FACULTY RECRUITMENT TEST

CATEGORY-C

Formal School Education/XI, XII

PHYSICS

PAPER – B

Time: 1 Hour **Maximum Marks: 40**

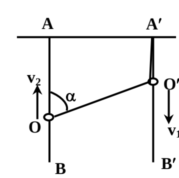
Name:...	Marks:
Subject:…………………………...	

Instructions

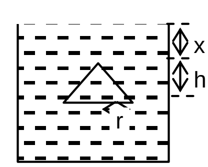
- * Attempt all questions.
- * Paper 2 has Two Parts **I and II**. Each question of **Part I carries 2 marks** and each question of **part II caries 5 marks.**
- * Calculators and log tables are ***not permitted.***

PART – I

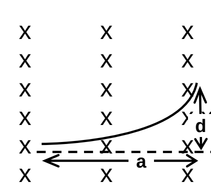
1. Two small rings O and O′ are put on two vertical stationary rods AB and A′B′ respectively. The two ends of an inextensible thread is tied at point A′ and on ring O and the thread passes through ring O′.
Assuming that ring O′ moves downwards at a constant velocity v_1, determine the velocity v_2 of the ring O, when $\angle AOO' = \alpha$.



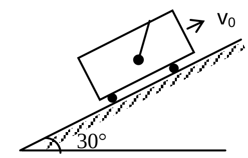
2. A regular cone of height h and base radius r is placed inside a liquid of density ρ, such that it is in equilibrium as shown in the figure. Depth of the vertex of the cone from the free surface is x. Find the force exerted by the liquid only on the inclined surface of the cone.



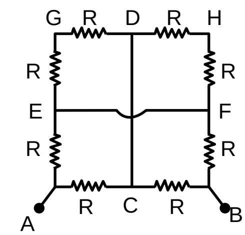
3. In a certain region of space there exists a constant and uniform magnetic field of induction B. The width of the magnetic field is a. A charged particle having charge q, is projected perpendicular to $\vec{B}$ and along the width of the field. If deflection produced by the field perpendicular to the width is d, then find the magnitude of the momentum of the particle.



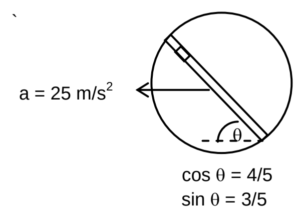
4. A vehicle is moving up the inclined plane with constant velocity v_0 as shown in the figure. A pendulum with a thread of length ℓ is hanging from the roof of the vehicle. Find the time period of oscillation of pendulum. It is given that plane is inclined from horizontal by angle of $\theta = 30^0$.



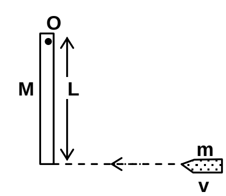
5. Find the equivalent resistance of the circuit between the terminals, A and B. If each resistance is of R Ω.



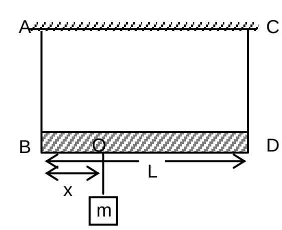
6. A circular disc with a groove along its diameter is placed horizontally. A block of mass 1 kg is placed as shown. The co-efficient of friction between the block and all surfaces of groove in contact is $\mu = 2/5$. The disc has an acceleration of 25 m/s^2. Find the acceleration of the block with respect to disc.



7. A wooden log of mass **M** and length **L** is hinged by a frictionless nail at O. A bullet of mass **m** strikes with velocity **v** and sticks to it. Find angular velocity of the system immediately after the collision about O.

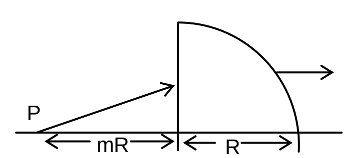


8. A massless rod is suspended by two identical strings AB and CD of equal length. A block of mass m is suspended from point O such that BO is equal to 'x'. Further, it is observed that the frequency of 1^{st} harmonic (fundamental frequency) in AB is equal to 2^{nd} harmonic frequency in CD. Find the length of BO.



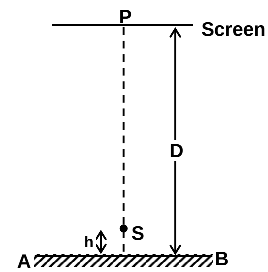
9. A conducting liquid bubble of radius a and thickness t (t <<a) is charged to potential V. If the bubble collapses to a droplet, find the potential on the droplet.

10. A quarter cylinder of radius R and refractive index 1.5 is placed on a table. A point object P is kept at a distance of mR from it. Find the value of m for which a ray from P will emerge parallel to the table as shown in figure.



PART – II

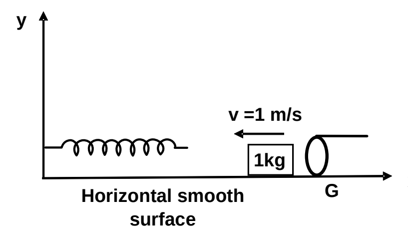
11. A point source *S* emitting light of wavelength 600 nm is placed at a very small height *h* above a flat reflecting surface *AB* (see figure). The intensity of the reflected light is 36% of the incident intensity. Interference fringes are observed on a screen placed parallel to the reflecting surface at a very large distance *D* from it.



(a) What is the shape of the interference fringes on the screen?
(b) Calculate the ratio of the minimum to the maximum intensities in the interference fringes formed near the point *P* (shown in the figure)
(c) If the intensity at point *P* corresponds to a maximum, calculate the minimum distance through which the reflecting surface *AB* should be shifted so that the intensity at *P* again becomes maximum.

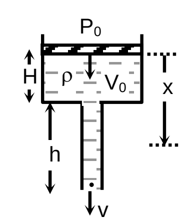
12. Highly energetic electrons are bombarded on a target of an element containing 30 neutrons. The ratio of radii of nucleus to that of Helium nucleus is $(14)^{1/3}$. Find
(a) atomic number of the nucleus.
(b) the frequency of K_α line of the X–ray produced. ($R = 1.1 \times 10^7\ m^{-1}$ and $c = 3 \times 10^8$ m/s)

13. At t = 0 a block of mass m kg is fired from a fixed toy gun G, which is at x = 2m. A spring of spring constant 100 N/m and natural length 100 cm is attached to a fixed wall and is oriented such that it is always parallel to x-axis and in front of the gun as shown in the figure. The block hits the spring and returns back to G after compressing the spring.
(a) Find time period of the block.



(b) Draw a velocity of the block-time curve for one time period. Assuming positive velocity towards +x axis.
(c) Draw a x-position-time curve for one time period.

14. An ideal liquid flows out of a vessel of cross sectional area A and depth H, through a vertical pipe of cross sectional area A/4 and depth h as shown in the figure. A mass less piston, fitted at top of the vessel, moving with a velocity v_0 at the instant represented where P_0 is atmospheric pressure and ρ is density of liquid. At the instant which is shown in figure. [v and v_0 both are unknown quantities]



(a) find the value of v_0.
(b) For this instant Draw graph
(i) pressure in the system as a function of x.
(ii) velocity of fluid as a function of x.

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