40 W bulb (B) 60 W bulb
(C) 100 W bulb (D) all will burn equally brightly

28. The value of current I in the circuit shown in figure is
(A) 3 ampere
(B) 13 ampere
(C) 23 ampere
(D) –3 ampere



29. A bulb (100 W, 200 V) is attached to a voltage of 160 V. The power dissipation is
(A) 64 W (B) 100 W
(C) 32 W (D) 160 W

30. A proton and an alpha particle enter in a uniform magnets field with the same velocity. The period of rotation of the alpha particle will be:
(A) four times that of the proton (B) two times that of the proton
(C) three times that of the proton (D) same as that of the proton

31. At a certain place a magnet makes 30 oscillations per minute. At another place where the magnetic field is double its time period will be:
(A) 4 sec (B) 2 sec (C) 1/2 sec (D) $\sqrt{2}$ sec

32. A bar magnet when suspended freely oscillates with a period of 4 sec in the earth's magnetic field. It is broken into two exact halves. Then the period of each half is:
(A) 4 sec (B) 2 sec (C) 6 sec (D) 16 sec

33. Electron and proton of equal momentum enter a uniform magnetic field normal to the lines of force. If the radii of curvature of circular paths be r_e and r_P respectively, then
(A) $r_e/r_p = 1/1$ (B) $r_e/r_p = m_p/m_e$ (C) $r_e/r_p = \sqrt{m_p/m_e}$ (D) $r_e/r_p = \sqrt{m_e/m_p}$

34. The self-inductance of a coil is L. keeping length and area same, the number of turns of the coil is increased to four times. The inductance of the coil will now be

(A) $\frac{1}{4}$L (B) L (C) 4L (D) 16L

35. In a circuit with a coil of resistance of 2Ω, the magnetic flux changes from 2.0 wb to 10.0 WB in 0.2s. The charge that flows in the coil during this time is

(A) 5.0 coulomb. (B) 4.0 coulomb. (C) 1.0 coulomb. (D) 0.8 coulomb.

36. The direction of the induced current is such that it opposes the cause to which it is due, this is

(A) consistent with observed facts
(B) a statement of Lenz's law
(C) a consequence of law of conservation of energy
(D) all of the above

37. In an R-L-C circuit v = 20 sin (314 t + 5π/6) and i = 10 sin (314 t + 2π/3)
The power factor of the circuit is

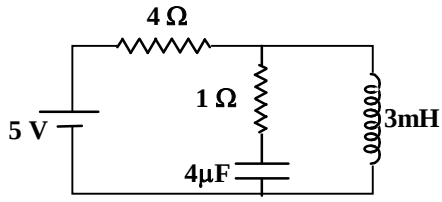
(A) 0.5 (B) 0.966 (C) 0.866 (D) 1

38 An alternating current is given by $i = i_1 \cos \omega t + i_2 \sin \omega t$. The rms current is given by

(A) $i_1 + i_2$ (B) $(\sqrt{i_1} + \sqrt{i_2})^2$ (C) $\frac{i_1 + i_2}{2}$ (D) none of these

39. In the figure shown the steady state current through the inductor will be

(A) zero
(B) 1A
(C) 1.25 A
(D) can not be determined



40. In an a.c. circuit voltage v and current i are given by v = 100 sin 100 t volts, i = 100 sin {100 t + π/3} mA. The power dissipated in the circuit is

(A) 10^4 W (B) 10 W (C) 2.5 W (D) 5 W

41. The root mean square value of voltage (V) in an AC circuit is

(A) $0.637V_{max}$ (B) $0.707\ V_{max}$ (C) $2V_{max}$ (D) $\sqrt{2}\ V_{max}$

42. In a series LRC circuit, resonance occurs when

(A) $R = X_L \sim X_C$ (B) $X_L = X_C$ (C) $X_L = 10\ X_C$ more (D) $X_L - X_C > R$

43. The reactance of a inductor at 50 Hz is 10 Ω. What will be its reactance at 200 Hz ?

(A) 10 Ω (B) 40 Ω (C) 2.5 Ω (D) 20 Ω

44. Electric charge +10 μC, +5 μC, - 3μC and + 8μC are placed at the corners of a square of side $\sqrt{2}$ m. The potential at the centre of the square is

(A) 18×10^5 V (B) 1.8×10^6 V
(C) 1.8 V (D) 1.8×10^5 V

Assertion & Reason type (45 – 49)

45. **Assertion:**
An electron and a proton enter a uniform magnetic field at right angles to the field with equal velocities, then, deviation of both from the original path will be the same.

Reason:
In the situation described above, electron and proton will experience magnetic forces of same magnitude.
(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:**
If a proton and an electron, initially at rest, are accelerated through the same potential difference, their final kinetic energies will be equal.

Reason:
Mass of proton is about 1840 times the mass of electron.
(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:**
Hot wire instruments can be used to measure A.C.as well as DC voltage.

Reason:
Hot wire instruments measure peak value of the current/voltage.
(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:**
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:
change of potential will be zero along normal to the direction of electric field.
(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:**
When charges are shared between two bodies, there occurs no loss of charge but there does occur a loss of energy.

Reason:
In case of sharing of charges, conservation of energy fails.
(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

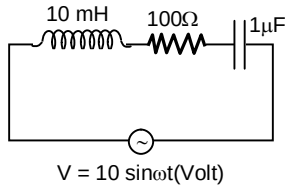
*This section contains **6 Multiple Choice Questions** number **50 to 55, out of which 4 questions are based on case studies.** Each question has 4 choices (A), (B), (C) and (D), out of which **ONLY ONE** is correct.*

50. The time period of a charged particle undergoing a circular motion in a uniform magnetic field is independent of its
(A) speed (B) mass
(C) charge (D) magnetic induction

51. A uniform electric field and a uniform magnetic field are acting along the same direction in a certain region. If an electron is projected along the direction of the fields with a certain velocity then
(A) it will turn towards right of direction of motion
(B) it will turn towards left of direction of motion
(C) its velocity will decrease
(D) its velocity will increase

Case Study (52 – 55)

Referring to the given circuit, answer the following,



52. Peak current in the circuit is less than 0.1 A for
(A) ω = 8000 rad/s (B) ω = 1050 rad/s
(C) ω = 10000 rad/s (D) ω = 1500 rad/s

53. Voltage across the combination and the current are in same phase for
(A) ω = 8000 rad/s (B) ω = 1050 rad/s
(C) ω = 10000 rad/s (D) ω = 1500 rad/s

54. Voltage across the combination leads the current for
(A) ω = 8000 rad/s (B) ω = 10500rad/s
(C) ω = 10000 rad/s (D) ω = 1500 rad/s

55. Current through the circuit leads the voltage across it for
(A) ω = 8000 rad/s (B) ω = 10500rad/s
(C) ω = 10000 rad/s (D) ω = 1500 rad/s