FACULTY RECRUITMENT TEST

CATEGORY-C

Formal School Education/XI, XII

PHYSICS

PAPER – A

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

Name:..	Marks:
Subject:………………………...	

Instructions

* Attempt all questions.

* Paper 1 has Two Parts **I and II**. Each question of **Part I carries 2 marks** and each question of **part II caries 5 marks.**

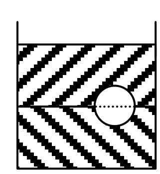
* Calculators and log tables are ***not permitted.***

PART – I

1. A research satellite of mass 200 kg circles the earth in an orbit of average radius 3R/2, where R is the radius of the earth. Assuming the gravitational pull on a mass 1 kg on earth's surface to be 10 N, Calculate the pull on the satellite.

2. A 40.0 kg boy is standing on a plank of mass 160 kg. The plank originally at rest, is free to slide on a smooth frozen lake. The boy walks along the plank at a constant speed of 1.5 m/s relative to the plank. Calculate the speed of the boy relative to the ice surface.

3. A solid uniform ball having volume V and density ρ floats at the interface of two immiscible liquids as shown in the figure. The densities of the upper and the lower liquids are ρ_1 and ρ_2 respectively such $\rho_1 < \rho < \rho_2$. What fraction of the volume of the ball will be in the upper liquid and what fraction in the lower one?



4. A piece of metal weighs 210 g in air, 180 g in water and 120 g in liquid. Calculate specific gravity of metal and liquid.

5. A cylinder is made up of two materials. The core part has radius R and thermal conductivity K_1. The remaining a part has outer radius 2R and thermal conductivity K_2. Find an expression for effective thermal conductivity K of the composite cylinder between its ends.

6. A container of volume 0.02 m^3 contains a mixture of neon and argon gases at a temperature of 27°C and pressure of 1×10^5 N/m^2. The total mass of the mixture is 28 g. If the molecular weights of neon and argon are 20 and 40 respectively, determine the masses of the individual gases in the mixture, assuming them to be ideal. (R = 8.314 J/mole K)

7. A person throws vertically up n balls per second with the same velocity, He throws a ball whenever the previous one is at its highest point. Calculate the height to which the balls rise.

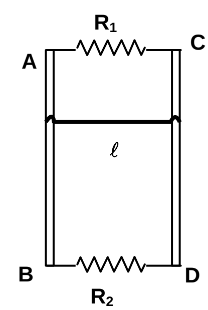
8. A block of mass m is placed on a smooth horizontal surface. A force making an angle θ with the horizontal starts acting on the block. The magnitude of the force is constant but its direction with the horizontal changes as $\theta = a + bs$, where a and b are constants and s is the distance covered by the block. If $|F| = 2mb$, find the velocity of the block as a function of the angle θ.

9. How many photons are emitted per second by a 5 mW laser source operating at 632.8 nm?

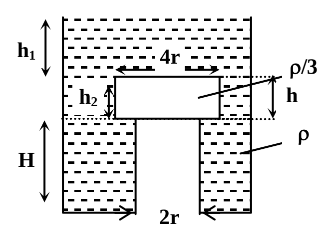
10. What is the energy and wavelength of a thermal neutron at a temperature of 20^0 C.

PART – II

11. Two parallel vertical metallic rails AB and CD are separated by 40 cm. They are connected at the two end by resistances R_1 and R_2 as shown A metallic bar of length ℓ mass 100 g slides along the rails without friction. A uniform magnetic field of 0.5 T perpendicular to the plane of the rails is established. It is found that when the bar attains the terminal velocity, the powers dissipated in R_1 and R_2 are 0.50 W and 0.75 W respectively. Find the terminal velocity of the bar and values of R_1 and R_2. Neglect the resistances of the bar and the rails.



12. A wooden cylinder of diameter 4r, height h and density $\rho/3$ is kept on a hole of diameter 2r of a tank, filled with water of density ρ as shown in the figure. The height of the base of cylinder from the base of tank is H.
(a) If level of liquid starts decreasing slowly when the level of liquid is at a height h_1 above the cylinder, the block just starts moving up. What is the value of h_1?



(b) Let the cylinder is prevented from moving up, by applying a force and water level is further decreased. Then, calculate the height of water level (h_2 in figure) for which the cylinder remains in original position without application of force.

13. A thin non conducting ring of radius R is placed in the XY plane. The charge is distributed along the ring with density. $\lambda = \lambda_0 \cos\theta$ where λ_0 is a constant and θ is the angle made by a radius vector with positive direction of X axis. Find the electric field intensity at the centre of the ring.

14. (a) A double convex lens has focal length 25.0 cm. The radius of one of the surfaces is double of the other. Find the radii of curvature if the refractive index of the material of the lens is 1.5.
(b) A particle executes a simple harmonic motion of amplitude 1.0 cm along the principal axis of a convex lens of focal length 12 cm. The mean position of oscillation is at 20 cm from the lens. Find the amplitude of the image of the particle.