JEE Main 2024 Physics Question Paper April 6 Shift 1

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

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. A particle of mass m is situated on the earth's surface. Find the minimum kinetic energy required so that it can escape from the earth's surface.

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2. Which of the following does not explain the wave theory of a particle?

(1) Reflection
(2) Diffraction
(3) Photoelectric effect
(4) Interference

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3. Which of the above phenomena represent particle nature?

(1) Interference
(2) Diffraction
(3) Polarisation
(4) Photoelectric effect

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4. In a prism, the ratio of minimum deviation and prism angle is $\sqrt{3}$, and the refractive index of the prism is $\sqrt{3}$. Find the prism angle A.

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5. Speed of wave in a medium is 1.5×10^8 m/s. Relative permittivity of medium (ϵ_r) is 2. Find the value of relative permeability.

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6. There is a pulley block system where $m_1 > m_2$ and the acceleration of block m_1 is $\frac{g}{\sqrt{2}}$ upward. Find the ratio of m_1 to m_2.

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7. A particle is performing SHM with amplitude $A = 0.6$ m and time period $T = \pi$. Find the maximum velocity.

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8. Find the ratio of the shortest wavelength of the Lyman series to the shortest wavelength of the Balmer series.

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9. The initial velocity of a particle is 100 m/s. After some time it changes to 40 m/s. What is the percentage change in its kinetic energy? The mass of the particle is 40 gm.

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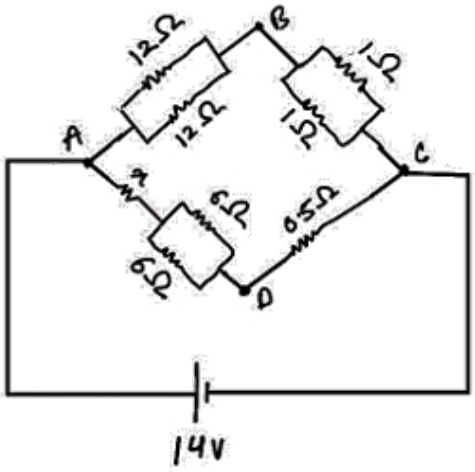
10. In the circuit below, the potential at B and the potential at D are the same. Find the value of resistance x.



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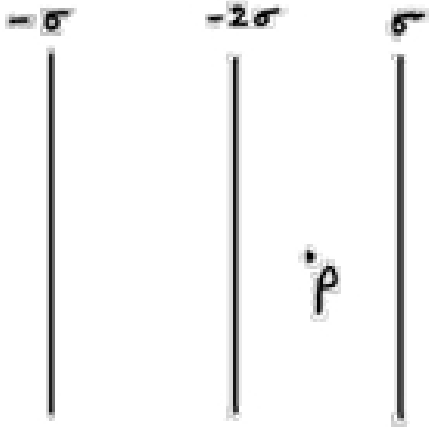
11. There are 3 infinite sheets of charge density $-\sigma$, -2σ, and σ respectively. Then find the electric field at point P (as shown in figure) [Sheets are non-conducting].



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12. He gas and O_2 gas are at the same temperature. Find the ratio of their rms speed of molecules.

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13. Which of the following materials is not a semiconductor?

(1) Germanium
(2) Silicon

(3) Graphite
(4) Copper oxide

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14. If the 4 masses $m, \frac{m}{2}, 2m, 4m$ have the same momentum, which of the following will have maximum kinetic energy?

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15. Match the column.

Quantity Dimensional Formula(i)Torque $(a)[ML^2T^{-2}](ii)$Magnetic field $(b)[MA^{-1}T^{-2}](iii)$Magnetic

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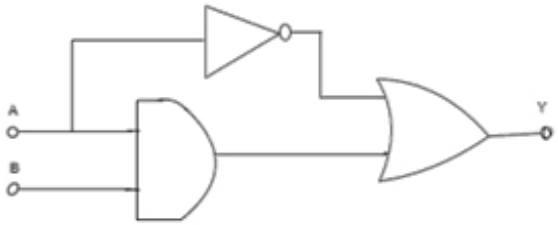
16. Find out the truth table.



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17. Given $T = 2\pi\sqrt{\frac{m}{K}}$, if m decreases by 1% and time period T increases by 2%, find the percentage change in K.

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18. A train starting from rest first accelerates up to speed 80 km/h for time t, then it moves with a constant speed for time $3t$. The average speed of the train for this duration of journey will be:

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19. A big drop is made out of 1000 small drops, if the ratio of total surface energy of droplets and surface energy of the big drop is $10/x$, then find the value of x.

20. The frequency of the electron in the first Bohr orbit in the H-atom is:

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21. While measuring the diameter of a wire using a screw gauge, the following readings were noted: - Main scale reading is 1 mm, - Circular scale reading is equal to 42 divisions. Pitch of screw gauge is 1mm and it has 100 divisions on the circular scale. Find the diameter of the wire. The value of x is:

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22. A hydrogen atom having energy E in the ground state, when it is revolving at a radius of orbit $r = 8.48\,\text{Å}$. Its energy becomes $\frac{E}{x}$. Find the value of x.

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23. Energy incident on metal surface is 2.48 eV and the stopping potential is 0.5 V. Find the work function.

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24. Statement 1: Inductor has maximum current at resonance frequency.
Statement 2: Current in a purely resistive circuit can never be less than the current in series in an LRC circuit.
Which of the following is correct?

(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.

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25. A thin spherical shell (conducting) having charge density σ. Find the electric field at the surface of the shell.
