

JEE Main 2024 April 5 Shift 2 Physics Question Paper

Time Allowed :1 Hour	Maximum Marks :100	Total Questions :30
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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. 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

Question 1: Given below are two statements:

Statement I: When the white light passed through a prism, the red light bends lesser than yellow and violet.

Statement II: The refractive indices are different for different wavelengths in dispersive medium.

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

Options:

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

Question 2: Which of the following statement is not true about stopping potential (V_0)?

Options:

- (1) It depends on the nature of emitter material.

- (2) It depends upon frequency of the incident light.
 - (3) It increases with increase in intensity of the incident light.
 - (4) It is $1/e$ times the maximum kinetic energy of electrons emitted.
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Question 3: The angular momentum of an electron in a hydrogen atom is proportional to (where r is the radius of orbit of the electron):

Options:

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

Question 4: A galvanometer of resistance $100\ \Omega$ when connected in series with $400\ \Omega$ measures a voltage of up to $10\ V$. The value of resistance required to convert the galvanometer into an ammeter to read up to $10\ A$ is $x \times 10^{-2}\ \Omega$. The value of x is:

Options:

- (1) 2
 - (2) 800
 - (3) 20
 - (4) 200
-

Question 5: The vehicles carrying inflammable fluids usually have metallic chains touching the ground:

Options:

- (1) To conduct excess charge due to air friction to ground and prevent sparking.
 - (2) To alert other vehicles.
 - (3) To protect tyres from catching dirt from ground.
 - (4) It is a custom.
-

Question 6: If n is the number density and d is the diameter of the molecule, then the average distance covered by a molecule between two successive collisions (i.e., mean free path) is represented by:

Options:

- (1) $\frac{1}{\sqrt{2}\pi d^2}$
 - (2) $\sqrt{2}\pi d^2$
 - (3) $\frac{1}{\sqrt{2}\pi d^2 n}$
 - (4) $\frac{1}{\sqrt{2}n\pi^2 d^2}$
-

Question 7: A particle moves in the x - y plane under the influence of a force $\vec{F}$ such that its linear momentum is

$$\vec{P}(t) = \hat{i} \cos(kt) - \hat{j} \sin(kt).$$

If k is constant, the angle between $\vec{F}$ and $\vec{P}$ will be:

Options:

- (1) $\frac{\pi}{2}$
 - (2) $\frac{\pi}{6}$
 - (3) $\frac{\pi}{4}$
 - (4) $\frac{\pi}{3}$
-

Question 8: The electrostatic force ($\vec{F}_1$) and magnetic force ($\vec{F}_2$) acting on a charge q moving with velocity $\vec{v}$ can be written as:

Options:

- (1) $\vec{F}_1 = q\vec{v} \cdot \vec{E}$, $\vec{F}_2 = q(\vec{B} \cdot \vec{v})$
 - (2) $\vec{F}_1 = q\vec{B}$, $\vec{F}_2 = q(\vec{B} \times \vec{v})$
 - (3) $\vec{F}_1 = q\vec{E}$, $\vec{F}_2 = q(\vec{v} \times \vec{B})$
 - (4) $\vec{F}_1 = q\vec{E}$, $\vec{F}_2 = q(\vec{B} \times \vec{v})$
-

Question 9: A man carrying a monkey on his shoulder cycles smoothly on a circular track of radius 9 m and completes 120 revolutions in 3 minutes. The magnitude of centripetal acceleration of the monkey is (in m/s^2):

Options:

- (1) zero
 - (2) $16\pi^2 \text{ m/s}^2$
 - (3) $4\pi^2 \text{ m/s}^2$
 - (4) $57600\pi^2 \text{ m/s}^2$
-

Question 10: A series LCR circuit is subjected to an AC signal of 200 V , 50 Hz . If the voltage across the inductor ($L = 10 \text{ mH}$) is 31.4 V , then the current in this circuit is:

Options:

- (1) 68 A
 - (2) 63 A
 - (3) 10 A
 - (4) 10 mA
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Question 11: What is the dimensional formula of ab^{-1} in the equation

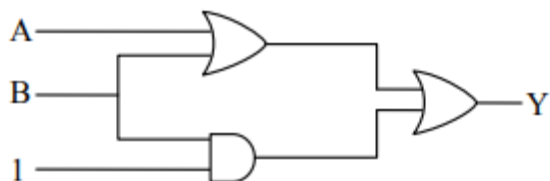
$$\left(P + \frac{a}{V^2}\right)(V - b) = RT,$$

where letters have their usual meaning?

Options:

- (1) $[M^0 L^3 T^{-2}]$
- (2) $[ML^2 T^{-2}]$
- (3) $[M^1 L^5 T^{-2}]$
- (4) $[M^4 L^7 T^4]$

Question 12: The output (Y) of the logic circuit given below is 0 only when:



Options:

- (1) $A = 1, B = 0$
- (2) $A = 0, B = 0$
- (3) $A = 1, B = 1$
- (4) $A = 0, B = 1$

Question 13: A body is moving unidirectionally under the influence of a constant power source. Its displacement in time t is proportional to:

Options:

- (1) t^2
- (2) $t^{2/3}$
- (3) $t^{3/2}$
- (4) t

Question 14: Match List-I with List-II:

List-I (EM-Wave)	List-II (Wavelength Range)
(A) Infra-red	(I) $< 10^{-3}$ nm
(B) Ultraviolet	(II) 400 nm to 1 nm
(C) X-rays	(III) 1 mm to 700 nm
(D) Gamma rays	(IV) 1 nm to 10^{-3} nm

Choose the correct answer from the options given below:

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

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

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

Question 15: During an adiabatic process, if the pressure of a gas is found to be proportional to the cube of its absolute temperature, then the ratio of $\frac{C_P}{C_V}$ for the gas is:

Options:

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

Question 16:

Match List-I with List-II :

	List-I		List-II
(A)	A force that restores an elastic body of unit area to its original state	(I)	Bulk modulus
(B)	Two equal and opposite forces parallel to opposite faces	(II)	Young's modulus
(C)	Forces perpendicular everywhere to the surface per unit area same everywhere	(III)	Stress
(D)	Two equal and opposite forces perpendicular to opposite faces	(IV)	Shear modulus

Choose the correct answer from the options given below :

Options:

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

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

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

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

Question 17: A vernier calipers has 20 divisions on the vernier scale, which coincides with the 19th division on the main scale. The least count of the instrument is 0.1 mm. One main scale division is equal to __ mm.

Options:

- (1) 1
- (2) 0.5
- (3) 2
- (4) 5

Question 18: A heavy box of mass 50 kg is moving on a horizontal surface. If the coefficient of kinetic friction between the box and the horizontal surface is 0.3, then the force of kinetic friction is:

Options:

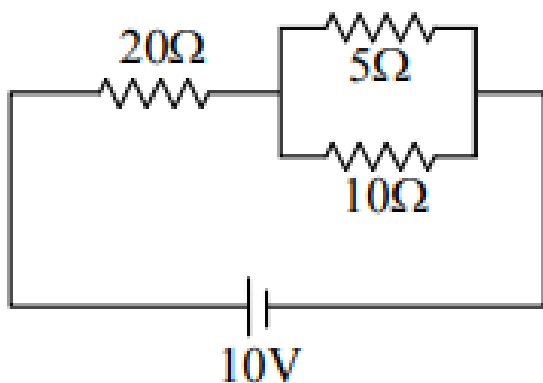
- (1) 14.7 N
- (2) 147 N
- (3) 1.47 N
- (4) 1470 N

Question 19: A satellite revolving around a planet in a stationary orbit has a time period of 6 hours. The mass of the planet is one-fourth the mass of Earth. The radius of the orbit of the planet is (Given: Radius of geo-stationary orbit for Earth is 4.2×10^4 km):

Options:

- (1) 1.4×10^4 km
- (2) 8.4×10^4 km
- (3) 1.68×10^5 km
- (4) 1.05×10^4 km

Question 20: The ratio of heat dissipated per second through the resistances 5Ω and 10Ω in the circuit given below is:



Options:

- (1) 1 : 2

- (2) 2 : 1
(3) 4 : 1
(4) 1 : 1

Question 21: A solenoid of length 0.5 m has a radius of 1 cm and is made up of m number of turns. It carries a current of 5 A. If the magnitude of the magnetic field inside the solenoid is 6.28×10^{-3} T, then the value of m is:

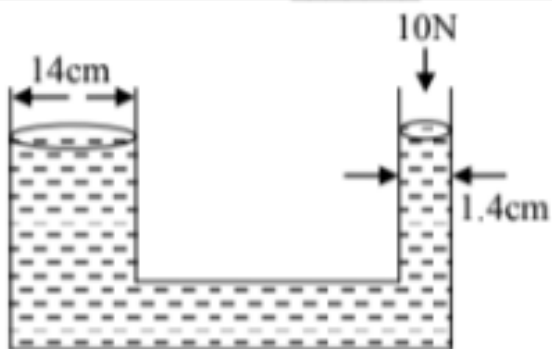
Question 22: The shortest wavelength of the spectral lines in the Lyman series of the hydrogen spectrum is $915 \text{ \AA}$. The longest wavelength of spectral lines in the Balmer series will be $\text{\AA}$.

Question 23: In a single slit experiment, a parallel beam of green light of wavelength 550 nm passes through a slit of width 0.20 mm. The transmitted light is collected on a screen 100 cm away. The distance of first order minima from the central maximum will be $x \times 10^{-5}$ m. The value of x is:

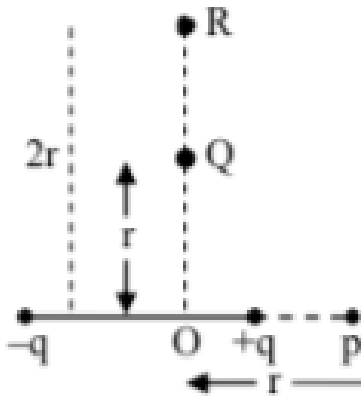
Question 24: A sonometer wire of resonating length 90 cm has a fundamental frequency of 400 Hz when kept under some tension. The resonating length of the wire with a fundamental frequency of 600 Hz under the same tension is _____ cm.

Question 25: A hollow sphere is rolling on a plane surface about its axis of symmetry. The ratio of rotational kinetic energy to its total kinetic energy is $\frac{x}{5}$. The value of x is _____.

Question 26: A hydraulic press containing water has two arms with diameters as mentioned in the figure. A force of 10 N is applied on the surface of water in the thinner arm. The force required to be applied on the surface of water in the thicker arm to maintain equilibrium of water is _____ N.



Question 27: The electric field at point P due to an electric dipole is E . The electric field at point R on the equatorial line will be $\frac{E}{x}$. The value of x is:



Question 28: The maximum height reached by a projectile is 64 m. If the initial velocity is halved, the new maximum height of the projectile is _____ m.

Question 29: A wire of resistance $20\ \Omega$ is divided into 10 equal parts. A combination of two parts is connected in parallel, and so on. Now the resulting pairs of parallel combinations are connected in series. The equivalent resistance of the final combination is _____ Ω .

Question 30: The current in an inductor is given by $I = (3t + 8)$, where t is in seconds. The magnitude of the induced emf produced in the inductor is 12 mV. The self-inductance of the inductor is _____ mH.