ELIZADE UNIVERSITY
ILARA-MOKIN
ONDO STATE

FACULTY: Basic and Applied Sciences
DEPARTMENT: Physical and Chemical Sciences
SECOND SEMESTER EXAMINATIONS
2015/2016 ACADEMIC SESSION

COURSE CODE: PHY 106

COURSE TITLE: Properties of matter

DURATION: 2 hours

HOD's SIGNATURE

TOTAL MARKS: 60

Matriculation Number: ____________________

INSTRUCTIONS:

1. Write your matriculation number in the space provided above and also on the cover page of the exam booklet.
2. This question paper consists of 3 pages with printing on both sides.
3. Answer questions only in the exam booklet provided.
4. More marks are awarded for detailed solution than for the final numerical answer.
5. Box your final answers. Marks will be deducted for untidy work.
6. Attempt any (4) of the Six (6) questions. Each question is worth 15 points.
7. All approximations should be rounded up to 2 decimal places (2 d.p.)
8. Your final answers should be in S.I. units

TABLE OF FORMULAS AND CONSTANTS

$g = 9.81 ms^{-2}$	$\pi = 3.142$	$P_{atm} = 101325$	$\rho_{water} = 1000 kgm^{-3}$	$\rho_{oil} = 790 kgm^{-3}$
$\rho_{mercury} = 13,600 kgm^{-3}$	$\alpha_{copper} = 1.7 * 10^{-5} C^{-1}$	$\alpha_{brass} = 1.9 * 10^{-5} C^{-1}$	$J = Av$	$Stress(\varepsilon) = \frac{F_{\perp}}{A}$
$P + \frac{1}{2}\rho v^2 + \rho gh = const.$	$Strain(\sigma) = \frac{\Delta l}{l_o}$	$Y = \frac{F_{\perp}}{A} \div \frac{\Delta l}{l_o}$	$\rho = m/V$	$P_{gauge} = P - P_{atm}$
$\alpha = \frac{\Delta L}{L_o(\Delta T)}$	$Vol_{cylinder} = \pi r^2 h$	$Vol_{sphere} = \frac{4}{3}\pi r^3$	$C.S.A_{cylinder} = 2\pi rh$	$v = v_o + at$

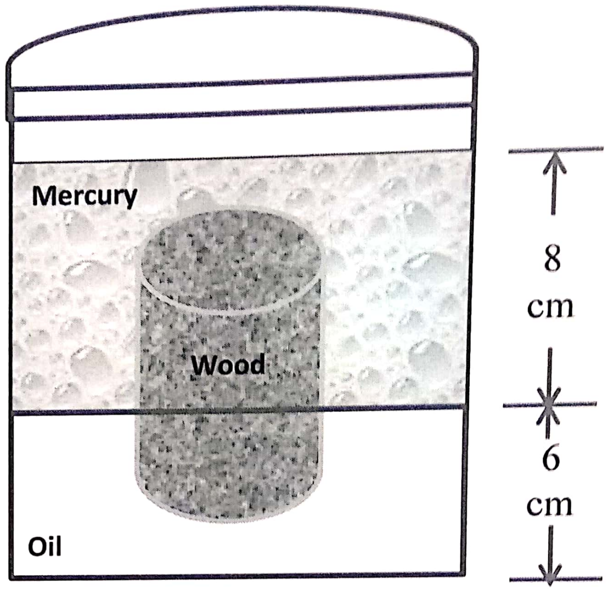
QUESTION ONE

A cylindrical block of wood of diameter 4cm and height 8cm, floats at the interface between mercury and oil with its lower surface 3cm below the interface. Calculate

(a) The gauge pressure at the upper surface of the block?

(b) The gauge pressure at the lower surface of the block?

(c) The mass and density of the block

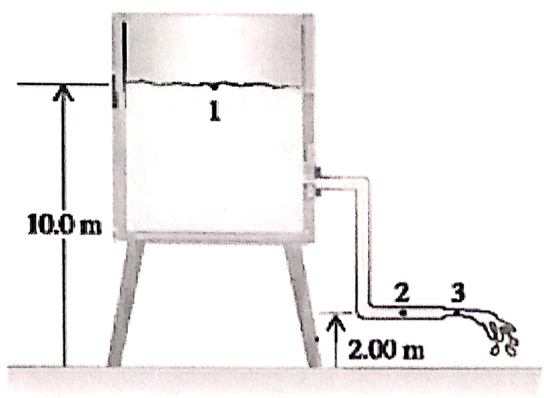


QUESTION TWO

An object of average density ρ_{obj} floats at the surface of a fluid of density ρ_{fluid} (a) In terms of ρ_{obj} and ρ_{fluid}, what fraction (F_{obj}) of the object is above the fluid? (b) Using (a), discuss the correct limiting behavior as $\rho_{obj} \rightarrow \rho_{fluid}$ and $\rho_{obj} \rightarrow 0$. (c) If a sphere floats in water and glycerin with 30% and 60% of its volume submerged respectively. Determine the densities of glycerin and the sphere.

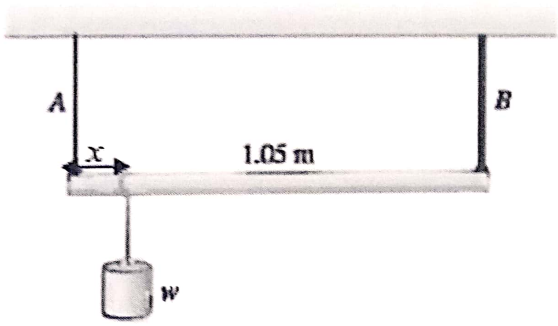
QUESTION THREE

Elizade university student hostel maintains a large tank with an open top, containing water for emergencies. Water flows steadily from the tank and the area of the tank is very large compared with the cross-sectional area of the pipe. The diameter at point 2 and 3 are 6.60cm and 2.20cm respectively. Assuming that Bernoulli's equation applies, find (a) the velocity at point 3 (b) the mass flow rate (c) velocity and gauge pressure at point 2.



QUESTION FOUR

A 1.05m long rod of negligible weight is supported at its ends by wires A and B of equal length with diameter of B twice that of A. If the Young's modulus of wire A is 1.5 times that of B, compute the value of x that will produce (a) equal stress in A and B (b) equal elongation in A and B.



QUESTION FIVE

(a)A hole in brass plate has a diameter of 8 cm and is 0.030 mm too small to allow a copper ball pass through when the ball and the plate are at a temperature of 54°C. At what temperature (the same for the plate and ball) will the ball just pass through the hole?

(b) The table below shows initial lengths, change in temperatures and changes in the length of 3 rods. Which of these materials are the same?

Material	Lo	ΔT	ΔL
A	0.2L	0.3ΔT	0.04ΔL
B	0.4L	0.2ΔT	0.03ΔL
C	0.02L	6ΔT	0.08ΔL
D	0.04L	6ΔT	0.09ΔL

QUESTION SIX

Our Tibia requires compressive strength for our day-to-day activities and can only take about 1% change in length before fracture. If a 90kg woman jumps from a height and lands on her two legs without fracture, compute (a) the maximum stress her tibia can withstand assuming that the stress is equally distributed between her legs, (b) the maximum force that can be experienced on her two legs on landing, and (c) the maximum acceleration on landing.