JEE Main 2024 Physics Question Paper April 8 Shift 2

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

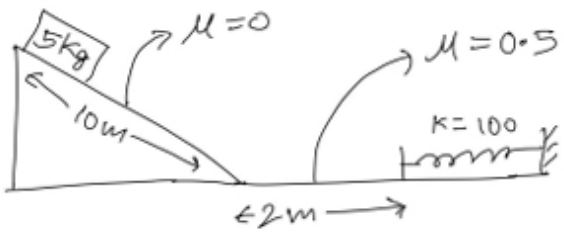
1. A particle is projected at such an angle that its maximum height and range are the same. Then find the angle of projection.

---

2. If the wavelength of an electron and proton are the same, then find the ratio of their kinetic energies.

---

3. In the given diagram, calculate the maximum compression in the spring. (The angle of wedge is 30°)



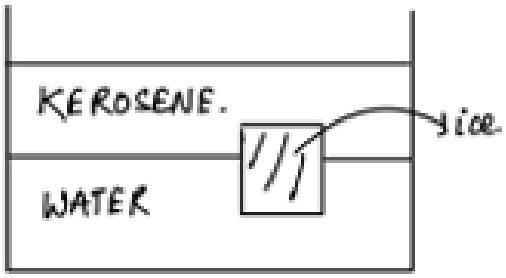
4. A disc of mass m and radius R is rotating with angular speed ω. If another similar disc is placed gently on the rotating disc, then find the new angular speed of the discs.

---

5. Dimension formula of $\epsilon_0 E^2$. (Where E is electric field)

---

6. Find the ratio of volume of ice in kerosene and water. (Specific gravity of kerosene = 0.8 and specific gravity of ice = 0.9)



---

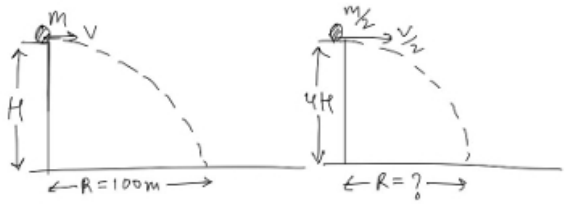
7. The work done by a diatomic gas during an isobaric process is 100J. Calculate the heat supplied.

---

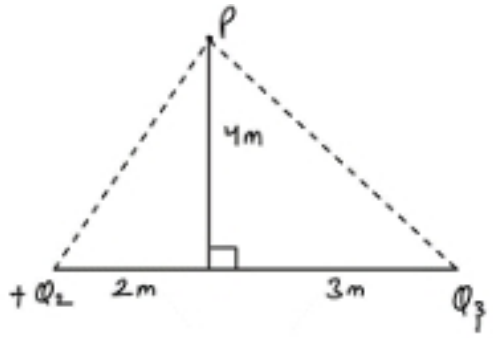
8. An infinitely long current-carrying wire of radius 'a' carries uniform current (i). Find out the ratio of the magnetic field at distance $a/2$ and $2a$.

---

9. Two particles are projected from two different towers of heights H and $4H$ with velocity V and $V/2$ respectively. If the horizontal range for the first particle is 100m, then find the horizontal range for the other.



10. If electric field at point P due to Q_2 and Q_3 is zero in the y-direction, then find the ratio of $\frac{Q_2}{Q_3}$.



---

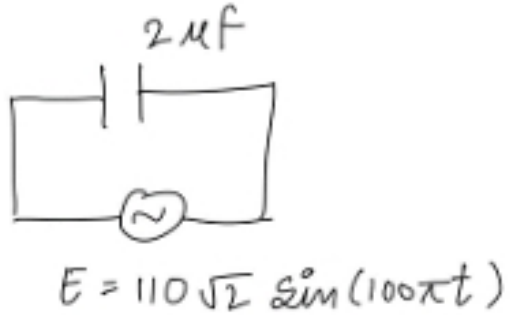
11. Two satellites are revolving around a planet at radius R and $4R$ respectively. If the speed of the first satellite is $6v$, then find the speed of the second satellite.

---

12. A wave equation is given as $y = 2\cos(2\pi(360t - x))$. Find the frequency.

---

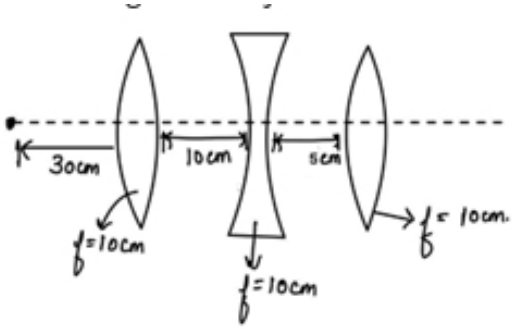
13. An ac source is connected across a capacitor having capacitance 2 µF. Find the rms current in the given circuit.



---

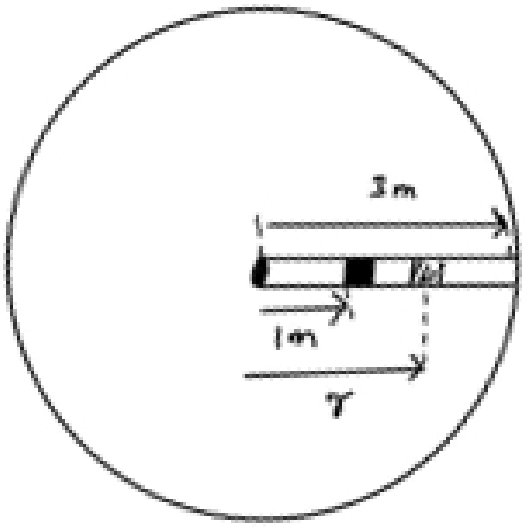
14. Some amount of water is heated using a constant supply source for 20 minutes. Now if we change the length of the heating element then the same amount of water gets heated using the same source in 15 minutes. Calculate the change in length.

15. Find distance between final image and object.



16. In the above two cases, if the time taken in case-I is t and time taken in case-II is nt to reach at the bottom of the wedge, find the value of μ in terms of n. (μ = Coefficient of friction)

17. A disc having radius 3 m has a smooth groove as shown in the figure. The disc is rotating with some constant angular velocity. If a particle has some mass m as disc is put gently at a distance of 1 m from the centre, then the velocity of the particle with respect to the disc when it leaves the disc is $(2\omega\sqrt{x})$, find x.

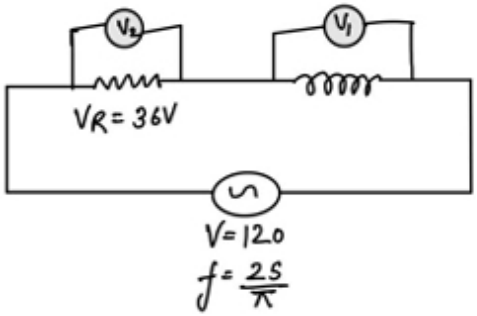


---

18. A water drop falls from the sky and attains the terminal velocity of 6 cm/s. What will be the terminal velocity if 8 similar drops condense and fall from the sky?

---

19. In the given AC circuit, having resistance and inductance connected in series. If voltage across the resistance is 36 V and the resistance of the resistor is 90, then find the self-inductance of the coil of inductor.



---

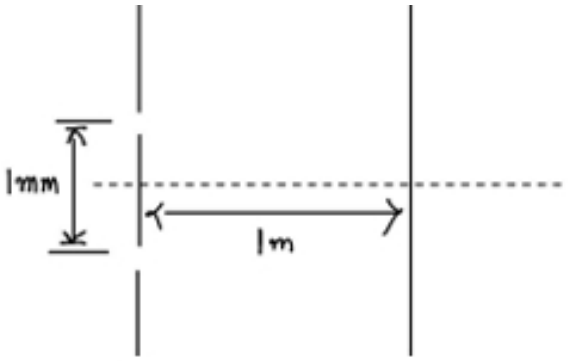
20. A particle is performing SHM, at a particular position $x = 0.4\,\text{m}$, potential energy is 0.4 J and kinetic energy is 0.5 J, then find amplitude of SHM.

---

21. An isotope ^{12}B of mass m having proton (m_p) and neutron (m_n) then what will be the binding energy in terms of m_p, m_n, and m?

---

22. In a YDSE shown, a monochromatic light of wavelength 500 nm is incident, at point P 10th maxima is formed. Now the two slits are replaced with a single slit of width w placed at the centre, the first diffraction minima is observed at P. Find w.

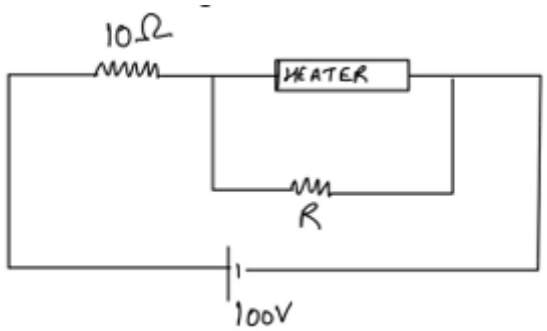


---

23. If the least count of vernier caliper is $\frac{1}{20}$ cm. If the main scale division is 1 mm. How many N division of vernier scale coincide with main scale?

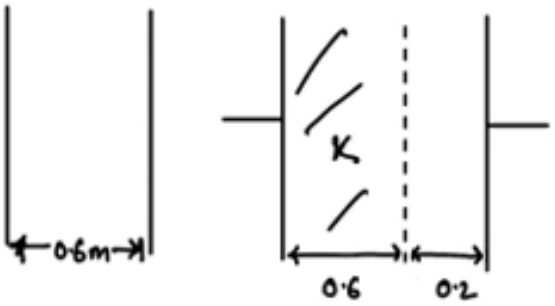
---

24. If the power drop across the heater is 62.5 watts and power rating of the heater is 1000 watts, what will be the value of R in the following circuit?



---

25. A parallel plate capacitor has plate area A and plate separation is 0.6 m. Now a dielectric of dielectric constant K is filled between the plates to maintain the same capacitance and the separation is increased by 0.2 m. Find the value of K.



---

26. If the pitch of screw gauge is 1mm and there is no instrument between its jaws, then zero is 5 divisions below the measurement line. Now we put a wire, then the reading of MSD is 4 and 60 divisions of the circular scale. Find the diameter of the wire if the total division on the circular scale is 100.
