

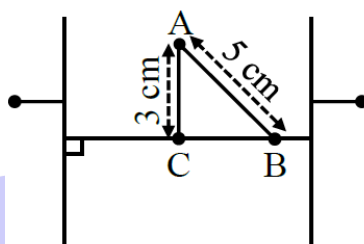
JEE-MAIN EXAM APRIL, 2025

Date: - 02-04-2025 (SHIFT-2)

PHYSICS

SECTION-A

1. Two large plane parallel conducting plates are kept 10 cm apart as shown in figure. The potential difference between them is V . The potential difference between the points A and B (shown in the figure) is :



- (1) $\frac{1}{4}V$ (2) $\frac{2}{5}V$ (3) $1V$ (4) $\frac{3}{4}V$
2. Given below are two statements : one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A) : Net dipole moment of a polar linear isotropic dielectric substance is not zero even in the absence of an external electric field.
Reason (R) : In absence of an external electric field, the different permanent dipoles of a polar dielectric substance are oriented in random directions.
 In the light of the above statements, choose the most appropriate answer from the options given below :
- (1) (A) is correct but (R) is not correct
 (2) Both (A) and (R) are correct and (R) is the correct explanation of (A)
 (3) Both (A) and (R) are correct but (R) is not the correct explanation of (A)
 (4) (A) is not correct but (R) is correct
3. Given a charge q , current I and permeability of vacuum μ_0 . Which of the following quantity has the dimension of momentum?
- (1) qI / μ_0 (2) $q\mu_0 / I$ (3) $q^2\mu_0 I$ (4) $q\mu_0 I$
4. If μ_0 and ϵ_0 are the permeability and permittivity of free space, respectively, then the dimension of $\left(\frac{1}{\mu_0 \epsilon_0} \right)$ is:
- (1) T^2 / L^2 (2) L / T^2 (3) T^2 / L (4) L^2 / T^2

5. Assuming the validity of Bohr's atomic model for hydrogen like ions the radius of Li^{++} ion in its ground state is given by $\frac{1}{X} a_0$, where $X = \underline{\hspace{2cm}}$ (Where a_0 is the first Bohr's radius.)

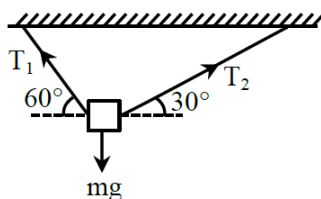
(1) 1 (2) 3 (3) 2 (4) 9

6. Two identical objects are placed in front of convex mirror and concave mirror having same radii of curvature of 12 cm, at same distance of 18 cm from the respective mirrors. The ratio of sizes of the images formed by convex mirror and by concave mirror is :

(1) 1 / 3 (2) 1 / 2 (3) 3 (4) 2

7. A body of mass 1 kg is suspended with the help of two strings making angles as shown in figure. Magnitudes of tensions T_1 and T_2 , respectively, are (in N) :

(Take acceleration due to gravity $10m/s^2$)



(1) $5\sqrt{3}, 5$ (2) $5, 5\sqrt{3}$ (3) 5, 5 (4) $5\sqrt{3}, 5\sqrt{3}$

8. Match List - I with List - II.

List - I

- (A) Heat capacity of body
(B) Specific heat capacity of body
(C) Latent heat
(D) Thermal conductivity

List - II

- (I) Jkg^{-1}
(II) JK^{-1}
(III) $Jkg^{-1}K^{-1}$
(IV) $Jm^{-1}K^{-1}s^{-1}$

Choose the correct answer from the options given below :

- (1) (A)-(III), (B)-(IV), (C)-(I), (D)-(II) (2) (A)-(IV), (B)-(III), (C)-(II), (D)-(I)
(3) (A)-(III), (B)-(I), (C)-(II), (D)-(IV) (4) (A)-(II), (B)-(III), (C)-(I), (D)-(IV)

9. A sinusoidal wave of wavelength 7.5 cm travels a distance of 1.2 cm along the x -direction in 0.3 sec. The crest P is at $x = 0$ at $t = 0sec$ and maximum displacement of the wave is 2 cm. Which equation correctly represents this wave ?

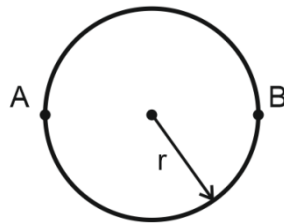
- (1) $y = 2\cos(0.83x - 3.35t)cm$ (2) $y = 2\cos(0.13x - 0.5t)cm$
(3) $y = 2\sin(0.83x - 3.5t)cm$ (4) $y = 2\cos(3.35x - 0.83t)cm$

10. Energy released when two deuterons (${}_1H^2$) fuse to form a helium nucleus (${}_2He^4$) is :

(Given : Binding energy per nucleon of ${}_1H^2 = 1.1MeV$ and binding energy per nucleon of ${}_2He^4 = 7.0MeV$)

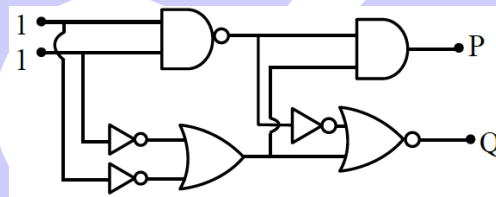
(1) 5.9 MeV (2) 26.8 MeV (3) 8.1 MeV (4) 23.6 MeV

11. The moment of inertia of a circular ring of mass M and diameter r about a tangential axis lying in the plane of the ring is :
- (1) $\frac{3}{8}Mr^2$ (2) $\frac{3}{2}Mr^2$ (3) $2Mr^2$ (4) $\frac{1}{2}Mr^2$
12. In a moving coil galvanometer, two moving coils M_1 and M_2 have the following particulars :
- $R_1 = 5\Omega, N_1 = 15, A_1 = 3.6 \times 10^{-3} m^2, B_1 = 0.25T$
- $R_2 = 7\Omega, N_2 = 21, A_2 = 1.8 \times 10^{-3} m^2, B_2 = 0.50T$
- Assuming that torsional constant of the springs are same for both coils, what will be the ratio of voltage sensitivity of M_1 and M_2 ?
- (1) 1 : 2 (2) 1 : 3 (3) 1 : 1 (4) 1 : 4
13. A sportsman runs around a circular track of radius r such that he traverses the path ABAB. The distance travelled and displacement, respectively, are



- (1) $3\pi r, 2r$ (2) $\pi r, 3r$ (3) $2r, 3\pi r$ (4) $3\pi r, \pi r$
14. An electron with mass ' m ' with an initial velocity $(t=0)\vec{v} = v_0\hat{j}$ ($v_0 > 0$) enters a magnetic field $\vec{B} = B_0\hat{j}$. If the initial de-Broglie wavelength at $t = 0$ is λ_0 then its value after time ' t ' would be :
- (1) λ_0 (2) $\frac{\lambda_0}{\sqrt{1 + \frac{e^2 B_0^2 t^2}{m^2}}}$ (3) $\frac{\lambda_0}{\sqrt{1 - \frac{e^2 B_0^2 t^2}{m^2}}}$ (4) $\lambda_0 \sqrt{1 + \frac{e^2 B_0^2 t^2}{m^2}}$
15. A bi-convex lens has radius of curvature of both the surfaces same as $1/6cm$. If this lens is required to be replaced by another convex lens having different radii of curvatures on both sides ($R_1 \neq R_2$), without any change in lens power then possible combination of R_1 and R_2 is :
- (1) $\frac{1}{5}cm$ and $\frac{1}{7}cm$ (2) $\frac{1}{3}cm$ and $\frac{1}{3}cm$ (3) $\frac{1}{6}cm$ and $\frac{1}{9}cm$ (4) $\frac{1}{3}cm$ and $\frac{1}{7}cm$
16. A solenoid having area A and length ' l ' is filled with a material having relative permeability 2. The magnetic energy stored in the solenoid is:
- (1) $B^2 Al$ (2) $\frac{B^2 Al}{4\mu_0}$ (3) $\frac{B^2 Al}{\mu_0}$ (4) $\frac{B^2 Al}{2\mu_0}$

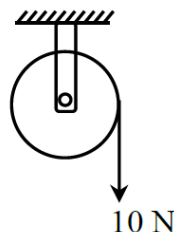
17. Identify the characteristics of an adiabatic process in a monoatomic gas.
- (A) Internal energy is constant.
 (B) Work done in the process is equal to the change in internal energy.
 (C) The product of temperature and volume is a constant.
 (D) The product of pressure and volume is a constant.
 (E) The work done to change the temperature from T_1 to T_2 is proportional to $(T_2 - T_1)$.
- Choose the correct answer from the options given below :
- (1) (B), (D) only (2) (A), (C), (E) only (3) (B), (E) only (4) (A), (C), (D) only
18. Consider a circular loop that is uniformly charged and has a radius $a\sqrt{2}$. Find the position along the positive z -axis of the cartesian coordinate system where the electric field is maximum if the ring was assumed to be placed in xy plane at the origin :
- (1) $a/\sqrt{2}$ (2) a (3) 0 (4) $a/2$
19. Two water drops each of radius ' r ' coalesce to form a bigger drop. If ' T ' is the surface tension, the surface energy released in this process is :
- (1) $4\pi r^2 T[\sqrt{2} - 1]$ (2) $4\pi r^2 T[2 - 2^{2/3}]$ (3) $4\pi r^2 T[2 - 2^{1/3}]$ (4) $4\pi r^2 T[1 + \sqrt{2}]$
20. In the digital circuit shown in the figure, for the given inputs the P and Q values are :



- (1) $P = 0, Q = 1$ (2) $P = 0, Q = 0$ (3) $P = 1, Q = 0$ (4) $P = 1, Q = 1$

SECTION-B

21. A ray of light suffers minimum deviation when incident on a prism having angle of the $\frac{4}{6}$ prism equal to 60° . The refractive index of the prism material is $\sqrt{2}$. The angle of incidence (in degrees) is _____
22. A wheel of radius 0.2 m rotates freely about its center when a string that is wrapped over its rim is pulled by force of 10 N as shown in figure. The established torque produces an angular acceleration of 2 rad/s^2 . Moment of inertia of the wheel is _____ kgm^2 . (Acceleration due to gravity = 10 m/s^2)



23. The length of a light string is 1.4 m when the tension on it is 5 N. If the tension increases to 7 N, the length of the string is 1.56 m. The original length of the string is _____ m.

24. The internal energy of air in $4m \times 4m \times 3m$ sized room at 1 atmospheric pressure will be $____ \times 10^6 J$.
(Consider air as diatomic molecule)
25. A satellite of mass 1000 kg is launched to revolve around the earth in an orbit at a height of 270 km from the earth's surface. Kinetic energy of the satellite in this orbit is $____ \times 10^{10} J$.
(Mass of earth $= 6 \times 10^{24} kg$, Radius of earth $= 6.4 \times 10^6 m$, Gravitational constant $= 6.67 \times 10^{-11} Nm^2 kg^{-2}$)

NTA ANSWER

- | | | | | | | | | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 1. | (2) | 2. | (4) | 3. | (4) | 4. | (4) | 5. | (2) | 6. | (2) | 7. | (1) |
| 8. | (4) | 9. | (1) | 10. | (4) | 11. | (1) | 12. | (3) | 13. | (1) | 14. | (1) |
| 15. | (1) | 16. | (2) | 17. | (3) | 18. | (2) | 19. | (2) | 20. | (2) | 21. | 45 |
| 22. | 1 | 23. | 1 | 24. | 12 | 25. | 3 | | | | | | |

