

JEE Main 2023 8 April Shift 2 Physics Question Paper

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 Duration of test is 3 Hours.
2. This paper consists of 90 questions.
3. There are three parts in the 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 s which have only one correct answer. Each carries 4 marks for correct answer and –1 mark for wrong answer..
 5. (ii) Section-B: This section contains 10 s. In Section-B, attempt any five s out of 10. The answer to each of the s is a numerical value. Each 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 hydraulic automobile lift is designed to lift vehicles of mass 5000 kg. The area of cross-section of the cylinder carrying the load is 250 cm^2 . The maximum pressure the smaller piston would have to bear is:

- (1) $2 \times 10^5 \text{ Pa}$
 - (2) $20 \times 10^6 \text{ Pa}$
 - (3) $200 \times 10^6 \text{ Pa}$
 - (4) $2 \times 10^6 \text{ Pa}$
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2. The orbital angular momentum of a satellite is L , when it is revolving in a circular orbit at height h from the earth's surface. If the distance of the satellite from the earth's center is increased by eight times its initial value, then the new angular momentum will be:

- (1) $8L$
 - (2) $3L$
 - (3) $4L$
 - (4) $9L$
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3. The waves emitted when a metal target is bombarded with high-energy electrons are:

- (1) Microwaves
 - (2) X-rays
 - (3) Radio Waves
 - (4) Infrared Rays
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4. Match List I with List II:

List I	List II
A. Torque	I. ML^2T^{-2}
B. Stress	II. $ML^{-1}T^{-2}$
C. Pressure gradient	III. $ML^{-1}T^{-1}$
D. Coefficient of viscosity	IV. $ML^{-1}T^{-1}$

Choose the correct answer from the options given below:

- (1) A-III, B-IV, C-I, D-II
 - (2) A-II, B-I, C-IV, D-III
 - (3) A-IV, B-II, C-III, D-I
 - (4) A-II, B-IV, C-I, D-III.
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5. Give below are two statements:

- **Statement I:** Area under velocity-time graph gives the distance traveled by the body in a given time.
- **Statement II:** Area under acceleration-time graph is equal to the change in velocity in the given time.

In the light of the given statements, choose the correct answer from the options given below:

- (1) Both Statement I and Statement II are true.
 - (2) Statement I is correct but Statement II is false.
 - (3) Both Statement I and Statement II are false.
 - (4) Statement I is incorrect but Statement II is true.
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6. The power radiated from a linear antenna of length l is proportional to: (Given, λ = Wavelength of wave):

- (1) $\frac{l}{\lambda}$
 - (2) $\frac{l^2}{\lambda}$
 - (3) $\frac{l}{\lambda^2}$
 - (4) $\left(\frac{l}{\lambda}\right)^2$
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7. Electric potential at a point P due to a point charge of $5 \times 10^{-9} \text{ C}$ is 50 V. The distance of P from the point charge is:

- (1) 3 cm
- (2) 9 cm
- (3) 0.9 cm

(4) 90 cm

8. The acceleration due to gravity at height h above the earth if $h \ll R$ (Radius of earth) is given by:

- (1) $g' = g \left(1 - \frac{h^2}{2R^2}\right)$
 - (2) $g' = g \left(1 - \frac{h}{2R}\right)$
 - (3) $g' = g \left(1 - \frac{2h^2}{R^2}\right)$
 - (4) $g' = g \left(1 - \frac{2h}{R}\right)$
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9. An emf of 0.08 V is induced in a metal rod of length 10 cm held normal to a uniform magnetic field of 0.4 T, when it moves with a velocity of:

- (1) 2 ms^{-1}
 - (2) 20 ms^{-1}
 - (3) 3.2 ms^{-1}
 - (4) 0.5 ms^{-1}
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10. Work done by a Carnot engine operating between temperatures 127°C and 27°C is 2 kJ. The amount of heat transferred to the engine by the reservoir is:

- (1) 2 kJ
 - (2) 4 kJ
 - (3) 2.67 kJ
 - (4) 8 kJ
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11. The width of fringe is 2 mm on the screen in a double-slit experiment for the light of wavelength 400 nm. The width of the fringe for the light of wavelength 600 nm will be:

- (1) 1.33 mm
- (2) 3 mm
- (3) 2 mm
- (4) 4 mm

12. The temperature at which the kinetic energy of oxygen molecules becomes double that of its value at 27°C is:

- (1) 1227°C
- (2) 627°C
- (3) 327°C
- (4) 927°C

13. Given below are two statements: one is labeled as Assertion A and the other is labeled as Reason R.

- **Assertion A:** Electromagnets are made of soft iron.
- **Reason R:** Soft iron has high permeability and low retentivity.

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.

14. The trajectory of a projectile, projected from the ground, is given by:

$$y = x - \frac{x^2}{20},$$

where x and y are measured in meters. The maximum height attained by the projectile will be:

- (1) 10 m
- (2) 200 m
- (3) $10\sqrt{2}$ m
- (4) 5 m

15. A bullet of mass 0.1 kg moving horizontally with speed 400 ms^{-1} hits a wooden block of mass 3.9 kg kept on a horizontal rough surface. The bullet gets embedded into the block and moves 20 m before coming to rest. The coefficient of friction between the block and the surface is _____. (Given $g = 10\text{ m/s}^2$):

- (1) 0.90
- (2) 0.65
- (3) 0.25
- (4) 0.50

16. For a given transistor amplifier circuit in CE configuration $V_{CC} = 1\text{ V}$, $R_C = 1\text{ k}\Omega$, $R_B = 100\text{ k}\Omega$ and $\beta = 100$. The value of base current I_B is:

- (1) $I_B = 100\text{ }\mu\text{A}$
- (2) $I_B = 10\text{ }\mu\text{A}$
- (3) $I_B = 0.1\text{ }\mu\text{A}$
- (4) $I_B = 1.0\text{ }\mu\text{A}$

17. For particle P revolving around the center O with a radius of circular path r and angular velocity ω , as shown in the figure below, the projection of OP on the x -axis at time t is:

- (1) $x(t) = r \cos\left(\omega t + \frac{\pi}{6}\right)$
- (2) $x(t) = r \cos\left(\omega t - \frac{\pi}{6}\right)$
- (3) $x(t) = r \cos(\omega t)$
- (4) $x(t) = r \sin\left(\omega t + \frac{\pi}{6}\right)$

18. A radioactive material is reduced to $\frac{1}{8}$ of its original amount in 3 days. If $8 \times 10^{-3}\text{ kg}$ of the material is left after 5 days, the initial amount of the material is:

- (1) 64 g

- (2) 40 g
 - (3) 32 g
 - (4) 256 g
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19. The equivalent resistance between A and B as shown in the figure is:

- (1) $20\text{ k}\Omega$
 - (2) $30\text{ k}\Omega$
 - (3) $5\text{ k}\Omega$
 - (4) $10\text{ k}\Omega$
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20. In the photoelectric effect:

- A : The photocurrent is proportional to the intensity of the incident radiation.
- B : Maximum kinetic energy with which photoelectrons are emitted depends on the intensity of the incident light.
- C : Maximum kinetic energy with which photoelectrons are emitted depends on the frequency of the incident light.
- D : The emission of photoelectrons requires a minimum threshold intensity of incident radiation.
- E : Maximum kinetic energy of the photoelectrons is independent of the frequency of the incident light.

Choose the correct answer from the options given below:

- (1) B and C only
 - (2) A and C only
 - (3) A and E only
 - (4) A and B only
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21. A 600 pF capacitor is charged by 200 V supply. It is then disconnected from the supply and is connected to another uncharged 600 pF capacitor. Electrostatic energy lost in the process is $\text{-----}\mu\text{J}$.

22. A series combination of a resistor of resistance $100\ \Omega$, inductor of inductance $1\ \text{H}$, and capacitor of capacitance $6.25\ \mu\text{F}$ is connected to an AC source. The quality factor of the circuit will be _____.

23. The number density of free electrons in copper is nearly $8 \times 10^{28}\ \text{m}^{-3}$. A copper wire has an area of cross-section $2 \times 10^{-6}\ \text{m}^2$ and is carrying a current of $3.2\ \text{A}$. The drift speed of the electrons is _____ $\times 10^{-6}\ \text{ms}^{-1}$.

24. A hollow spherical ball of uniform density rolls up a curved surface with an initial velocity $3\ \text{m/s}$ (as shown in figure). The maximum height with respect to the initial position covered by it will be _____ cm (Take, $g = 10\ \text{m/s}^2$).

25. A steel rod of length $1\ \text{m}$ and cross-sectional area $10^{-4}\ \text{m}^2$ is heated from 0°C to 200°C without being allowed to extend or bend. The compressive tension produced in the rod is _____ $\times 10^4\ \text{N}$. (Given Young's modulus of steel $= 2 \times 10^{11}\ \text{N/m}^2$, coefficient of linear expansion $= 10^{-5}\ \text{K}^{-1}$).

26. The ratio of the magnetic field at the center of a current-carrying coil of radius r to the magnetic field at a distance r from the center of the coil on its axis is $\sqrt{x} : 1$. The value of x is _____.

27. The ratio of the wavelength of spectral lines H_α and H_β in the Balmer series is $\frac{x}{20}$. The value of x is _____.

28. Two transparent media having refractive indices 1.0 and 1.5 are separated by a spherical refracting surface of radius of curvature $30\ \text{cm}$. The center of curvature of the surface is towards the denser medium, and a point object is placed on the principal axis in the rarer medium at a distance of $15\ \text{cm}$ from the pole of the surface. The distance of the image from the pole of the surface is _____ cm .

29. A guitar string of length $90\ \text{cm}$ vibrates with a fundamental frequency of $120\ \text{Hz}$. The

length of the string producing a fundamental frequency of 180 Hz will be _____ cm.

30. A body of mass 5 kg is moving with a momentum of $10 \text{ kg} \cdot \text{ms}^{-1}$. Now a force of 2 N acts on the body in the direction of its motion for 5 s. The increase in the kinetic energy of the body is _____ J.
