MENGO SENIOR SCHOOL
PHYSICS DEPARTMENT P 510/1
SENIOR 6 BEGINNING OF TERM 1 2003
TIME: 2 HOURS 30 MINUTES

Instructions:
-Draw a table indicating numbers attempted.

1.Attempt five questions, section B is compulsory
2.Assume where necessary

-Gravitational acceleration g=9.81 $m\text{-}s^2$
-Universal gravitational constant $G=6.67 \times 10^{-11}Nm^2kg^{-2}$
-Radius of the Eaith $=6.4 \times 10^3km$
-Mass of the Eaith $=6.0 \times 10^{24}kg$
-Density of water $=1 \times 10^3kgm^{-3}$
-Density of steel $=7.8 \times 10^3kg^{-3}$

SECTION A

1(a) In an experiment to determine the acceleration due to gravity, the following values of period of oscillation were obtained for various lengths of a simple pendulum.

length, l(m)	0.20	0.30	0.40	0.50
period, t (s)	0.90	1.09	1.25	1.40

(i) Plot a suitable graph and use it to determine the acceleration due to gravity. (6)
(ii) State two factors that could affect the accuracy of the results in this experiment. (3)

(b)What is the difference between damped and free vibrations? (3)

(c) Two strings of force constants k_1 and k_2 are suspended from a horizontal support. A mass m hangs from the lower ends of the springs as shown in the diagram.

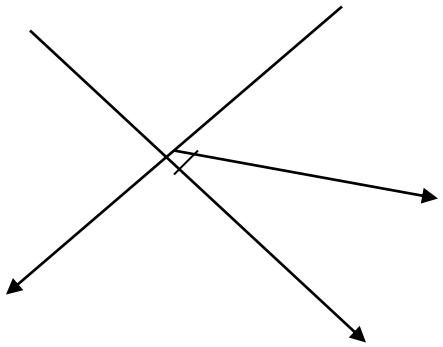
If both springs have negligible mass, show that when m is displaced from its equilibrium position, it describes SHM of frequency $f = \frac{1}{2}\frac{k_1 + k_2}{m}$ (6)

(d) A particle moving with SHM has velocities of $4cm^{-2}$ and 3 cms^{-1} at distances of 3cm and 4cm respectively from its equilibrium position. Find the amplitude of oscillation. (3)

2(a)(i) Define a couple?

(ii) Show that if a couple rotates a body, the rate of which work is done is equal to the product of the angular velocity of the body and the torque on the body. (3)

(b) In the figure below, the forces are in equilibrium.



Find :

(i) the maginitude of force F

(ii) the angle Ø

(b)State the conditions for equilibrium of a body under the action of coplanar forces (2)

(c)In the diagram below, AB is a uniform rigid bar of length 3m and weight 100N freely hinged at A to a vertical wall, A rope is fastened between end B and AB is horizontal

A weight of 200N is hang on the bar 0.5m from end B. Determine:

(i) The tension in the rope. (30

(ii) The total reaction of the hinge (4)

3(a) Define the terms: Ductility
Elastic Deformation
Breaking Stress

(b) A rod of mild steel of uniform cross-sectional area 0.0030m^2 and length 1.0m Is stretched steadily until it breaks.

(i) Sketch a graph to show the relationship between the force and the extension. Explain the shape of the graph. (5)

(ii) When the applied force on the rod is 120KN the strain is 4.0×10^{-4}.Calculate Young's modulus for steel. (3)

(c) Show that surface tension and surface energy are equivalent. (30

(d)(i) Derive the expression for the capillary rise in a tube of radius r dipped in a liquid of surface tention , density , if the angle of contact is .

(ii) A droplet of mercury of radius 2.00mm falls vertically and on hitting the ground it sprits into 64 droplets each of radius 0.50mm. Calculate the change in surface energy.(3) Account for the change in (i) above. (1)
(Surface tension of mercury = 0.52Nm^{-1})

4(a)(i) Define: terminal velocity (1)
coefficient of viscosity. (1)

b(i)Describe an experiment that can be carried out to compare the viscositities of two liquids. (5)

(ii) Explain the origin of viscosity in a gas. (2)

(iii)Describe the effects of temperature on the viscosity of the gas.

(c) The table below gives the time of fall of steel spheres of different diameters falling through a distance of 60cm in a viscous fluid of density $1.26 \times 10^3 kgm^{-3}$.

(i) Calculate the uniform sped Vo of each steel ball. (2)

(ii) Plot a graph of Vo against d^2. (4)

(iii) Use the graph in (iii) above to find the viscosity of the liquid. (3)

SECTION B

5(a)(i) what is meant by a scale of temperatures. (2)

(ii) What qualities make a particular thermometric property suitable for use in a practical thermometer?

(iii) List four thermometric properties used in thermometry. (20

(b) Define the Celsius-scale of temperature on:
(i) Platinum resistance scale (1)
(ii) Mercury-in-glass scale (1)

(c) The resistance R in ohms of a platinum wise of various temperatures ^{0}c on the mercury-in-glass scale is given by the following table.

Calculate:
(i) The temperature on the platinum scale corresponding to 65^0c on the Hg-in-glass scale. (3)

(ii) The temperature on the Hg-in-glass scale corresponding to 45^0c on platinum scale. (3)

(d)(i) What are the advantages and disadvantages of using a platinum resistance thermometer. (4)

(ii) The numerical value of the physical property of a given substance is 1.05 at the ice temperature will the numerical value of the physical property be 1.21? (2)

6(a)(i) Define specific Heat capacity and give the units in which it is measured. (2)

(ii) Explain how you would determine the specific Heat capacity of a liquid using The method of mixtures. (6)
State any precautions and assumptions made.

(b)(i) In an experiment to determine the specific Heat capacity, a metal of mass 500g is heated to 120^0c and dropped into 100g of water at 20^0c, contained in a calorimeter of heat capacity $40JK^{-1}$. The final temperature reached by the mixture is 45^0c. Find the specific Heat Capacity of the metal. (4)

(ii) State any assumption made in the experiment. (1)

(c)(i) The temperature of 0.45kg of water in a calorimeter of Heat capacity $80jk^{-1}$ is increased from 288k to 352k in 4805 by an electrical heater. Neglecting heat losses, calculate the power of the heater. (3)

(ii) When the heater is placed in 0.50kg of paraffin, in a similar vessel at the same temperature, the temperature rises to 341k in 2405. Calculate the specific Heat capacity of paraffin. (4)

END