

JEE Main 2024 Physics Question Paper April 9 Shift 1

Time Allowed :3 Hours	Maximum Marks :300	Total Questions :90
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General Instructions

Read the following instructions very carefully and strictly follow them:

1. The test is of 3 hours duration.
2. The question paper consists of 90 questions, out of which 75 are to attempted. The maximum marks are 300.
3. There are three parts in the question paper consisting of Physics, Chemistry and Mathematics having 30 questions in each part of equal weightage.
4. Each part (subject) has two sections.
 - (i) Section-A: This section contains 20 multiple choice questions which have only one correct answer. Each question carries 4 marks for correct answer and -1 mark for wrong answer.
 - (ii) Section-B: This section contains 10 questions. In Section-B, attempt any five questions out of 10. The answer to each of the questions is a numerical value. Each question carries 4 marks for correct answer and -1 mark for wrong answer. For Section-B, the answer should be rounded off to the nearest integer

Physics

1. Find the work done by one mole of monoatomic gas undergoing adiabatic expansion such that the volume changes from V to $2V$.

2. Angle between two vectors is $\cos^{-1}\left(\frac{5}{9}\right)$, if $|\vec{A} + \vec{B}| = \sqrt{2}|\vec{A} - \vec{B}|$ and $\vec{A} = n\vec{B}$, find the value of n .

3. Find the dimensional formula of latent heat.

4. Find the energy equivalent (in MeV) for 1 gm mass of substance.

5. A vehicle travels half of the distance with speed 3 m/s and other half of distance in two equal time intervals with speed 6 m/s and 9 m/s. The average speed of vehicle is:

6. What will be the order of de-Broglie wavelength of α -particle, proton, electron if their kinetic energies are the same?

7. In an Atwood machine, two masses m_1 and m_2 are suspended and the magnitude of acceleration of the masses is $\frac{g}{8}$. Find the ratio of masses.

8. Statement-1: Concave lens always forms erect and virtual images.

Statement-2: If an object is placed at one centre of curvature of concave lens, then image forms at the centre of curvature of the other side.

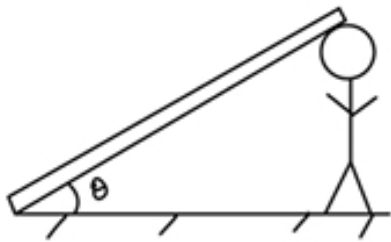
- (1) Only statement -1 is correct.
- (2) Only statement -2 is correct.
- (3) Both of the statements are correct.
- (4) None of the statements is correct.

9. Find the ratio of initial to final pressure for a gas compressed adiabatically from 5 litres to 4 litres. (Given $\gamma = \frac{3}{2}$)

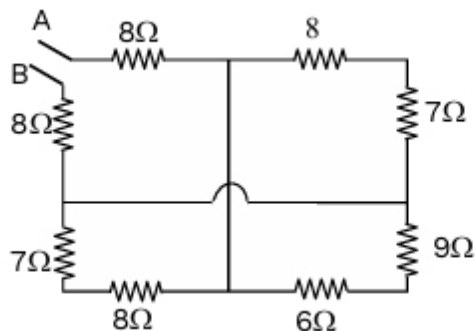
10. If particle A is on the Earth's surface and another particle B is revolving around the Earth $R/20$ above Earth's surface, then the difference in mechanical energies of A and B will be: (Radius of Earth is $R = 6570$ km)

11. If a particle performing SHM has $x = 4\text{ m}$, $v = 2\text{ m/s}$, and $a = 16\text{ m/s}^2$, then what will be its amplitude?

12. If a rod of weight W is resting on the head of a man at an angle θ as shown in the figure, find the load on the man's head.



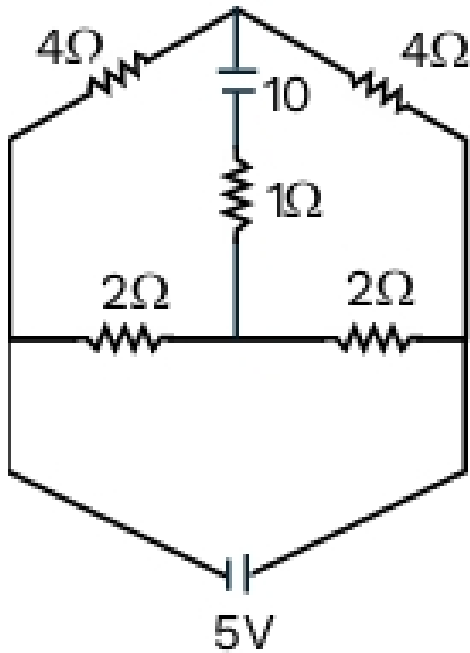
13. Find $R_{\text{equivalent}}$.



14. Find the wavelength of light emitted by the bulb which uses the LED having the band gap of 1.42 eV .

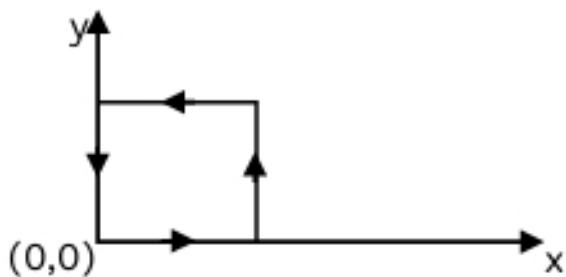
15. If the velocity of a particle of mass m is given by $v = \alpha\sqrt{x}$, find the work done by the particle to go from $x = 0$ to $x = d$.

16. Find the current passing through $1\ \Omega$ resistance.

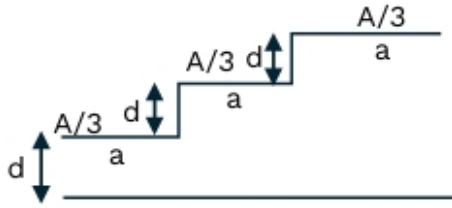


17. An inductor when connected to a 20V DC battery gives a current of 5A and when connected to a (20V, 50Hz) AC supply the current through the inductor is 4A. Find the inductance of the loop.

18. A square loop of side 2 m carrying current i is placed in a magnetic field $\vec{B} = (1 + 4x)\hat{k}$. Find the net force acting on the loop.

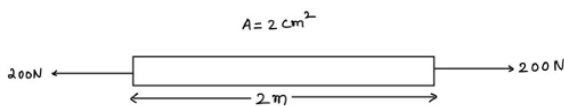


19. A capacitor is made of a flat plate of area A and a second plate having a stair-like structure as shown in the figure. The width of each stair is a and the height is d . Find the capacitance of the assembly.



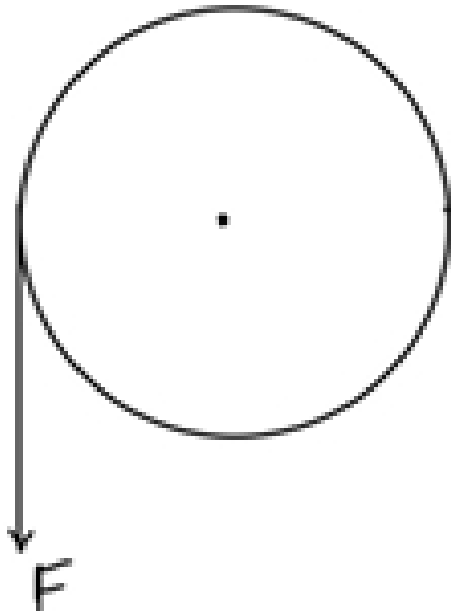
20. In a Young's double slit experiment, the slits are 1 mm apart and are illuminated by a light of $\lambda = 600 \text{ nm}$. What should be the minimum distance from central maximum where intensity of light is $\frac{1}{4}$ of maximum intensity on a screen placed 1 m distance from the plane of slits?

21. If the Young's modulus of the rod (shown in the figure) is $Y = 10^{11} \text{ N/m}^2$, then find elongation in the rod (ΔL).



22. EM wave traveling in x -direction with $E = 60 \text{ V/m}$. Find magnetic field B .

23. A body of moment of inertia $I = 0.4 \text{ kg} \cdot \text{m}^2$ and radius $r = 10 \text{ cm}$ is given as shown in the figure. If a force of $F = 40 \text{ N}$ is applied on the periphery of the body for 10 seconds, then angular velocity attained will be?



24. A half ring of $R = 10$ cm and linear density is 4 nC/m. Find the potential at the center of the ring.
