INTI
International College Penang
LAUREATE INTERNATIONAL UNIVERSITIES

FINAL
Examination Paper

(COVER PAGE)

Session	:	**August 2017**
Programme	:	Foundation in Science (CFSI)
Course	:	**PHY1203: Physics 1**
Date of Examination	:	13 December 2017 (Wednesday)
Time	:	11:00am – 1:00pm Reading Time : Nil
Duration	:	2 hours

Special Instructions :

This paper consists of **FIVE (5)** questions. Answer any **FOUR (4)** questions in the answer booklet provided. All questions carry equal marks.

Materials permitted :

Non-Programmable Scientific Calculator

Materials provided :

Physics Booklet

Examiner(s) : **Adele Kam**

Moderator : Assoc. Prof. Dr. Khoo Bee Ee

This paper consists of 7 printed pages, including the cover page.

INTI INTERNATIONAL COLLEGE PENANG

FOUNDATION IN SCIENCE (CFSI)
PHY1203: PHYSICS 1
FINAL EXAMINATION: AUGUST 2017 SESSION

Instructions: This paper consists of **FIVE (5)** questions. Answer any **FOUR (4)** questions in the answer booklet provided. All questions carry equal marks.

Question 1

(a)

(i) The fastest growing plant on record is a *Hesperoyucca whipplei* that grew 3.7 m in 14 days. Determine its growth rate in micrometers per second. (3 marks)

(ii) One cubic foot of substance *X* has a mass of 125 pounds. Determine its density in kg/m^3. (Given 1 pound = 0.454 kg, 1 foot = 0.3048 m) (4 marks)

(b) A particle's position is given by $x = 4 - 12t + 3t^2$ (where t is in seconds and x is in meters).

(i) What is its velocity at $t = 1$ s? (2 marks)

(ii) Is it moving in the positive or negative direction of x just then? Explain. (2 marks)

(iii) Is there ever an instant when the velocity is zero? Explain. (2 marks)

(iv) Is this particle moving with constant acceleration? Explain. (2 marks)

(c) Two vectors are given as: $\vec{a} = 3\hat{\imath} - 5\hat{\jmath} + 2\hat{k}$ and $\vec{b} = 4\hat{\imath} - \hat{\jmath} - 7\hat{k}$. Determine

(i) $\vec{a} \cdot \vec{b}$ (2 marks)

(ii) The magnitude of the vectors, $|\vec{a}|$ and $|\vec{b}|$ (2 marks)

(iii) The angle between $\vec{a}$ and $\vec{b}$ (2 marks)

(iv) $\vec{b} \times \vec{a}$ (2 marks)

(v) $2\vec{b} - \vec{a}$ (2 marks)

Question 2

(a) A ball is thrown toward a wall at speed 25.0 m/s and at angle $\theta_0 = 40.0°$ above the horizontal as shown in Figure 2(a). The wall is distance d = 22.0 m from the release point of the ball.

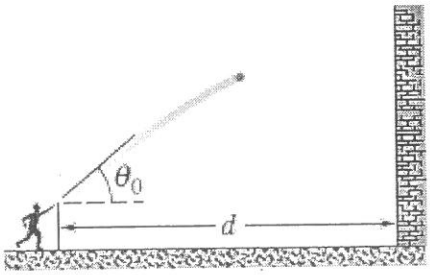

Figure 2 (a)

(i) How far above the release point does the ball hit the wall? (6 marks)

(ii) What are the horizontal and vertical components of its velocity as it hits the wall? (3 marks)

(iii) When it hits, has it passed the highest point on its trajectory? Explain. (2 marks)

(b) In Figure 2(b), block 1 of mass m_1 = 2.0 kg and block 2 of mass m_2 = 3.0 kg are connected by a string of negligible mass and are initially held in place. Block 2 is on a frictionless surface tilted at θ= 30°. The coefficient of kinetic friction between block 1 and the horizontal surface is 0.25. The pulley has negligible mass and friction. Once they are released, the blocks move.

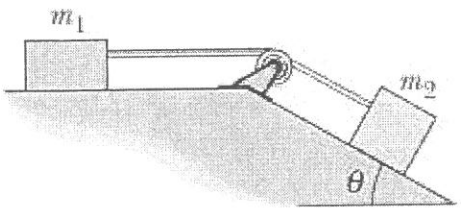

Figure 2(b)

(i) Determine the acceleration of the blocks. (6 marks)

(ii) Determine the tension in the string. (3 marks)

(c) An electric vehicle starts from rest and accelerates at a rate of 2.0 m/s^2 in a straight line until it reaches a speed of 20 m/s. The vehicle then slows at a constant rate of 1.0 m/s^2 until it stops. How much time elapses from start to stop? (5 marks)

Question 3

(a) A sliding 2.0 kg block, as shown in Figure 3(a), collides into and compresses a horizontal spring 4.0 cm from its rest position. The spring constant, k, is 350 N/cm and the coefficient of friction between the block and the sliding surface is 0.32. Determine the speed of the block when it contacts the spring.

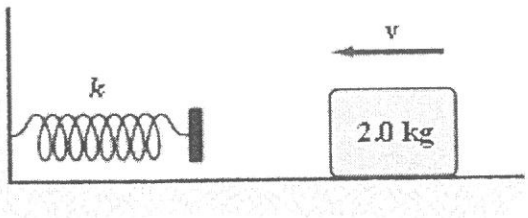

Figure 3(a) (8 marks)

(b) A wooden block is freely supported on brackets at a height 4.0 m above the ground as shown in Figure 3(b). A bullet of mass 5.0 g is shot vertically upwards into the wooden block of mass 95 g. It embeds itself in the block. The impact causes the block to rise above the supporting brackets. The bullet hits the block with a velocity of 200 m/s. How far above the ground will the block be at the maximum height of its path?

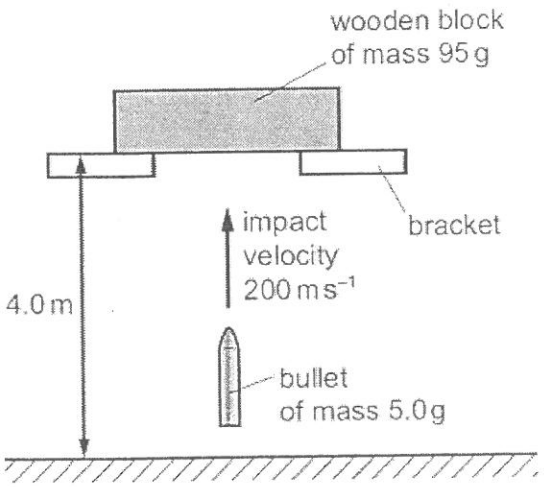

Figure 3(b) (7 marks)

(c) A circular disk of radius 50 cm starts from rest at t = 0s, and rotates with a constant angular acceleration of 3.6 rad/s^2. Its rotational inertia is 3.3 kgm^2. At t = 3.1 s of its rotation, determine

(i) The angular speed of the disk. (2 marks)

(ii) The number of revolutions the disk has rotated. (2 marks)

(iii) The net torque acting on the disk. (2 marks)

(iv) The work done by the net torque acting on the disk. (2 marks)

(v) The tangential acceleration of the disk. (2 marks)

Question 4

(a) A ball rolls down a ramp from rest without slipping as shown in Figure 4(a). The ball has a diameter of 12 cm and a mass of 6 kg. The height of the stand is 2 m. Determine the angular speed of the ball just before it reaches the floor. Given $I_{ball} = \frac{2}{5}MR^2$.

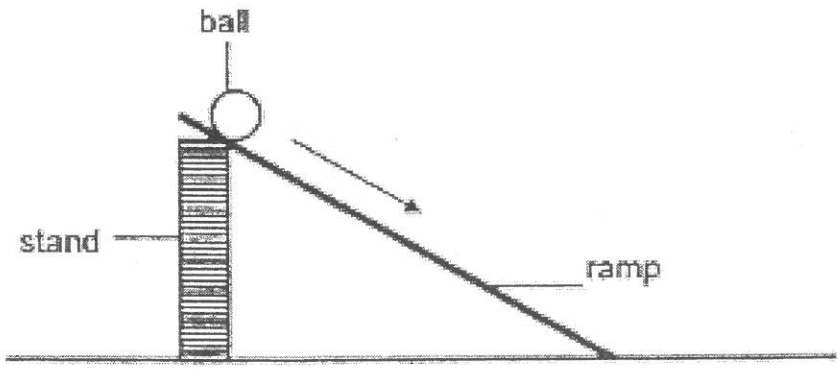

Figure 4(a) (8 marks)

(b) Figure 4(b) (not to scale) shows one alignment of the sun, earth, and moon. The gravitational force vector F_{SM} that the sun exerts on the moon is perpendicular to the force vector F_{EM} that the earth exerts on the moon. The masses are: mass of sun = 1.99 x 10^{30} kg, mass of earth = 5.98 x 10^{24} kg, mass of moon = 7.35 x 10^{22} kg. The distances shown in the drawing are r_{SM} = 1.50 x 10^{11} m and r_{EM} = 3.85 x 10^8 m. Determine the magnitude of the net gravitational force on the moon.

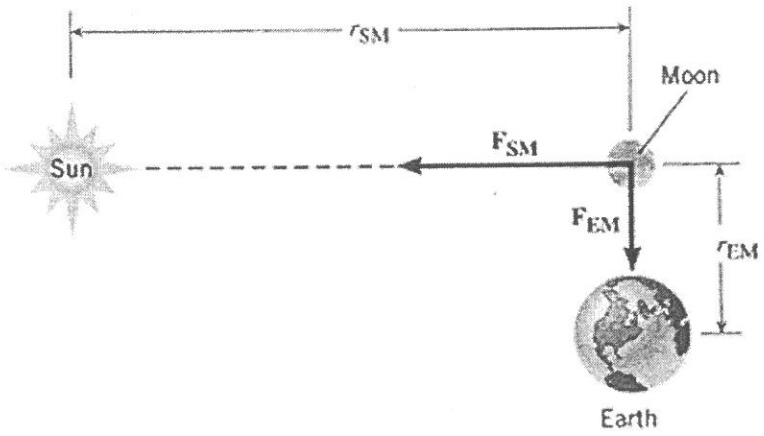

Figure 4(b) (8 marks)

(c) A standard basketball has a mass of 624 g and a diameter of 24.3 cm. (Density of water = 1000 kg/m^3.)

(i) If the ball is held fully under water, calculate the buoyant force acting on the ball. (4 marks)

(ii) When released, the ball would float. Explain why. (2 marks)

(iii) What percentage of the ball would sink in the water after its release? (3 marks)

Question 5

(a) A mass of 2 kg oscillating on a spring with constant 4 N/m passes through its equilibrium point with a velocity of 8 m/s.

(i) What is the energy of the system at the equilibrium point? (2 marks)

(ii) From the answer in part (i) derive the maximum displacement, x_m of the mass. What is the assumption made in your calculation? (3 marks)

(iii) What is the period of oscillation for the system? (2 marks)

(b) The linear density of a string is 1.6 x 10^{-4} kg/m. A transverse wave on the string is described by the equation $y = (0.021\ \text{m}) \sin [(2.7\ \text{m}^{-1})x + (20\ \text{s}^{-1})t]$.

(i) What is the wave speed? (2 marks)

(ii) What is the tension in the string? (2 marks)

(iii) What is the wavelength of the transverse wave? (2 marks)

(c) A fire truck emits an 880 Hz siren. As the truck approaches a stationary observer on the sidewalk, he perceives the pitch to be 950 Hz. What pitch will he hear after the truck passes and is moving away? Assume the truck's velocity remains constant, and that the velocity of sound in air is 340 m/s. (5 marks)

(d) Asbestos layer whose thickness is 20 mm is used as an insulator over a boiler wall. Consider an area of 0.9 m^2 and calculate the rate of heat flow over this area if the temperatures on either side of the insulation are 400°C and 30°C. Given the thermal conductivity is 0.116 W/mK. (3 marks)

(e) A 50 L sealed cylinder contains 100 moles of helium gas. Its pressure at 0°C is 4.54 x 10^6 Pa. What is the change in pressure when the gas is heated to 227°C? (1L = 1000 cm^3) (4 marks)

~ The End ~

phy1203(f)/aug2017/formatted