JEE Main 2025 April 7 Shift 2 Physics Question Paper

Time Allowed :3 Hours	Maximum Marks :300	Total Questions :75

General Instructions

Read the following instructions very carefully and strictly follow them:

1. Multiple choice questions (MCQs)
2. Questions with numerical values as answers.
3. There are three sections: **Mathematics, Physics, Chemistry**.
4. **Mathematics:** 25 (20+5) 10 Questions with answers as a numerical value. Out of 10 questions, 5 questions are compulsory.
5. **Physics:** 25 (20+5) 10 Questions with answers as a numerical value. Out of 10 questions, 5 questions are compulsory..
6. **Chemistry:** 25 (20+5) 10 Questions with answers as a numerical value. Out of 10 questions, 5 questions are compulsory.
7. Total: 75 Questions (25 questions each).
8. 300 Marks (100 marks for each section).
9. **MCQs:** Four marks will be awarded for each correct answer and there will be a negative marking of one mark on each wrong answer.
10. **Questions with numerical value answers:** Candidates will be given four marks for each correct answer and there will be a negative marking of 1 mark for each wrong answer.

PHYSICS

Section - A

26. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).

Assertion (A): The outer body of an aircraft is made of metal which protects persons sitting inside from lightning strikes.
Reason (R): The electric field inside the cavity enclosed by a conductor is zero.
In the light of the above statements, choose the most appropriate answer from the options given below:
(1) Both (A) and (R) are correct and (R) is the correct explanation of (A)
(2) (A) is correct but (R) is not correct

(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

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27. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): The density of the copper (^{64}Cu) nucleus is greater than that of the carbon (^{12}C) nucleus.
Reason (R): The nucleus of mass number A has a radius proportional to $A^{1/3}$.
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) (A) is not correct but (R) is correct
(3) Both (A) and (R) are correct and (R) is the correct explanation of (A)
(4) Both (A) and (R) are correct but (R) is not the correct explanation of (A)

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28. The unit of $\sqrt{\frac{2I}{\epsilon_0 c}}$ is:
(Where I is the intensity of an electromagnetic wave, and c is the speed of light)
(1) Vm
(2) NC
(3) Nm
(4) NC^{-1}

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29. The dimension of $\sqrt{\frac{\mu_0}{\epsilon_0}}$ is equal to that of:
(Where μ_0 is the vacuum permeability and ϵ_0 is the vacuum permittivity)
(1) Voltage
(2) Capacitance
(3) Inductance
(4) Resistance

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30. A photo-emissive substance is illuminated with a radiation of wavelength λ_i so that it releases electrons with de-Broglie wavelength λ_e. The longest wavelength of radiation that can emit photoelectron is λ_0. Expression for de-Broglie wavelength is given by :
(m : mass of the electron, h : Planck's constant and c : speed of light)
(1) $\lambda_e = \frac{h}{\sqrt{2mc\left(\frac{h}{\lambda_i} - \frac{h}{\lambda_0}\right)}}$
(2) $\lambda_e = \sqrt{\frac{h\lambda_0}{2mc}}$

(3) $\lambda_e = \frac{h}{\sqrt{2mch\left(\frac{1}{\lambda_i}-\frac{1}{\lambda_0}\right)}}$

(4) $\lambda_e = \sqrt{\frac{h\lambda_i}{2mc}}$

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31. Given below are two statements : one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A) : The radius vector from the Sun to a planet sweeps out equal areas in equal intervals of time and thus areal velocity of planet is constant.
Reason (R) : For a central force field the angular momentum is a constant. In the light of the above statements, choose the most appropriate answer from the options given below :

(1) Both (A) and (R) are correct and (R) is the correct explanation of (A) (2) Both (A) and (R) are correct but (R) is not the correct explanation of (A) (3) (A) is correct but (R) is not correct (4) (A) is not correct but (R) is correct

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32. The helium and argon are put in the flask at the same room temperature (300 K). The ratio of average kinetic energies (per molecule) of helium and argon is : (Give : Molar mass of helium = 4 g/mol, Molar mass of argon = 40 g/ mol)
(1) 1 : 10 (2) 10 : 1 (3) 1 : $\sqrt{10}$ (4) 1 : 1

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33. A capillary tube of radius 0.1 mm is partly dipped in water (surface tension 70 dyn/cm and glass water contact angle $\approx 0^\circ$) with 30° inclined with vertical. The length of water risen in the capillary is ____ cm. (Take $g = 9.8$ m/s^2)
(1) $\frac{82}{5}$
(2) $\frac{57}{2}$
(3) $\frac{71}{5}$
(4) $\frac{68}{5}$

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34. A mirror is used to produce an image with magnification of $\frac{1}{4}$. If the distance between object and its image is 40 cm, then the focal length of the mirror is ____.
(1) 10 cm
(2) 12.7 cm
(3) 10.7 cm
(4) 15 cm

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35. A dipole with two electric charges of $2\,\mu C$ magnitude each, with separation distance $0.5\,\mu m$, is placed between the plates of a capacitor such that its axis is parallel to an electric field established between the plates when a potential difference of $5\,V$ is applied. Separation between the plates is $0.5\,mm$. If the dipole is rotated by 30° from the axis, it tends to realign in the direction due to a torque. The value

of torque is :
(1) $5 \times 10^{-9}\, Nm$
(2) $5 \times 10^{-3}\, Nm$
(3) $2.5 \times 10^{-12}\, Nm$
(4) $2.5 \times 10^{-9}\, Nm$

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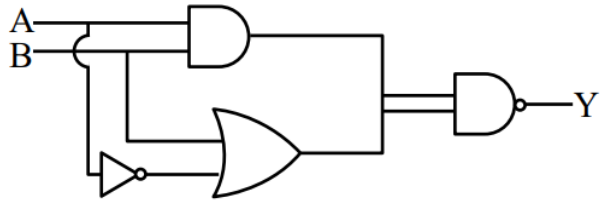
36. Consider the following logic circuit.



The output is Y = 0 when :
(1) A = 1 and B = 1
(2) A = 0 and B = 1
(3) A = 1 and B = 0
(4) A = 0 and B = 0

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37. Match List-I with List-II.

List-I		List-II	
(A)	Mass density	(I)	$[ML^2T^{-3}]$
(B)	Impulse	(II)	$[MLT^{-1}]$
(C)	Power	(III)	$[ML^2T^0]$
(D)	Moment of inertia	(IV)	$[ML^{-3}T^0]$

Choose the correct answer from the options given below :
(1) (A)-(IV), (B)-(II), (C)-(III), (D)-(I)
(2) (A)-(I), (B)-(III), (C)-(IV), (D)-(II)
(3) (A)-(IV), (B)-(II), (C)-(I), (D)-(III)
(4) (A)-(II), (B)-(III), (C)-(IV), (D)-(I)

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38. The equation of a wave travelling on a string is $y = \sin[20\pi x + 10\pi t]$, where x and t are distance and time in SI units. The minimum distance between two points having the same oscillating speed is :
(1) 5.0 cm
(2) 20 cm

(3) 10 cm
(4) 2.5 cm

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39. Given below are two statements : one is labelled as Assertion (A) and the other is labelled as Reason (R)
Assertion (A) : Refractive index of glass is higher than that of air.
Reason (R) : Optical density of a medium is directly proportionate to its mass density which results in a proportionate refractive index.

In the light of the above statements, choose the most appropriate answer from the options given below :
(1) (A) is not correct but (R) is correct
(2) Both (A) and (R) are correct and (R) is the correct explanation of (A)
(3) (A) is correct but (R) is not correct
(4) Both (A) and (R) are correct but (R) is not the correct explanation of (A)

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40. Given below are two statements : one is labelled as Assertion (A) and the other is labelled as Reason (R)
Assertion (A) : Magnetic monopoles do not exist.
Reason (R) : Magnetic field lines are continuous and form closed loops.
In the light of the above statements, choose the most appropriate answer from the options given below :

(1) Both (A) and (R) are correct but (R) is not the correct explanation of (A)
(2) (A) is correct but (R) is not correct
(3) Both (A) and (R) are correct and (R) is the correct explanation of (A)
(4) (A) is not correct but (R) is correct

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41. Which one of the following forces cannot be expressed in terms of potential energy?
(1) Coulomb's force
(2) Gravitational force
(3) Frictional force
(4) Restoring force

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42. Match List-I with List-II.

List-I (Thermodynamic Process)		List-II (Characteristic)	
(A)	Isothermal	(I)	ΔW (work done) = 0
(B)	Adiabatic	(II)	ΔQ (supplied heat) = 0
(C)	Isobaric	(III)	ΔU (change in internal energy) $\neq 0$
(D)	Isochoric	(IV)	$\Delta U = 0$

Choose the correct answer from the options given below :
(1) (A)-(III), (B)-(II), (C)-(I), (D)-(IV)
(2) (A)-(IV), (B)-(I), (C)-(III), (D)-(II)
(3) (A)-(IV), (B)-(II), (C)-(III), (D)-(I)
(4) (A)-(II), (B)-(IV), (C)-(I), (D)-(III)

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43. A helicopter flying horizontally with a speed of $360\,km/h$ at an altitude of $2\,km$, drops an object at an instant. The object hits the ground at a point O, $20\,s$ after it is dropped. Displacement of 'O' from the position of helicopter where the object was released is :
(use acceleration due to gravity $g = 10\,m/s^2$ and neglect air resistance)
(1) $2\sqrt{5}\,km$
(2) $4\,km$
(3) $7.2\,km$
(4) $2\sqrt{2}\,km$

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44. An object with mass $500\,g$ moves along x-axis with speed $v = 4\sqrt{x}\,m/s$. The force acting on the object is :
(1) 8 N
(2) 5 N
(3) 6 N
(4) 4 N

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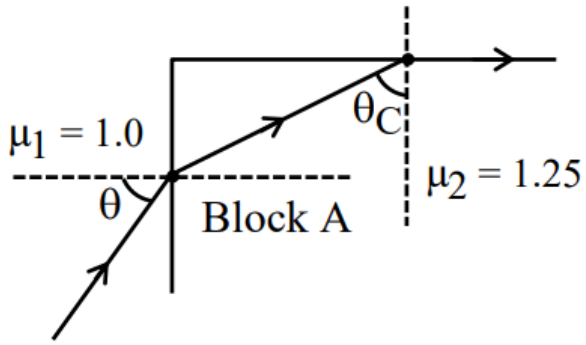
45. A transparent block A having refractive index $\mu_2 = 1.25$ is surrounded by another medium of refractive index $\mu_1 = 1.0$ as shown in figure. A light ray is incident on the flat face of the block with incident angle θ as shown in figure. What is the maximum value of θ for which light suffers total internal reflection at the top surface of the block ?



(1) $\tan^{-1}(4/3)$
(2) $\tan^{-1}(3/4)$
(3) $\sin^{-1}(3/4)$
(4) $\cos^{-1}(3/4)$

SECTION-B

46. A parallel plate capacitor has charge $5 \times 10^{-6}\,C$. A dielectric slab is inserted between the plates and almost fills the space between the plates. If the induced charge on one face of the slab is $4 \times 10^{-6}\,C$ then the dielectric constant of the slab is ____.

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47. An inductor of reactance $100\,\Omega$, a capacitor of reactance $50\,\Omega$, and a resistor of resistance $50\,\Omega$ are connected in series with an AC source of $10\,V$, $50\,Hz$. Average power dissipated by the circuit is ____ W.

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48. Two cylindrical rods A and B made of different materials, are joined in a straight line. The ratio of lengths, radii and thermal conductivities of these rods are : $\frac{L_A}{L_B} = \frac{1}{2}$, $\frac{r_A}{r_B} = 2$, and $\frac{K_A}{K_B} = \frac{1}{2}$. The free ends of rods A and B are maintained at $400\,K$, $200\,K$, respectively. The temperature of rods interface is ____ K, when equilibrium is established.

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49. The electric field in a region is given by $\vec{E} = (2\hat{i} + 4\hat{j} + 6\hat{k}) \times 10^3\,N/C$. The flux of the field through a rectangular surface parallel to x-z plane is $6.0\,Nm^2C^{-1}$. The area of the surface is ____ cm^2.

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50. M and R be the mass and radius of a disc. A small disc of radius R/3 is removed from the bigger disc as shown in figure. The moment of inertia of remaining part of bigger disc about an axis AB passing through the centre O and perpendicular to the plane of disc is $\frac{4}{x}MR^2$. The value of x is ____.
