



THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

(A Constituent College of JKUAT)

(A Centre of Excellence)

Faculty of Engineering & Technology

DEPARTMENT OF BUILDING & CIVIL ENGINEERING

DIPLOMA IN BUILDING & CIVIL ENGINEERING

APS 2101: APPLIED PHYSICS I

END OF SEMESTER EXAMINATION

SERIES: AUGUST 2012

TIME: 2 HOURS

Instructions to Candidates:

You should have the following for this examination

- *Answer Booklet*
- *Scientific Calculator/Mathematical Tables*

This paper consists of **FIVE** questions. Answer question **ONE** and any other **TWO** questions

Maximum marks for each part of a question are as shown

This paper consists of **THREE** printed pages

Question One (20 Marks)

- a) State the kinetic theory of matter and use it to differentiate the three states of matter. **(8 marks)**
- b) (i) Define density and state its SI units **(2 marks)**
(ii) A balloon of constant volume 5000m^3 and 4750kg rises to an altitude where the up thrust is 4750g Newtons. Calculate the density of air at this altitude $g = \text{gravitational acceleration} = 9.8\text{m/s}^2$. **(3 marks)**
- c) (i) State **TWO** precautions necessary when using a density bottle. **(2 marks)**
(ii) In an experiment to determine relative density of oil the following data was obtained
mass of sinker in air = 3grammes
Mass of sinker in water = 4 grammes
Mass of sinker in oil = 2 grammes
From the above information, determine density of oil. **(3 marks)**
- d) State the Archimedes principle. **(2 marks)**

Question Two (20 marks)

- a) State the Hooke's Law **(2 marks)**
- b) Calculate the maximum load which may be placed on a steel wire of diameter 2.0mm if the permitted strain must not exceed 0.001 and the young modulus for steel is $2.0 \times 10^{11}\text{ p.a.}$ **(4 marks)**
- c) A wire 2m long and cross-sectional area 10^{-6} m^2 is stretched 1mm by a force of 50N in the elastic region. Calculate.
i) The strain **(2 marks)**
ii) The young modulus **(3 marks)**
iii) The energy stored in the wire. **(3 marks)**
- d) The cube block below of length 2cm is under shear force as shown in figure 1

3mm

Calculate the modulus of rigidity for the block. (4 marks)

e) Explain the meaning of elasticity of a substance. (2 marks)

Question Three (20 marks)

a) Define the term “surface Tension”. (2 marks)

b) Differentiate between adhesion and cohesive forces

c) (i) In an experiment to measure surface tension by capillary tube show that the surface tension Y will be given by Hint use an illustration. (5 marks)

$$Y_o = \frac{rh\rho g}{2}$$

(ii) In an experiment to measure surface tension by capillary tube method the following data was

$$\rho = 1gcm^{-3}$$

obtained. $r = 0.2mm$, $h = 6.6m$ and . Calculate the surface tension in S.I units.

(3 marks)

(iii) State the **TWO** assumptions in the experiment in c (iii) (2 marks)

d) Draw an illustration to show an angle of contact of mercury in a tube. (2 marks)

e) Explain the effect of cross-sectional area on capillarity (2 marks)

Question Four (20 marks)

a) Derive the **THREE** equations of motion. (8 marks)

b) A car moving with a velocity of 36km/h accelerates uniformly at $1ms^{-2}$ until it reaches a velocity of 54km/h. Calculate.

i) Time taken (2 marks)

ii) Distance travelled during the acceleration. (2 marks)

iii) The velocity reached 100m from the place where the acceleration began. (3 marks)

$$R = \frac{U^2 \sin 2\theta}{g}$$

c) Show that for a projective motion the Range R is given by (5 marks)

Question Five (20 marks)

a) Explain why a body moving in a circular path with constant velocity is said to accelerate. (2 marks)

b) (i) Differentiate between centripetal and centrifugal forces. (4 marks)

(ii) State **ONE** application of circular motion in the industry. (1 marks)

c) A heavy flywheel of moment of inertia $0.3kgm^2$ is mounted on a horizontal axle radius $0.01m$ and negligible mass neglecting friction. Find:

i) The angular acceleration if a force of 40N is applied tangentially to the axle. (3 marks)

ii) The angular velocity of flywheel after 10 seconds from rest. (2 marks)

d) Define the following terms. **(6 marks)**
i) Torque
ii) Angular acceleration
iii) Couple

e) State the Law of conservation of angular momentum. **(2 marks)**