

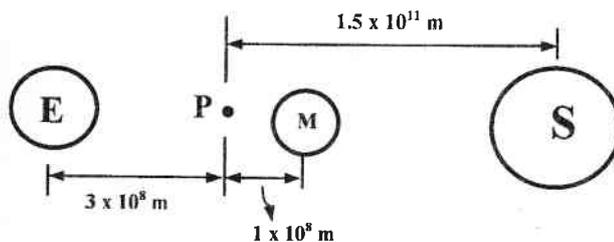
Bago University
Department of Physics
First Semester Examination, March 2019

First Year (BSc)
(Physics Specialization)

Phys 1101
General Physics I
Time Allowed: (3) Hours

Answer any Six questions.

- 1 (a) Is there an acceleration involved in projectile motion? Explain. Write down the equations for (i) maximum height, (ii) time of flight and (iii) maximum horizontal length of projectile motion.
(b) A communications satellite in a circular orbit at an altitude of 500 km makes one complete revolution in 95 minutes. What is the centripetal acceleration of the satellite?
($r = R_e + h$, $R_e = 6.4 \times 10^6 \text{m}$)
- 2 (a) Explain moment of inertia, mention its SI unit. What kinds of energy does a rolling object have? Write down them in equation.
(b) A solid wheel and a spoked wheel of equal mass and radius (20 kg and 0.50 m) are set into rotation by descending masses of 4.0 kg. What is the angular acceleration of each object?
- 3 (a) Define angular momentum. What is the angular momentum of the Earth due to its daily rotation?
($M_E = 6 \times 10^{24} \text{kg}$, $R_E = 6400 \text{km}$)
(b) Write down the equation of moment of inertia for (i) sphere, (ii) circular disc and (iii) spoked wheel. A particle in a disk rotating with a uniform angular speed of 2.0 rps is 0.20 m from the axis of rotation. What are the tangential speed of the particle and the angle through which it rotates in 0.50 s?
- 4 (a) State the Newton's law of gravitation in words and symbols. Also define gravitational field. Why can the acceleration due to gravity near the earth's surface be considered to be constant for most practical purposes?
(b) Find the resultant gravitational field at the location of a spacecraft which is at a point P between the earth and the moon. It is new moon, with the moon on a line between earth and sun; the sun is $1.5 \times 10^{11} \text{m}$ from point P.
(Masses: $m_{\text{earth}} = 6.0 \times 10^{24} \text{kg}$; $m_{\text{moon}} = 7.4 \times 10^{22} \text{kg}$; $m_{\text{sun}} = 2.0 \times 10^{30} \text{kg}$)



- 5 (a) What is friction? State the law of friction and explain the coefficient of static friction and kinetic friction.
(b) A box that weights 100N is being steadily dragged along the floor by a rope that makes an angle 30° with the horizontal. If the tension in the rope is 40N, what is the force of friction? What is the coefficient of friction?
- 6 (a) Express the efficiency of a machine. Why efficiency of a machine is always less than 1.0 or 100 percent? A small gasoline engine has a power input of 4.6 hp and measured brake horsepower of 3.5 hp. (i) What is the engine's efficiency? (ii) How much energy is lost in 10 min of operation?
(b) A 100 hp motor raises a 2080 lb elevator 200ft in 10.0 s. What is the efficiency of the elevator system? How much energy is lost during the 10.0s?

- 7 (a) Define viscosity. How does viscosity generally vary with temperature (i) in liquids and (ii) in gases?
- (b) A 10 kg block of wood 30 cm on a side is held submerged under water. What force is required to do this?
- 8 (a) Describe the Doppler effect. A small stick floating in a lake is observed to bob up and down 15 times in 60 seconds owing to a periodic surface disturbance. If the wave crests are 4.0 ft apart, what is the wave speed of the disturbance?
- (b) A driver of a car blows the horn, which has a frequency of 500 Hz, as it passes by a stationary observer. If the car travels at 60 mi h^{-1} , what is the frequency of the horn as heard by the observer (i) as the car approaches and (ii) as the car recedes? (Assume the speed of sound to be 1088 ft/s).
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