RIVERS STATE UNIVERSITY
NKPOLO OROWORUKWO, PORT HARCOURT
DEPARTMENT OF PHYSICS
FIRST SEMESTER, 2020/2021 SESSION EXAMINATIONS

PHY 105: GENERAL PHYSICS I

MONDAY, 30TH AUGUST, 2021; TIME ALLOWED: 2 HOURS (9.00 – 11.00 AM)

ANSWER 4 QUESTIONS IN ALL: 1 FROM EACH SECTION AND THE 4TH FROM ANY SECTION

SECTION A

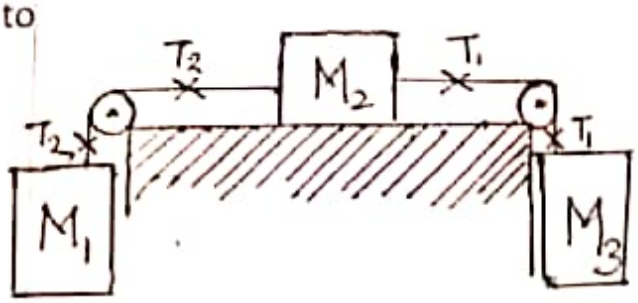
1 (a) The period T of vibration of a liquid drop depends on the density ρ, radius r, and surface tension γ of the liquid. Use the method of dimension to deduce an expression for the dependence of the period of vibration of a liquid drop on these quantities. **(9mrks)**

(b) From the definition of time of flight of a body thrown to a maximum height H and returns to the same projection plane, show that the total time of flight $T = \frac{2U\sin\theta}{g}$

Where U = initial velocity, g = acceleration due to gravity, θ = angle of projection, and T= Total time of flight. All symbol has its usual meanings. **($8^1/_2$mrks)**

2 (a) If **D = -5i +6j - 3k** and **E = 7i + 8j + 4k**, calculate **D X E** **(4 mrks)**

(b). Consider the Diagram below with masses M_1, M_2, and M_3 hanging over a free moving pulley. Suggest a direction for the motion of the masses and use the information to



()i Resolve the Tensions and acceleration in the string **(8mrks)**

(ii) Find the numerical values of the tensions T_1, T_2 and acceleration, a, in the string if M_1 = 0.5kg, M_2 = 1.5kg and M_3 = 4.5 kg. **($5^1/_2$mrks)**

Take g=10m/s²

$=T_1+T_1+T_2+T_2$

SECTION B

3. (a)(i) In circular motion state clearly what are meant by the terms angular displacement and period. **(4 marks)**

(ii) An object moving in a circular path of radius 400 cm takes 5 seconds to complete one circuit. Compute its speed and its centripetal acceleration. ($\pi = 3.14$) **(5½ marks)**

(b) (i) State clearly the difference between the term vector as used in medicine and physics. **(4 marks)**

(ii) Clearly state Kepler's laws of orbits and areas. **(4 marks)**

4. (a) (i) Compute the radius of the horizontal circle traced out by a conical pendulum when its string of length 40 cm makes an angle of 60° with the vertical. **(4½ marks)**

(ii) Clearly state the supposition principle. **(3 marks)**

(b) An artificial satellite orbits the earth at an altitude of 300 km in a circular orbit. Compute its (i) orbital speed and (ii) the time to complete one circuit. ($R_E = 6380$ km; $M_E = 5.98 \times 10^{24}$ kg; $G = 6.67 \times 10^{-11}$ Nm^2kg^{-1}) **(10 marks)**

Section C

5 (a) On a stress-strain graph for a wire subjected to a gradually increasing stress indicate the following points: (i) Ultimate Strength (U) (ii) Yield Point (Y) (iii) Elastic Lime (L) (iv) Proportionality Region **(8 marks)**

(b) A metal wire 75cm long and 0.13cm in diameter stretches 0.35cm when a load of 0.8kg is hung on its end. Calculate the: (i) Tensile stress (ii) Tensile Strain (iii) Young's Modulus **(9½ marks)**

6 (a) Define the term **Pressure** and state **four** different units of pressure **(7marks)**

(b) An object weighs 12.0N in air, when immersed in water, it weighs 8.0N. When immersed in another liquid, it weighs 10.0N. Calculate:

(i) Density of the object (ii) Density of the liquid **(10½ marks)**

Take g=10m/s²

2.0423×10^{-3}

$A = 2.043 \times 10^{-3}$

$F = 7.84$ πr^2 m/s² m

Department of Physics
Rivers State University, Port Harcourt
PHY 105-General Physics-I
First Semester Examination 2021/2022
Faculty of Basic Medical Science
Time allowed: 2 Hours

Instruction: Answer 4 questions in all; 1 from each section and the 4th from any section.

SECTION A

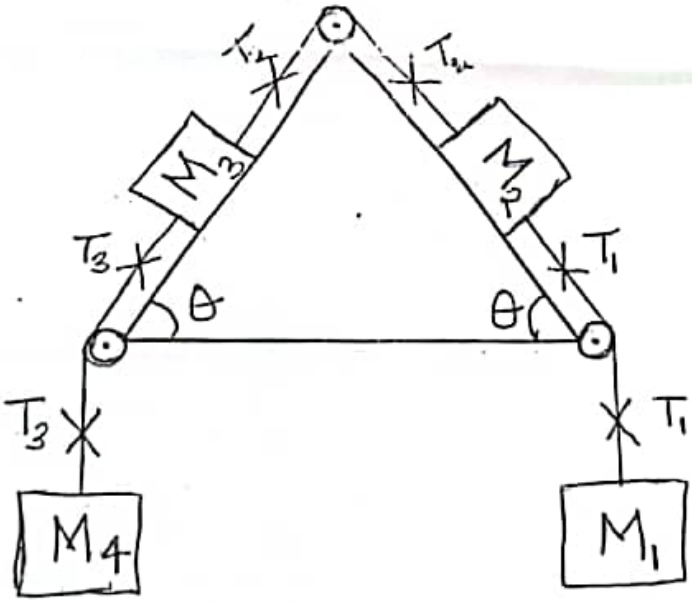
1. (a). Find the value of c if sum of two vectors a and b are given by a = 5m$\angle 60^0$ b = 6m $\angle 130^0$ (3.5mrks)

   (b) Consider the Diagram below with masses M_1, M_2, M_3 and M_4 hanging over a free moving pulley on an inclined frictionless plane. Suggest a direction for the motion of the masses and use the information to:

   i. Set up the correct equations for the forces acting on the system (2mrks)

   ii. Resolve the tensions T_1, T_2, T_3 and acceleration a in the string quantitatively (6mrks)

   iii. Find the numerical values of the tensions T_1, T_2, T_3 and acceleration a in the string of the diagram below, if M_4 = 6kg, M_3 = 2kg, M_2 = 1kg, M_1= 0.5kg, g = 9.8m/s^2 and the angle of inclination is 30^0. (6mrks)



2. (a). If the acceleration of an ingested poison through the oesophagus of a patient lying horizontally on a stretcher in time (t) is given by the equation a = t – (3t^4 + 11t) + (9t^4 + 30t), find the distance covered by the substance down his stomach in 1sec, neglecting the capillarity of the patient intestine, blood resistance and frictional forces. (6.5mrks).

   (b) i. Calculate the force on an electron moving with velocity $V = (2.5i)\times10^2 m/s$ in a magnetic field $B = (10i - 6k)\times10^2$ web/m^2. Given that $F = q(V X B)$, and for the electron $q = 1.6\times10^{-19}$ coulomb. (5mrks)

   ii. A body moving in a straight line with any acceleration of 12m/s^2 has a velocity of 80m/s after 5 seconds. Find the distance covered after the 9th seconds. (6mrks)

SECTION B

3. (a)(i). Distinguish between linear motion and circular motion. (3mrks)
(ii). What is simple harmonic motion, give two examples of SHM? (3mrks)
(b). A test-tube containing blood sample is spun round at constant speed in a circle of radius 20.0cm taking 0.1s to complete one revolution. Compute (i) its speed (ii). Its centripetal acceleration, (iii). The number of revolutions it makes per minute. (11.5mrks)

4. (a)(i). What is centripetal force? (3mrks)
(ii). Clearly State Kepler's law of areas (3mrks)
(b) (i). A nurse obtains the weight of a patient on earth to be 784N after which the patient is sent to Mars. What weight would a nurse on Mars (where the acceleration due to gravity is 35.4% that of earth) obtain as the patient's weight? ($g_{earth} = 9.8m/s^2$). (3.5mrks)
(ii). Compute the centripetal velocity that a 20g blood sample in a test-tube is moving if it is spun round in a circle of radius 5cm by a force of 50N. (3mrks)
(iii). What is Motion? Enumerate the four main types of motion. (5mrks)

SECTION C

5. (i). State one similarity and difference between elastic region and proportionality region in a stress-strain graph (4mrks)
(ii). Explain the following terms, Elasticity and plastic flow (4mrks)
(b). The compressibility of water is $5.0\times10^{-10}m^2/N$, calculate the decrease in volume of $100m^3$ of water, when subjected to a pressure of 15MPa (4mrks)
(c). (i) The expression $\Delta V/V_0 = e_l (1- 2\sigma)$ where the symbols used have their usual meaning. What does each of the following symbols represent $\Delta V/V_0$, e_l and σ (3mrks)
(ii). What is the value of σ that can be allowed or not realistic and why? (2.5mrks)

6. (a)(i) Draw and label a simple mercury barometer.
(ii). List three parameter that would be required to determine the external atmospheric pressure using the above barometer.
(iii). State two reasons why the simple mercury barometer is not accurate, hence, list the names of two accurate barometer you know.
(b) A solid of weight 6.0N is suspended by a string in water, the tension in the string is 4.0N, Calculate;
(i). The volume of the solid
(ii). The density of the solid
(iii). The relative density of the solid.
(c). A nail 2mm in diameter is embedded in a tire in which the gauge pressure is 1.8bar. How much force tends to push the nail out? 1 bar = $10^5N/m^2$