

JEE Main 2023 8 April Shift 1 Physics Question Paper

Time Allowed :180 minutes	Maximum Marks :300	Total questions :90
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General Instructions

Read the following instructions very carefully and strictly follow them:

- (A) The test is of 3 hours duration.
- (B) The question paper consists of 90 questions. The maximum marks are 300.
- (C) There are three parts in the question paper consisting of Physics, Chemistry and Mathematics having 30 questions in each part of equal weightage.
- (D) 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.

1. A cylindrical wire of mass $(0.4 \pm 0.01)\text{g}$ has length $(8 \pm 0.04)\text{ cm}$ and radius $(6 \pm 0.03)\text{ mm}$. The maximum error in its density will be:

- (1) 4%
 - (2) 1%
 - (3) 3.5%
 - (4) 5%
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2. The engine of a train moving with speed 10 ms^{-1} towards a platform sounds a whistle at frequency 400 Hz . The frequency heard by a passenger inside the train is (neglect air speed, speed of sound in air = 330 ms^{-1}):

- (1) 400 Hz
 - (2) 388 Hz
 - (3) 200 Hz
 - (4) 412 Hz
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3. The weight of a body on the earth is 400 N . Then weight of the body when taken to a depth half of the radius of the earth will be:

- (1) 300 N
 - (2) Zero
 - (3) 100 N
 - (4) 200 N
-

4. A TV transmitting antenna is 98 m high, and the receiving antenna is at ground level. If the radius of the earth is 6400 km , the surface area covered by the transmitting antenna is approximately:

- (1) 1240 km^2
 - (2) 1549 km^2
 - (3) 4868 km^2
 - (4) 3942 km^2
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5. Certain galvanometers have a fixed core made of non-magnetic metallic material.

The function of this metallic material is:

- (1) To produce large deflecting torque on the coil
 - (2) To bring the coil to rest quickly
 - (3) To oscillate the coil in magnetic field for longer period of time
 - (4) To make the magnetic field radial
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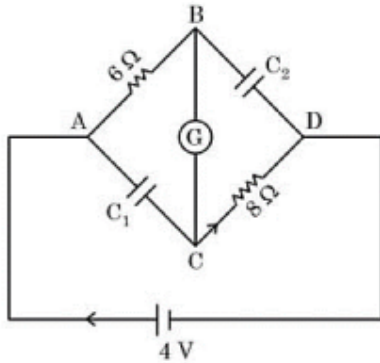
6. Dimension of $\frac{1}{\mu_0 \epsilon_0}$ should be equal to:

- (1) T/L
 - (2) T^2/L^2
 - (3) L/T
 - (4) L^2/T^2
-

7. Two projectiles A and B are thrown with initial velocities of 40 m/s and 60 m/s at angles 30° and 60° with the horizontal respectively. The ratio of their ranges is ($g = 10 \text{ m/s}^2$):

- (1) $2 : \sqrt{3}$
- (2) $\sqrt{3} : 2$
- (3) $4 : 9$
- (4) $1 : 1$

8. In this figure, the resistance of the coil of galvanometer G is 2Ω . The emf of the cell is 4 V . The ratio of potential difference across C_1 and C_2 is:



- (1) $\frac{5}{4}$
 - (2) 1
 - (3) $\frac{4}{5}$
 - (4) $\frac{3}{4}$
-

9. A charge particle moving in magnetic field B has components of velocity along B and perpendicular to B . The path of the charge particle will be:

- (1) Helical path with the axis along magnetic field B
 - (2) Straight along the direction of magnetic field B
 - (3) Helical path with the axis perpendicular to the direction of magnetic field B
 - (4) Circular path
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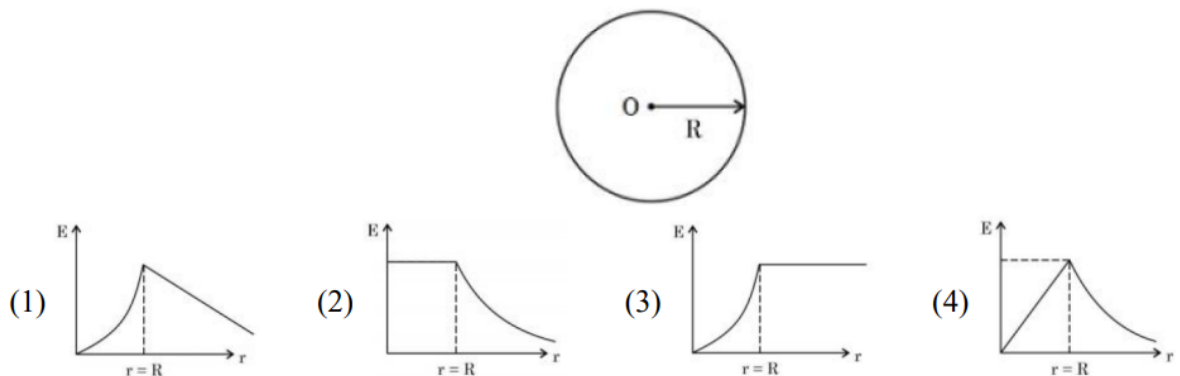
10. Proton (P) and electron (e) will have same de-Broglie wavelength when the ratio of their momentum is (assume $m_p = 1849 m_e$):

- (1) 1 : 43
- (2) 43 : 1

(3) 1 : 1849

(4) 1 : 1

11. Graphical variation of electric field due to a uniformly charged insulating solid sphere of radius R , with distance r from the center O is represented by:



12. For a nucleus A_ZX having mass number A and atomic number Z :

(1) B, C only

(2) A, B, C, D only

(3) B, C, E only

(4) C, D only

13. At any instant the velocity of a particle of mass 500 g is $(2t\hat{i} + 3t^2\hat{j}) \text{ ms}^{-1}$. If the force acting on the particle at $t = 1 \text{ s}$ is $(\hat{i} + x\hat{j}) \text{ N}$, then the value of x will be:

(1) 2

(2) 6

(3) 3

(4) 4

14. Given below are two statements:

Statement I: If E be the total energy of a satellite moving around the Earth, then its potential energy will be $\frac{E}{2}$.

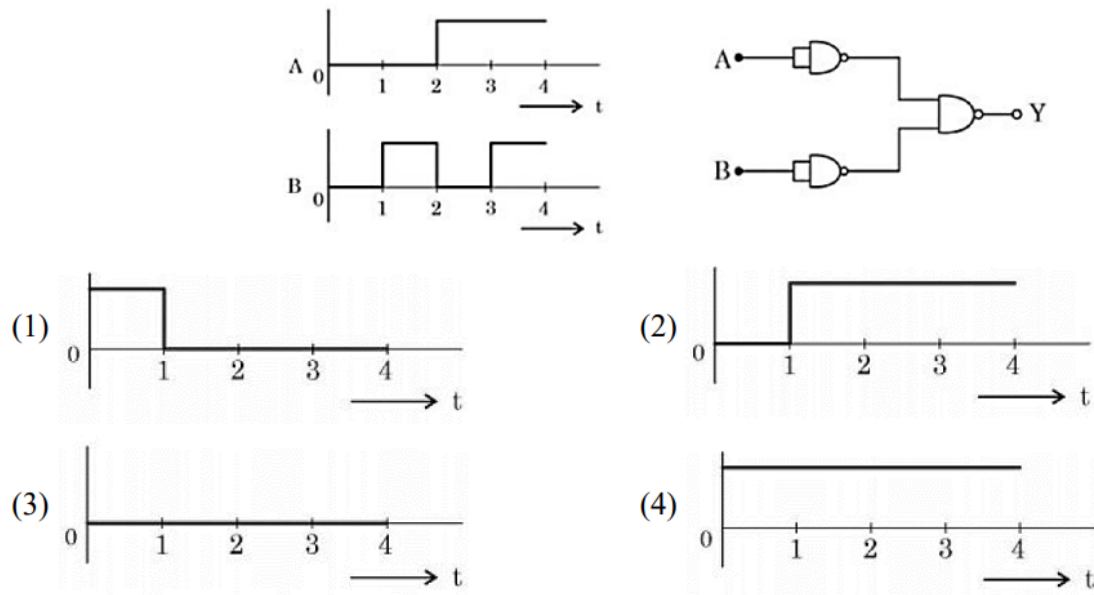
Statement II: The kinetic energy of a satellite revolving in an orbit is equal to the half the magnitude of total energy E .

- (1) Both Statement I and Statement II are incorrect
 - (2) Statement I is incorrect but Statement II is correct
 - (3) Statement I is correct but Statement II is incorrect
 - (4) Both Statement I and Statement II are correct
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15. Two forces having magnitude A and $\frac{A}{2}$ are perpendicular to each other. The magnitude of their resultant is:

- (1) $\frac{5A}{2}$
 - (2) $\frac{\sqrt{5}A^2}{2}$
 - (3) $\frac{\sqrt{5}A}{4}$
 - (4) $\frac{\sqrt{5}A}{2}$
-

16. For the logic circuit shown, the output waveform at Y is:



17. An aluminium rod with Young's modulus $Y = 7.0 \times 10^{10} \text{ N/m}^2$ undergoes elastic strain of 0.04%. The energy per unit volume stored in the rod in SI unit is:

- (1) 5600
 - (2) 2800
 - (3) 11200
 - (4) 8400
-

18. Given below are two statements:

Statement I: If heat is added to a system, its temperature must increase.

Statement II: If positive work is done by a system in a thermodynamic process, its volume must increase.

- (1) Both Statement I and Statement II are true
- (2) Both Statement I and Statement II are false
- (3) Statement I is true but Statement II is false
- (4) Statement I is false but Statement II is true

19. An air bubble of volume 1 cm^3 rises from the bottom of a lake 40 m deep to the surface at a temperature of 12°C . The atmospheric pressure is $1 \times 10^5 \text{ Pa}$, the density of water is 1000 kg/m^3 , and $g = 10 \text{ m/s}^2$. The volume of the air bubble when it reaches the surface will be:

- (1) 3 cm^3
 - (2) 4 cm^3
 - (3) 2 cm^3
 - (4) 5 cm^3
-

20. In a reflecting telescope, a secondary mirror is used to:

- (1) Make chromatic aberration zero
 - (2) Reduce the problem of mechanical support
 - (3) Move the eyepiece outside the telescopic tube
 - (4) Remove spherical aberration
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21. The momentum of a body is increased by 50% . The percentage increase in the kinetic energy of the body is:

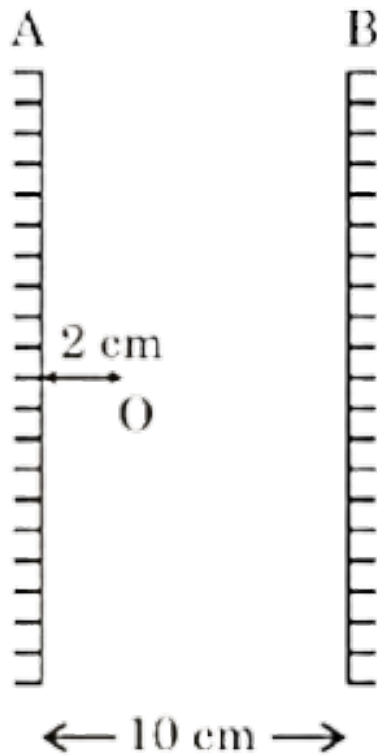
22. A nucleus with mass number 242 and binding energy per nucleon as 7.6 MeV breaks into two fragments each with mass number 121 . If each fragment nucleus has binding energy per nucleon as 8.1 MeV , the total gain in binding energy is:

23. An electric dipole of dipole moment $6.0 \times 10^{-6} \text{ C} \cdot \text{m}$ is placed in a uniform electric field of $1.5 \times 10^3 \text{ N/C}$. The work done in rotating the dipole by 180° in this field will be:

24. An organ pipe 40 cm long is open at both ends. The speed of sound in air is 360 m/s. The frequency of the second harmonic is:

25. The moment of inertia of a semicircular ring about an axis, passing through the center and perpendicular to the plane of the ring, is $(1/x)MR^2$, where R is the radius and M is the mass of the semicircular ring. The value of x will be:

26. Two vertical parallel mirrors A and B are separated by 10 cm. A point object O is placed at a distance of 2 cm from mirror A. The distance of the second nearest image behind mirror A from the mirror A is:



27. The magnetic intensity at the center of a long current carrying solenoid is found to be 1.6×10^3 A/m. If the number of turns is 8 per cm, then the current flowing through the solenoid is:

28. A current of 2 A through a wire of cross-sectional area 25.0 mm^2 . The number of free electrons in a cubic meter is 2.0×10^{28} . The drift velocity of the electrons is $\text{---} \times 10^{-6} \text{ m/s}$ (given, charge on electron $= 1.6 \times 10^{-19} \text{ C}$):

29. An oscillating LC circuit consists of a 75 mH inductor and a $1.2 \mu\text{F}$ capacitor. If the maximum charge to the capacitor is $2.7 \mu\text{C}$. The maximum current in the circuit will be:

30. An air bubble of diameter 6 mm rises steadily through a solution of density 1750 kg/m^3 at the rate of 0.35 cm/s . The coefficient of viscosity of the solution (neglect density of air) is ____ Pas (given, $g = 10 \text{ m/s}^2$):
