

BEGINNING OF TERM TWO 2010

S.6 PHYSICS

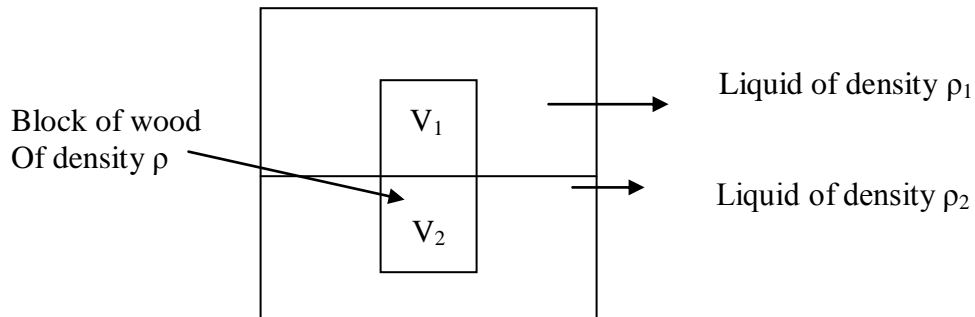
TIME: 2½ HOURS

DO ALL QUESTIONS

- 1.(a) (i) State Newton's laws of motion . [3mks]
(ii) Define impulse and derive its relation to linear momentum of the body on which it acts . [3mks]
- (b) A body of mass m_1 and velocity u_1 collides head on with a body of mass m_2 and velocity u_2 in the same direction as u_1 . Use Newton's laws to show that the quantity , $m_1u_1 + m_2u_2$ is conserved . [5mks]
- (c) A ball of mass 0.5kg is allowed to drop from rest , from a point a distance of 5.0m above a horizontal concrete floor . When the ball first hits the floor , it rebounds to a height of 3.0m .
(i) What is the speed of the ball just after the first collision with the floor ? [4mks]
(ii) If the collision lasts 0.01s , find the average force which the floor exerts on the ball . [5mks]

- 2.(a) (i) State Archimedes principle . [1mk]
(ii) What is simple harmonic motion ? [2mks]
- (b) A uniform cylinder rod of length 0.08m , cross sectional area 0.02m^3 and density 900kgm^{-3} floats vertically in a liquid of density 1000kgm^{-3} . The rod is depressed through a distance of 0.005m and then released .
(i) Show that the rod performs simple harmonic motion . [5mks]
(ii) Find the frequency of the resultant oscillations [4mks]
(i) Find the velocity of the rod when it is at a distance of 0.004m above the Equilibrium position . [3mks]

(c)



A block of wood of density floats at the interface between immiscible Liquids of density ρ_1 and ρ_2 as shown .

- (i) Show that the ratio of the volume V_1 and V_2 of the block in the two Liquids is given by $\frac{V_1}{V_2} = \frac{\rho_2 - \rho}{\rho - \rho_1}$ [4mks]
- (ii) What happens when the block of wood is replaced with a denser one ? [1mk]

- 3.(a) State Kepler's laws of gravitation . [3mks]
- (b) (i) Show that the period of a satellite in a circular orbit of radius r about the Earth is given by $T = \left(\frac{4\pi^2}{GM_e} \right)^{1/2} r^{3/2}$ [5mks]
 Where G is the universal gravitational constant and M_e is the mass of the earth .
- (ii) Explain briefly how world wide radio or television communications can be Achieved with the help of satellites . [4mks]
- (c) A satellite of mass 100kg in a circular orbit at a height of 3.59×10^7 m above the earth's surface .
- (i) Find the mechanical energy of the satellite . [4mks]
- (ii) Explain what would happen if the mechanical energy was decreased . [4mks]
- [Take $M_e = 5.97 \times 10^{24}$ m and $r_e = 6.4 \times 10^6$ m]
- 4.(a) (i) State the desired properties a material must have to be used as a thermometric liquid substance . [2mks]
- (ii) Explain why scales of temperature based on different thermometric properties may not agree . [1mk]
- (b) (i) Draw a well labeled diagram to show the structure of a simple constant volume gas thermometer . [3mks]
- (ii) Describe how a simple constant-volume gas thermometer can be used to establish a Celsius scale of temperature . [5mks]
- (iii) State the advantages and disadvantages of mercury in glass thermometer and a constant-volume gas thermometer . [3mks]
- (c) The resistance of the element of a platinum resistance thermometer is 4.00Ω at the ice-point and 5.46Ω at the steam point . What temperature on the platinum resistance scale would correspond to a resistance of 9.84Ω ? [3mks]
- (d) The mean kinetic energy of one mole of an ideal gas is 3.74×10^3 J . Calculate the Room temperature . [3mks]
- 5.(a) State the laws of photo electric emission [4mks]
- (b) (i) Describe an experiment to determine plank's constant . [5mks]
- (ii) Violet light of wavelength $0.4\mu\text{m}$ is incident on a metal surface of threshold wavelength $0.65\mu\text{m}$. Find the maximum speed of the emitted electrons . [4mks]
- (iii) Explain why light whose frequency is less than threshold frequency can not cause photo emission . [2mks]
- (c) (i) What are X – rays ? [1mk]
- (ii) Explain how intensity and penetrating power of X – rays produced by an X – ray tube can be varied . [4mks]

"HARD WORK PAYS"