INTI International College Penang

FINAL
Examination Paper

(COVER PAGE)

Session	:	August 2019
Programme	:	Foundation In Science (CFSI)
Course	:	**PHY1205: Physics 1**
Date of Examination	:	12 December 2019 (Thursday)
Time	:	8:00AM – 10:00AM Reading Time : Nil
Duration	:	2 Hrs

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	:	**Dr. Khoo Bee Ee**

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

INTI INTERNATIONAL COLLEGE PENANG

FOUNDATION IN SCIENCE (CFSI)
PHY1205: PHYSICS 1
FINAL EXAMINATION: AUGUST 2019 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) A certain species of plant grows 1.3 m in 20 days. Determine its growth rate in nanometers per second. (4 marks)

(ii) The density of Barium is 236 lb/ft^3. Determine its density in kg/m^3. (Given 1 pound (lb) = 0.454 kg, 1 foot (ft) = 0.3048 m) (4 marks)

(b) A ball is thrown vertically upward at ground level with a speed of 30.0 m/s.

(i) How high does it rise? (3 marks)

(ii) How long does the ball take to hit the ground? (4 marks)

(iii) What is its velocity when it returns to the level from which it started? (2 marks)

(c) A bicycle travels 3.7 km due east, then 4.4 km at 15.0° east of north, and finally another 2.1 km due south to reach its destination. The time lost in turning is negligible. Calculate the magnitude and direction of the bicycle's net displacement. (8 marks)

Question 2

(a) Figure 2(a) shows the motion path of a cannonball. The cannon sits on a cliff of 60 m height. The cannonball was launched with an initial velocity of 25 m/s at an angle of 53° with the horizontal.

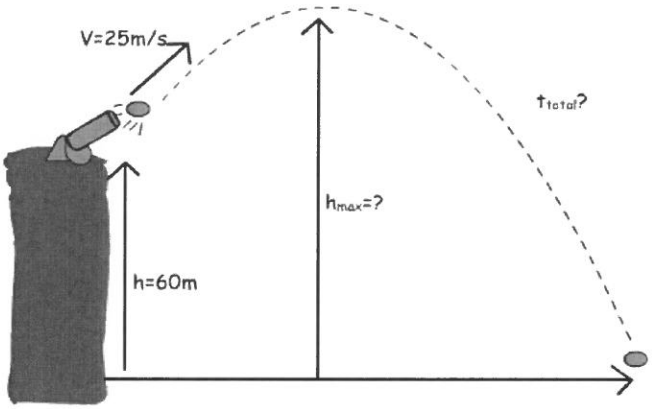

Figure 2(a)

Determine the

(i) maximum height it can reach (measured from the ground). (4 marks)

(ii) total flight time. (4 marks)

(b) The system in Figure 2 (b) below includes 3 blocks of masses m_1 = 2 kg, m_2 = 3 kg and m_3 = 5 kg linked by massless and frictionless strings and pulleys.

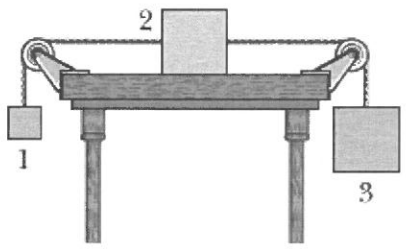

Figure 2(b)

(i) Find the magnitude of the acceleration of the 3 blocks. (3 marks)

(ii) Find the magnitude of the tension of the string between m_1 and m_2. (3 marks)

(iii) Find the magnitude of the tension of the string between m_2 and m_3. (3 marks)

(c) (i) A 50.0 N force is applied horizontally to a 12.0 kg block which is initially at rest. After traveling 6.45 m, the speed of the block is 5.90 m/s. What is the coefficient of kinetic friction? (5 marks)

(ii) In Figure 2(c) below, the spring has a force constant of 5000 N/m, the block has a mass of 6.20 kg, and the height h of the hill is 5.25 m. Determine the compression of the spring such that the block just makes it to the top of the hill. Assume that there are no frictional forces involved. (3 marks)

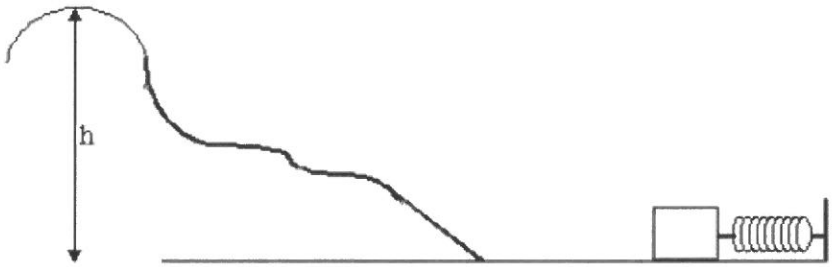

Figure 2(c)

Question 3

(a) (i) A 0.5 kg ball hits a wall with a velocity of 10 m/s to the left. The ball hits the wall and bounces off with a velocity of 8 m/s to the right. What is the average force exerted by the wall on the ball if the ball is in contact with wall for 0.1 s? (4 marks)

(ii) A constant force of 120 N acts for 6 s on a box of mass 8 kg horizontally that initially rests on a horizontal frictionless surface. Determine the change in the box's momentum and calculate the final speed of the box after 10 s have passed. (4 marks)

(b) The angular position of a point on a rotating wheel is given by $\theta = 3t^3 - 2t^2 + 5t$, where θ is in radians and t is in seconds. Determine its

(i) angular velocity at $t = 4.0$ s. (2 marks)

(ii) angular acceleration at $t = 2.0$ s. (2 marks)

(c) A circular disk of radius 60 cm starts from rest, and rotates with a constant angular acceleration of 2.8 rad/s^2. After 4 s of rotation, determine

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

(ii) The number of revolutions the disk has rotated. (3 marks)

(d) A wheel rolls on a horizontal surface as shown in Figure 3 (d). The diameter of the wheel is 0.8 m and the acceleration of the center of mass is 0.5 m/s^2 when a frictional force of 3.5 N acts on the wheel. Determine the rotational inertia of the wheel about the rotational axis through the center of mass. (4 marks)

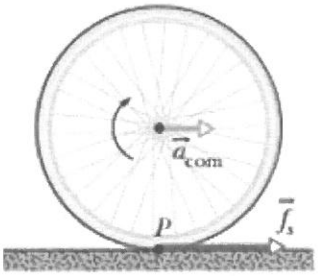

Figure 3(d)

(e) A machinist is using a wrench to loosen a nut. The wrench is 25.0 cm long, and he exerts a 17.0 N force at the end of the handle at 37° as shown in Figure 3(e).

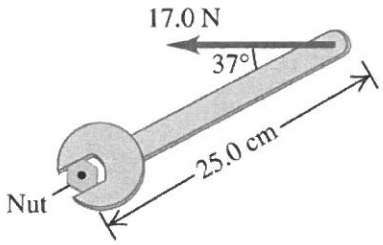

Figure 3(e)

(i) What is the magnitude of the torque the machinist exerts about the center of the nut? (2 marks)

(ii) What is the maximum torque he could exert with this force? (2 marks)

Question 4

(a) Three 5.0 kg spheres are located in the *xy* plane as shown in Figure 4(a). d_1 = 0.3 m and d_2 = 0.5 m. What is the magnitude of the net gravitational force on sphere A due to the other two spheres? (9 marks)

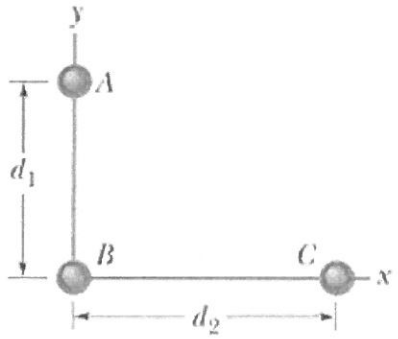

Figure 4(a)

(b) The mean radius of Venus and Earth are 6.05 x 10^3 km and 6.37 × 10^3 km respectively. The mass of Venus in 0.8 times Earth's mass. Earth's mass is 5.98 × 10^{24} kg. Determine

(i) The altitude above Earth's surface where the gravitational acceleration would be 5.8 m/s^2. (4 marks)

(ii) The escape speed in Venus? (4 marks)

(c) (i) A plastic cube with the dimensions 0.15 m x 0.15 m x 0.15 m floats in a tub of water. The cube is submerged to a height of 0.045 m. What is the mass of the cube? (5 marks)

(ii) A hydraulic lift consists of two pistons; the small piston has a cross sectional area of 5.0 cm^2 and the large piston has a cross sectional area of 300.0 cm^2. What force should be applied to the small piston in order to lift a 2000 kg van on the large piston? (3 marks)

Question 5

(a) An object with a mass of 36 g oscillates in simple harmonic motion with a frequency of 2.8 Hz and an amplitude of 4.0 cm.

(i) What is the total distance travelled by the particle in one cycle of its motion? (1 mark)

(ii) What is its maximum speed of this object and at what position does that occur? (4 marks)

(iii) What is the maximum acceleration of this object and at what position does that occur? (3 marks)

(b) The equation of a transverse wave traveling along a very long string is given by

$$y = 2.3 \sin (0.19 x + 6.6 t)$$

where x and y are expressed in meters and t is in seconds. Determine

(i) the wavelength (2 marks)

(ii) the frequency (2 marks)

(iii) the speed (2 marks)

(iv) the maximum transverse speed of a particle in the string (2 marks)

(c) (i) A square sheet of iron, 30 cm on each side, is initially at 25°C. Determine the change in its area when its temperature is raised to 100°C. The coefficient of linear expansion for iron is 11.8×10^{-6} °C^{-1}, (3 marks)

(ii) The conduction rate per unit area through a polymer slab 0.38 cm thick is 9.1 mW/cm^2 when the inner and outer surface temperatures are 70°C and 30°C, respectively. Determine the thermal conductivity of the polymer. (3 marks)

(iii) Calculate the rate of heat transfer by radiation from a hot object at 350°C into a 25°C environment, if the object has an emissivity of 0.680 and a 0.66 m^2 surface area. (3 marks)

~ The End ~