MENGO SENIOR SCHOOL

END OF TERM 3 YEAR 2003

S.5 PHYSICS PAPER 1

TIME: 2:30 HOURS

Attempt 5 questions including at least one from each of the section A and B.

Assume where necessary

Acceleration due to gravity	g	$= 9.81\ ms^{-2}$
Electron charge	e	$= 1.6 \times 10^{-19} C$
Electron Mass	m_e	$= 9.11 \times 10^{-31} kg$
Mass of earth		$= 5.9 \times 10^{24} kg$
Radius of earth		$= 6.4 \times 10^{6} m$
Planck's constant		$= 6.63 \times 10^{-34} Js$
Speed of light in a vacuum	C	$= 3.0 \times 10^{8}\ ms^{-1}$
Universal gravitational constant	G	$= 6.67 \times 10^{-11} Nm^2kg^{-2}$
Viscosity of air		$= 1.8 \times 10^{-5} NSm^{-2}$
Density of oil		$=900\ kg\ m^{-3}$

SECTION A

1(a)(i) What is meant by sealer and vector quantities? (2)
(ii) Give three examples of each of the quantities in (a)(i) above. (3)

(b)(i) What is meant by uniformly accelerated motion? (1)
(ii) Sketch speed-time and distance-time graphs for a body moving with uniform acceleration. (2)

(c) A ball is kicked from a spot 30m from the goal posts with a velocity of 20m/s at 30^0 to the horizontal. The ball just, clears the horizontal bar of the goal posts. Find
(i) The height of the goal posts (5)
(ii) The time of flight (4)
(iii) How far behind the goal posts the ball lands. (3)

2(a)(i) State Newton's law of gravitation. (1)
(ii) Derive an expression for the period of a planet moving in a circular orbit about the sum in terms of the radius of the orbit. (4)

(b) A satellite is launched in a circular orbit about the equator at a height 3.6×10^4 km above the earth's surface. Find
(i) The speed with which the satellite is launched into the orbit. (4)
(ii) The period of the satellite (3)

(c) A steel ball of mass 0.5kg is suspended from a light intensible string of length 1.0m. The ball is whirled in a horizontal circle of radius 0.5m. Determine:
(i) The centripetal force and the tension in the string (3)
(ii) The angular speed of the ball (2)
(iii) The angle between the string and the radius of the circle if the angular speed is increased to such a value that the tension in the string is 10N (Take $g = 9.8\ ms^{-2}$). (3)

3(a)(i) Define the term pressure at a point in a fluid. (1)
(ii) Show that the pressure at a given depth in a liquid in a vessel is independent of the cross-sectional area of the vessel. (4)

(b)(i) Define moment of a force. (1)
(ii) State the conditions which must be satisfied for a rigid body to be in static equilibrium. (2)

(c) A uniform ladder 4m long, mass 50kg rests with its upper end against a smooth vertical wall and with its lower end on a rough ground. What must be the least

coefficient of friction between the ground and the ladder for it to be inclined at 60^0 to the horizontal without slipping? (2)

4(a) Define surface tension and give its dimensions. (2)

(b)(i) Explain briefly how the molecular theory of matter accounts for the occurrence of surface tension. (6)

(ii) What is the effect of temperature on surface tension. (1)

(c)(i) A uniform capillary tube of radius r held vertically and lowered in a liquid of density and surface tension , show that the liquid rises to a height h given by $h = \frac{2 \quad \cos}{}$

where = angle of contact of the liquid with the tube
= acceleration due to gravity

(ii) If the above tube is dipped in a liquid of density $1g/cm^3$ and the liquid rises to a height of 10cm in the tube, calculate the radius of the capillary tube. (Surface tension of the liquid = $7.35 \times 10^2 Nm^{-1}$) = 0^0)

(4)

(iii) If the same tube is dipped in mercury, find the level of mercury in the tube. (Density of mercury = $1.36 \times 10^4 kg/m^3$, surface tension of mercury = 0.5N/m and angle of contact = 150^0) (3)

5(a)(i) What is simple harmonic motion? (2)

(ii) Show that the acceleration of a body moving in a circular path of radius r with a uniform speed is given by $\frac{\quad^2}{r}$

(4)

(b) Sketch displacement-time graphs for under damped and over damped oscillations.

(2)

(c) A mass of 0.5kg is suspended from the free ends of two springs of force constants $100Nm^{-1}$ and $50Nm^{-1}$ respectively as shown below:

Calculate:

(i) Extension produced (3)

(ii) Tension in each spring (2)

(iii) Energy stored in the springs (3)

(iv) Frequency of small oscillations when the mass is given a small vertical displacement. (4)

SECTION B

6(a) What is meant by work function of a metal? (1)

(b) State the laws of photoelectricity. (4)

(c) A freshy cleaned zinc plate, placed on the cap of a gold-leaf electroscope is irradiated with ultraviolet radiation. Explain what happens when the electroscope is:

(i) Negatively charged (3)

(ii) Positively charged (2)

(d) A metal of work function 2.50 eV is irradiated with length of an unknown frequency. The maximum velocity of the photoelectrons is 1.14×10^6 ms^{-1}, calculate the maximum wavelength of the incident radiation.(4)

(e) Describe an experiment for determining planck's constant. (6)

7(a)(i) Draw a labeled diagram showing the essential features of a C.R.O. State the uses of these features. (12)

(ii) Explain the use of a time-base in a C.R.O (2)

(b) An electron beam of energy 10 keV enters midway between the Y plates of a C.R.O, each of length 5.0cm and 2cm apart. A potential difference of 20V is applied across the plates. A fluorescent screen is placed 20cm beyond the plates. Calculate the vertical deflection of the electron on the screen.(6)

8(a)(i) What do you understand by "Specific charge" of an electron. (1)

(ii) Describe an experiment for determining the specific charge of an electron. (5)

(b) A high p.d is applied across two electrodes in air contained in a closed glass tube. Describe with the aid of labeled diagrams what will be observed when the pressure in the tube is progressively reduced down to very low pressures. (5)

(c) Give any three properties of cathode ways.

(d) An oil drop carried a charge of 24e and is between two plates 4mm apart. The drop falls under gravity with a velocity of 600 m/s, and a p.d of 1600V, applied between the plates makes the drop to rise with a steady velocity . Calculate:

(i) Radius of the drop (3)

(ii) The value of (3)

(Assume air bugyancy is negligible)

MERRY X-MAS AND HAPPY NEW YEAR