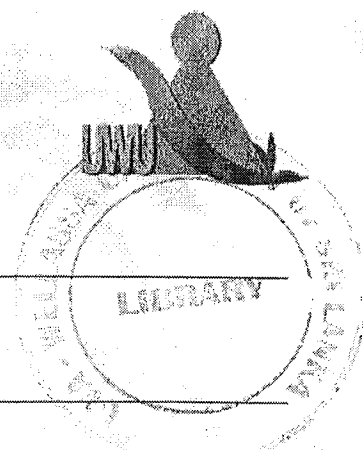




Wellassa University, Sri Lanka
End Semester Examination – March 2010
PHY 151-1 Physics I

Time: One (01) hour



Total 04 Questions
Answer All questions

1. A pulley consists of two disks as shown in Fig Q1, is free to rotate about a fixed horizontal axis through the center O . A weight W is suspended from a string wound around the smaller disk. Show that;

- a. Angular acceleration of the pulley is $\frac{Wag}{Wa^2 + \omega K^2}$
b. Tension in the string is $\frac{\omega WK^2}{Wa^2 + \omega K^2}$

Where a is the radius of the inner disk, K is the radius of gyration and ω is the weight of the pulley system.

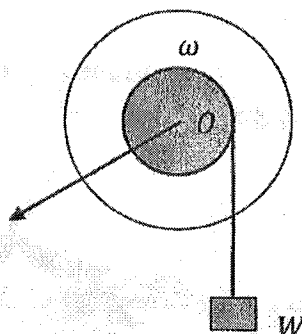


Fig Q1

Hint:

$$K = \sqrt{\frac{I}{M}} ; \text{ Where } I = \text{moment of inertia}$$

$M = \text{mass}$

(25 marks)

2. a. State the Newton's law of gravitation and derive the dimensions of the gravitational constant G in terms of mass M , length L and time T .
b. If radius and mass of the earth are R and M respectively, obtain expressions for
i. Orbital velocity
ii. Period of revolution.

Where a satellite of mass m revolving at height h above surface of the earth.

- c. A satellite is in a circular orbit at 600km above earth surface. The acceleration of gravity 8.2ms^{-2} at the altitude. The radius of the earth is 6400km. Determine;
- The speed of the satellite
 - Period of revolution around the earth

(25 marks)

3. a. Using the principle of conservation of angular momentum, show that the line joining a planet and the satellite sweeps equal areas at equal times when the satellite moves in an elliptical orbit around the planet.
- b. Determine the ratio between the greatest and the least distances between the satellite and the planet. The maximum and the minimum velocities of a satellite which is moving on an elliptical orbit around the planet are 13.2kms^{-1} and 8.2kms^{-1} respectively.
- c. Determine the least distance between the satellite and the planet, if the greatest distance is 53900km.

(25 marks)

4. An electron enters to a region where uniform electric field of $E = 200\text{NC}^{-1}$ as Fig Q4, with initial velocity of $V_0 = 3 \times 10^6\text{ms}^{-1}$.
- Find the acceleration (a) of the electron while in the electric field.
 - Find the time (t) takes the electron to travel through the region of electric field.
 - What is the vertical displacement (y) of the electron while it is in the electric field?
 - Find the speed of the electron (v) as it emerges from the electric field.

Charge of an electron (e) = $1.6 \times 10^{-19}\text{C}$, mass of an electron (m) = $9.1 \times 10^{-31}\text{kg}$

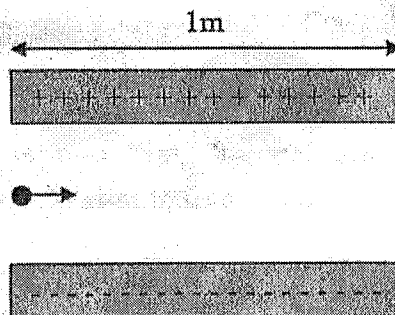


Fig Q4

(25 marks)