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Subject : Physics	**BOARD QUESTION PAPER**	**Total Marks : 70**
Class : XII	**Prelim No. - I**	**Time : 3 Hour**

Section - A

Q.1. Select and write the correct answer: (10)

i) A string is vibrating in first overtone then point formed exactly at the middle is
(a) Node
(b) Antinodes
(c) Sometimes node and sometimes antinodes
(d) None of these

ii) In a circuit L, C & R are connected in series with an alternating voltage of frequency f. the current leads the voltage by 45°. The value of C is

(a) $\dfrac{1}{\pi f(2\pi fL - R)}$

(b) $\dfrac{1}{2\pi f(2\pi fL - R)}$

(c) $\dfrac{1}{\pi f(2\pi fL + R)}$

(d) $\dfrac{1}{2\pi f(2\pi fL + R)}$

iii) If there are n parallel plates then there will be .... capacitors.
(a) n   (b) n − 1
(c) n + 1   (d) n²

iv) A beam of light of frequency 1.9 times the threshold frequency is incident on a photosensitive material. If the frequency is halved and intensity is doubled, then the photocurrent becomes
(a) doubled   (b) halved
(c) zero   (d) quadrupled

v) Over short distances of about a few fm, the strength of the........ is much higher.
(a) electrostatic force
(b) gravitational force
(c) nuclear force
(d) weak force

vi) The dimensional formula is of capacitance is

(a) $\left[M^{-1}L^{2}T^{4}A^{2} \right]$

(b) $\left[M^{1}L^{-2}T^{4}A^{2} \right]$

(c) $\left[M^{-1}L^{-2}T^{-4}A^{2} \right]$

(d) $\left[M^{1}L^{-2}T^{4}A^{-2} \right]$

vii) Solar cell operates on the principle of:
(a) diffusion
(b) recombination
(c) photo voltaic action
(d) carrier flow

viii) The kinetic energy of a particle varies as with time.
(a) $\sin\theta$ (b) $\cos\theta$
(c) $\sin^2\theta$ (d) $\cos^2\theta$

ix) In a moving coil galvanometer the deflection (ϕ) on the scale by a pointer attached to the spring is

(a) $\left(\dfrac{NA}{kB}\right)I$ (b) $\left(\dfrac{N}{kAB}\right)I$

(c) $\left(\dfrac{NAB}{k}\right)I$ (d) $\left(\dfrac{NAB}{kI}\right)$

x) In stationary waves
(a) Energy is uniformly distributed
(b) Energy is minimum at nodes and maximum at antinodes
(c) Energy is maximum at nodes and minimum at antinodes

(d) None of these

Q2. Answer the following: (8)

i) Why is it necessary to introduce a cylindrical soft iron core inside the coil of a galvanometer?

ii) What is the moment of inertia of the uniform rod about an axis shown in the diagram?
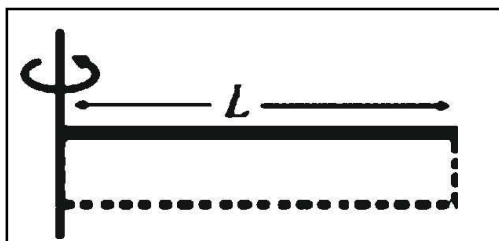
iii) Two straight wires A and B of lengths 10 m and 16 m and carrying currents

4.0 A and 5.0 A respectively in opposite directions, lie parallel to each other

4.0 cm apart. Compute the force per unit length on each wire.

iv) What is inductive reactance?

v) Why the average value of AC over a complete cycle has no value?

vi) Define the peak value of an alternating current?

vii) Find the terminal speed of an uncharged drop of radius 1.0×10^{-5} m and density 1.2×10^3 kg m^{-3} in Millikan's oil drop experiment?

(Take viscosity of air = 1.8×10^{-5} Pas and do not consider the buoyancy on the drop because of air).

viii) What will happen to the mean square speed of the molecules of a gas if the temperature of the gas increases?

Section - B

Attempt any Eight: (16)

Q.3. Prove that under certain conditions a magnet vibrating in uniform magnetic field performs angular S.H.M.

Q.4. **What is the ratio of the radii of gyration of a circular disc to that of a circular ring, each of same mass and**

radius, around their respective axes?

Q.5. What is critical velocity? How one can decide whether the motion of liquid is streamlined or turbulent with the help of Reynold's number?

Q.6. Write any two losses in a transformer. How can they be minimised?

Q.7. The amplitude of a wave is represented by

$$y = 0.2\sin 4\pi\left[\frac{t}{0.08} - \frac{x}{0.8}\right]$$ in SI units. Find

(a) wavelength, (b) frequency and (c) amplitude of the wave.

Q.8. State Ampere's circuital law and write its mathematical expression.

Q.9. The intensity of the light coming from one of the slits in Young's experiment is twice the intensity of the light coming from the other slit. What will be the approximate ratio of the intensities of the bright and dark fringes in the resulting interference pattern?

Q.10. Explain Bohr Magneton.

Q.11. Explain the construction & working of a perfectly black body.

Q.12. A gas in a cylinder is at pressure P. If the masses of all the molecules are made one third of their original value and their speeds are doubled, then find the resultant pressure.

**Q.13. State and explain zeroth law of thermodynamics.**

Q.14. Calculate the viscous force acting on a rain drop of diameter 1 mm, falling with a uniform velocity 2 m/s through air. The coefficient of viscosity of air is

1.8×10^{-5} Ns/m^2 .

Section - C

Attempt any Eight: (24)

Q.15. State the important conclusions drawn from Compton scattering.

Q.16. A hypothetical thermodynamic cycle is shown in the figure. Calculate the work done in 25 cycles.
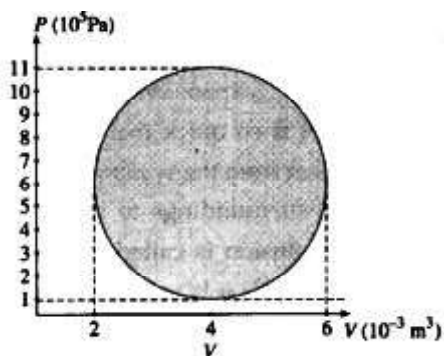
Q.17. A 20 cm wide thin circular disc of mass 200 g is suspended to a rigid support from a thin metallic string. By holding the rim of the disc, the string is twisted through 60° and released. It now performs angular oscillations of period 1 second. Calculate the maximum restoring torque generated in the string under undamped conditions. ($\pi^3 \approx 31$)

Q.18. The total work done in the cyclic process as shown in the diagram below is -2000 J.
(i) What does the negative sign mean?
(ii) What is the change in internal energy and the heat transferred during this process.
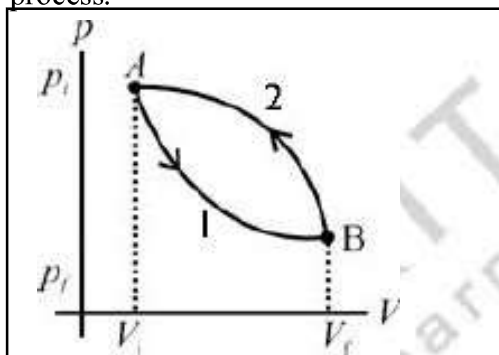
**Q.19.** Explain the types of thermodynamic systems in detail.

Q.20. In a capacitor of capacitance $20\mu F$, the distance between the plates is 2 mm. If a dielectric slab of width 1 mm and dielectric constant 2 is inserted between the plates, what is the new capacitance ?

Q.21. Water-glass interface forms a concave meniscus. Explain the reason for the observation.

Q.22. Explain the thermodynamics of an isochoric process.

Q.23. Figure shows a cylindrical wire of diameter a, carrying a current I. The current density which is in the direction of the central axis of the wire varies linearly with radial distance r from the axis according to the relation $J = J_o \, r/a$. Obtain the magnetic field B inside the wire at a distance r from its centre.
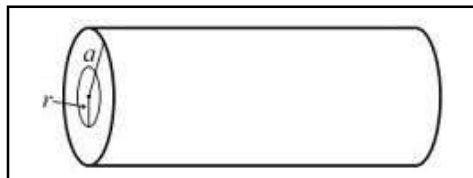
Q.24. Discuss the condition for the magnetic potential energy.

Q.25. Mention the important points to be kept in mind for an adiabatic process.

**Q.26.** A wire has linear density 4.0×10^{-3} kg/m. It is stretched between two rigid supports with a tension of 360 N. The wire resonates at a frequency of 420 Hz and 490 Hz in two successive modes. Find the length of the wire.

Section D

Attempt any Three: (12)

Q.27. State the laws of vibrating strings and explain how they can be verified using a sonometer.

Q.28. What happens when an AC signal is applied to the circuit given below? Explain in detail.
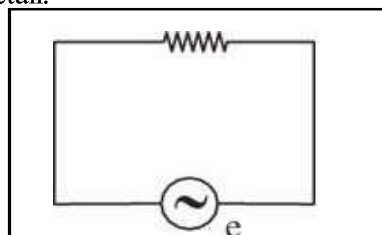
Q.29. Show that the minimum safe speed for a vehicle in the well of death is inversely proportional to the square root of coefficient of friction.

Q.30. Derive the decay law of radioactivity.

Q.31. Derive an expression for the emf induced in a straight conductor of length L moved at right angle to a uniform magnetic induction B with velocity v.

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