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22. Find the local maxima and local minima of function,
$$f(x) = x\sqrt{1-x}, \quad 0 < x < 1$$

Find also the local maximum and the local minimum value.
23. Find the intervals in which the function f given by $f(x) = \frac{4 \sin x - 2x - x \cos x}{2 + \cos x}$ is
 - i. increasing
 - ii. decreasing
24. A rectangular sheet of tin 45 cm by 24 cm is to be made into a box without top, by cutting off square from each corner and folding up the flaps. What should be the side of the square to be cut off so that the volume of the box is maximum?
25. Prove that the volume of the largest cone that can be inscribed in a sphere of radius R is $\frac{8}{27}$ of the volume of the sphere.
26. Show that the semi-vertical angle of the cone of the maximum value and of given slant height is $\tan^{-1} \sqrt{2}$
27. Show that semi-vertical angle of right circular cone of given surface area and maximum volume is $\sin^{-1} \left(\frac{1}{3} \right)$
28. Find the absolute maximum and minimum values of the function f given by $f(x) = \cos^2 x + \sin x$, $x \in [0, \pi]$
29. Show that the height of the cylinder of maximum volume that can be inscribed in a sphere of radius R is $\frac{2R}{\sqrt{3}}$. Also find the maximum volume.
30. Show that height of the cylinder of greatest volume which can be inscribed in a right circular cone of height h and semi vertical angle α is one-third that of the cone and the greatest volume of cylinder is $\frac{4}{27} \pi h^3 \tan^2 \alpha$.

PHYSICS

Date : 22-05-2026

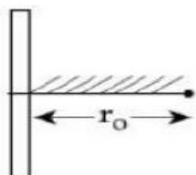
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Total Marks : 120

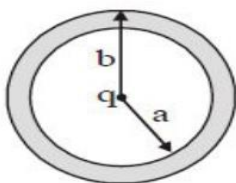
* SECTION - A

[120]

- Two metal spheres of radii R_1 and R_2 are charged to the same potential. The ratio of charges on the spheres is
(A) $\sqrt{R_1} : \sqrt{R_2}$ (B) $R_1 : R_2$ (C) $R_1^2 : R_2^2$ (D) $R_1^3 : R_2^3$
- A uniform electric field pointing in positive x -direction exists in a region. Let A be the origin, B be the point on the x -axis at $x = +1 \text{ cm}$ and C be the point on the y -axis at $y = +1 \text{ cm}$. Then the potentials at the points A , B and C satisfy
(A) $V_A < V_B$ (B) $V_A > V_B$ (C) $V_A < V_C$ (D) $V_A > V_C$
- The distance between H^+ and Cl^- ions in HCl molecule is $1.28 \text{ \AA}$. What will be the potential due to this dipole at a distance of $12 \text{ \AA}$ on the axis of dipole..... V
(A) 0.13 (B) 1.3 (C) 13 (D) 130
- A positive point charge is released from rest at a distance r_0 from a positive line charge with uniform density. The speed (v) of the point charge, as a function of instantaneous distance r from line charge, is proportional to



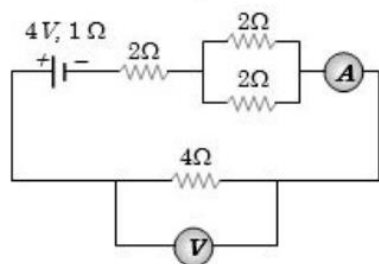
- (A) $v \propto e^{+r/r_0}$ (B) $v \propto \ln\left(\frac{r}{r_0}\right)$ (C) $v \propto \sqrt{\ln\left(\frac{r}{r_0}\right)}$ (D) $v \propto \left(\frac{r}{r_0}\right)$
5. In the figure shown the electric potential energy of the system is: (q is at the centre of the conducting neutral spherical shell of inner radius a and outer radius b)



- (A) 0 (B) $\frac{kq^2}{2b}$ (C) $\frac{kq^2}{2b} - \frac{kq^2}{2a}$ (D) $\frac{kq^2}{2a} - \frac{kq^2}{2b}$
6. A potential difference of 300 *volts* is applied to a combination of 2.0 μF and 8.0 μF capacitors connected in series. The charge on the 2.0 μF capacitor is

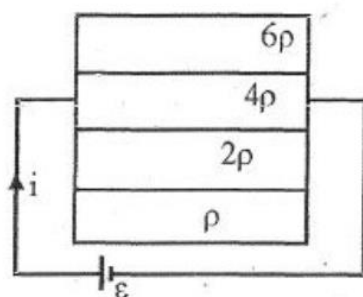
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13. What is the equivalent resistance of the circuit Ω



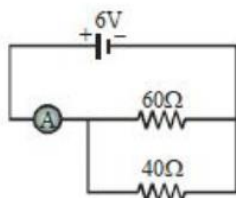
- (A) 6 (B) 7 (C) 8 (D) 9

14. If resistivity of all four wire connected in parallel is different as given in figure and all other dimensions of wire are same then current i is (resistance of wire having resistivity ρ is R_0)



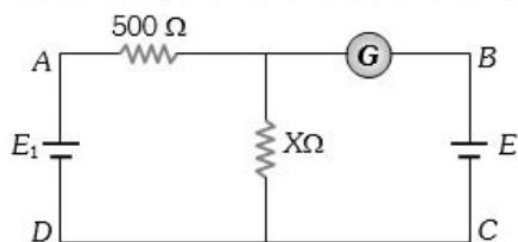
- (A) $\frac{23\varepsilon}{12R_0}$ (B) $\frac{13\varepsilon}{12R_0}$ (C) $\frac{25\varepsilon}{16R_0}$ (D) $\frac{13\varepsilon}{6R_0}$

15. The measurement of ammeter in the following circuit is A (Assuming ideal ammeter)



- (A) 2.4 (B) 3.4 (C) 4 (D) 0.25

16. In the adjoining circuit, the battery E_1 has an *e.m.f.* of 12 volt and zero internal resistance while the battery E has an *e.m.f.* of 2 volt. If the galvanometer G reads zero, then the value of the resistance X in ohm is



- (A) 10 (B) 100 (C) 500 (D) 200

17. In a potentiometer arrangement, a cell of *emf* 1.25 V gives a balance point at 35.0 cm length of the wire. If the cell is replaced by another cell and the balance

point shifts to 63.0 cm , what is the emf of the second cell in V ?

- (A) 4.65 (B) 2.25 (C) 8.64 (D) 10.52

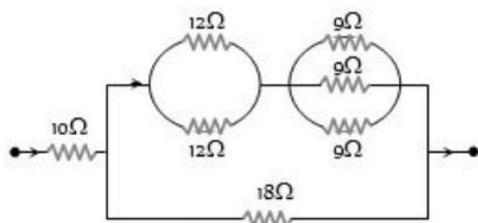
18. A heater A gives out 300 W of heat when connected to a 200 V d.c. supply. A second heater B gives out 600 W when connected to a 200 v d.c. supply. If a series combination of the two heaters is connected to a 200 V d.c. supply the heat output will be W

- (A) 100 (B) 450 (C) 300 (D) 200

19. A cable of resistance $10\ \Omega$ carries electric power from a generator producing 250 kW at 10000 volt . The current in the cable is A

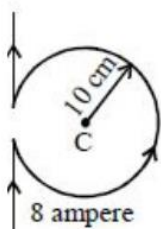
- (A) 25 (B) 250 (C) 100 (D) 1000

20. In the following circuit, $18\ \Omega$ resistor develops 2 J/sec due to current flowing through it. The power developed across $10\ \Omega$ resistance is W



- (A) 125 (B) 10 (C) 0.8 (D) 25

21. A long, straight wire is turned into a loop of radius 10 cm (see figure). If a current of 8 A is passed through the loop, then the value of the magnetic field and its direction at the centre C of the loop shall be close to



- (A) 5.0×10^{-5} newton/(amp – meter), outwards
 (B) 3.4×10^{-5} newton/(amp – meter), outwards
 (C) 1.6×10^{-5} newton/(amp – meter), inwards
 (D) 1.6×10^{-5} newton/(amp – meter), outwards

22. If wire of length L form a loop of radius R and have n turn. Find magnetic field at centre of loop if current flowing in loop is I

- (A) $\frac{\mu_0}{4\pi} \frac{I}{R^2} \times L^2$ (B) $\frac{\mu_0}{4\pi} \frac{I}{R^2} \times L \times n^2$ (C) $\frac{\mu_0 I}{4\pi} \frac{4\pi^2 n^2}{L}$ (D) $\frac{\mu_0}{4\pi} I 4\pi^2 n^2 \times L$

23. A coil having N turns is wound tightly in the form of a spiral with inner and outer radii a and b respectively. When a current I passes through the coil, the magnetic field at the centre is

(A) $\frac{\mu_0 NI}{b}$

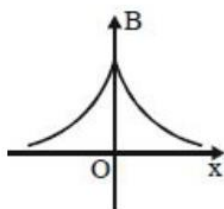
(B) $\frac{2\mu_0 NI}{a}$

(C) $\frac{\mu_0 NI}{2(b-a)} \ln \frac{b}{a}$

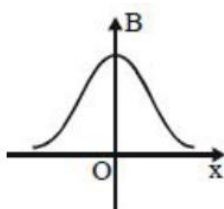
(D) $\frac{\mu_0 I^N}{2(b-a)} \ln \frac{b}{a}$

24. A circular coil is in $y-z$ plane with centre at the origin. The coil is carrying a constant current. Assuming direction of magnetic field at $x = -25 \text{ cm}$ to be positive direction of magnetic field, which of the following graphs shows variation of magnetic field along x -axis

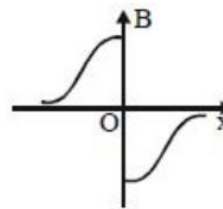
(A)



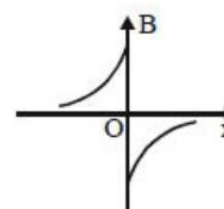
(B)



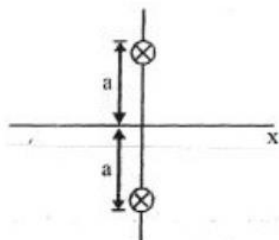
(C)



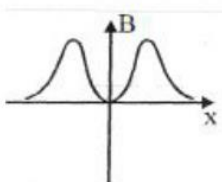
(D)



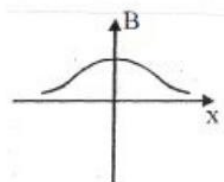
25. Two straight infinitely long current carrying wires are kept along z -axis at the coordinates $(0, a, 0)$ and $(0, -a, 0)$ respectively as shown in the figure. The current in each of the wire is equal and along negative z -axis (into the plane of the paper). The variation of magnetic field on the x -axis will be approximately



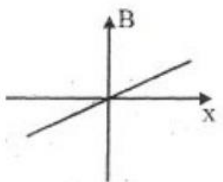
(A)



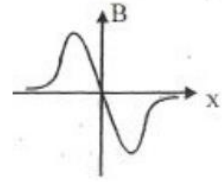
(B)



(C)



(D)



26. When a charged particle moving with velocity $\vec{v}$ is subjected to a magnetic field of induction $\vec{B}$, the force on it is non-zero. This implies that

(A) angle between is either zero or 180° (B) angle between is necessarily 90° (C) angle between can have any value other than 90° (D) angle between can have any value other than zero and 180° .

27. A charge of $4.0 \mu\text{C}$ is moving with a velocity of $4.0 \times 10^6 \text{ ms}^{-1}$ along the positive y -axis under a magnetic field $\vec{B}$ of strength $(2\hat{k}) \text{ T}$. The force acting on the charge is $x\hat{i} \text{ N}$. The value of x is _____.

(A) 12

(B) 78

(C) 85

(D) 32

28. The average dipole moment of Fe atoms is $1.8 \times 10^{-23} A - m^2$. The magnetic moment of an iron rod of length 10 cm and diameter 1 cm is..... $A - m^2$: (density and at. wt. of Fe are 7.87 g/cm^3 and 55.87)
- (A) 3 (B) 4 (C) 6 (D) 12
29. Due to the flow of current in a circular loop of radius R , the magnetic field produced at the centre of the loop is B . The magnetic moment of the loop is :-
- (A) $BR^3/2\pi\mu_0$ (B) $2\pi BR^3/\mu_0$ (C) $BR^2/2\pi\mu_0$ (D) $2\pi BR^2/\mu_0$
30. A galvanometer of resistance $20\ \Omega$ is to be converted into an ammeter of range 1 A . If a current of 1 mA produces full scale deflection, the shunt required for the purpose is Ω
- (A) 0.01 (B) 0.05 (C) 0.02 (D) 0.04

SUBJECT:-PHYSICAL EDUCATION

1. Differentiate between intramural and extramural competitions.
2. Explain the advantages of knockout tournament.
3. What is obesity? Write its causes.
4. Explain osteoporosis.
5. Write benefits of Pranayama.
6. Explain hypertension.
7. Differentiate between disability and disorder.
8. Explain adapted physical education.
9. Do any one activity:
 - * Make a chart on “Yoga and Healthy Lifestyle” OR
 - * Prepare a scrapbook on “Sports Events and Olympic Values