INTI International College Penang
LAUREATE INTERNATIONAL UNIVERSITIES

FINAL
Examination Paper

(COVER PAGE)

Session	:	**April 2017**
Programme	:	Foundation In Science (CFSI)
Course	:	**PHY1203: Physics 1**
Date of Examination	:	28 July 2017 (Friday)
Time	:	2:00pm – 4:00pm 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 : 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: APRIL 2017 SESSION

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Question 1

(a) The Concorde is the fastest airliner used for commercial services. It cruises at 1300 mi/h. 1 mile = 1609 m. What is the cruise speed of the Concorde in

(i) km/h? (2 marks)

(ii) m/s? (4 marks)

(b) An automobile traveling with constant velocity of 20 m/s passes a school-crossing corner, where the speed limit is 10 m/s. Just as the automobile passes, a police officer on a motorcycle stopped at the corner start off in pursuit with constant acceleration of 5.0 m/s^2.

(i) How much time elapses before the officer catches up with the automobile? (5 marks)

(ii) What is the officer's speed at that point? (2 marks)

(iii) What is the total distance each vehicle has traveled at that point? (2 marks)

(c) Three vectors are given by $\vec{A} = 3\hat{\imath} + 3\hat{\jmath} - 2\hat{k}$, $\vec{B} = -\hat{\imath} - 4\hat{\jmath} + 2\hat{k}$ and $\vec{C} = 2\hat{\imath} + 2\hat{\jmath} + \hat{k}$. Find

(i) $\vec{A} \times (\vec{B} + \vec{C})$ (5 marks)

(ii) $\vec{A} \cdot (\vec{B} \times \vec{C})$ (5 marks)

Question 2

(a) A small ball rolls horizontally off the edge of a tabletop that is 1.20 m high. It strikes the floor at a point 1.52 m horizontally from the table edge.

(i) How long is the ball in the air? (3 marks)

(ii) What is its speed at the instant it leaves the table? (2 marks)

(b) Block A with mass of 4.0 kg and block B with mass 1.5 kg are connected with a light string as shown in Figure 2(b) below.

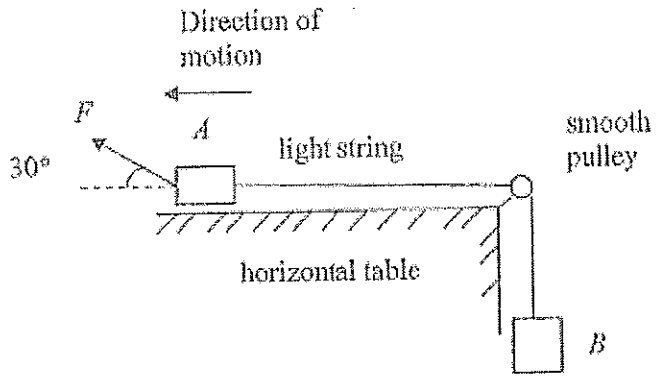

Figure 2(b)

The string can be assumed as massless, the pulley can be assumed as massless and frictionless, and the surface of the table is frictionless. At the instant $t = 0$, block A is pulled by a force, $F = 25$ N, in the direction shown. It begins to move left.

(i) Draw free body diagrams for each block and label all the forces acting on these blocks. (3 marks)

(ii) Determine the acceleration of the system of block and tension of the string. (5 marks)

(iii) Calculate the work done by gravitational force on Block B after it has moved upwards for the distance of 1.0 m. (2 marks)

(c) A block of mass 0.50 kg is placed against a spring of spring constant 1000 N/m attached to one end of a plane inclined at 53° as in in Figure 2(c).

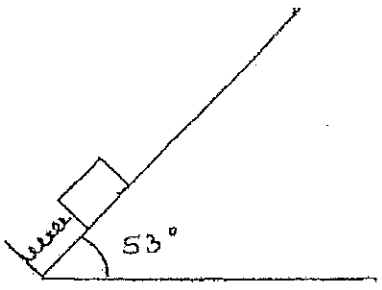

Figure 2(c)

The spring is compressed 0.20 m and the block is released from rest. Use conservation of energy methods to find the velocity of the block after it has slid 2.0 m up the plane if the coefficient of friction between the block and the plane is 0.30 s. (10 marks)

Question 3

(a) An object A of mass 4.2 kg and horizontal velocity 3.6 m s^{-1} moves towards object B as shown in Figure 3(a)(i).

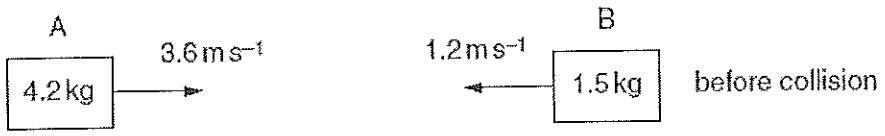

Figure 3(a)(i)

Object B of mass 1.5 kg is moving with a horizontal velocity of 1.2 m s^{-1} towards object A. The objects collide and then both move to the right, as shown in Figure 3(a)(ii).

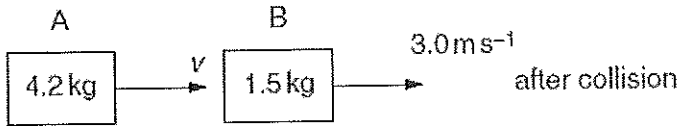

Figure 3(a)(ii)

Object A has velocity v and object B has velocity 3.0 m s^{-1}.

(i) Calculate the velocity v of object A after the collision (2 marks)

(ii) Determine whether the collision is elastic or inelastic. (3 marks)

(b) A disk rotates about its central axis from rest and accelerates with constant angular acceleration. At one time it is rotating at 10 rev/s; 60 revolutions later, its angular speed is 15 rev/s. Calculate:

(i) the angular acceleration in rad/s^2. (3 marks)

(ii) the time required to complete the 60 revolutions. (3 marks)

(iii) the time required to reach the 10 rev/s angular speed. (3 marks)

(iv) the number of revolutions from rest until the time the disk reaches the 10 rev/s angular speed. (3 marks)

(c) A constant horizontal force of magnitude 10 N is applied to a wheel of mass 10 kg and radius 0.30 m as shown in Figure 3 (c) below.

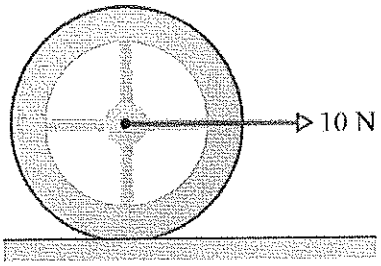

Figure 3(c)

The wheel rolls smoothly on the horizontal surface, and the acceleration of its center of mass has magnitude 0.60 m/s^2.

(i) Determine the magnitude and direction of the frictional force on the wheel. (3 marks)

(ii) Determine the rotational inertia of the wheel about the rotation axis through the center of mass? (5 marks)

Question 4

(a) Venus and Neptune orbit the sun (assume that the orbits of both planets are circular.). Data for the planets radius, r, and period, T, about the sun is given in the Table 4(a) below.

planet	r / 10^8 km	T / years
Venus	1.08	0.615
Neptune	45.0	

Table 4(a)

(i) Calculate the value of T for Neptune. (5 marks)

(ii) Determine the linear speed of Venus in its orbit. (3 marks)

(b) Three liquids that will not mix are poured into a cylindrical container. The volumes and densities of the liquids are 0.50 L, 2.6 g/cm^3; 0.25 L, 1.0 g/cm^3; and 0.40 L, 0.80 g/cm^3. What is the force on the bottom of the container due to these liquids? One liter = 1 L = 1000 cm^3. (Ignore the contribution due to the atmosphere.) (8 marks)

(c) A block of wood floats in fresh water with two-thirds of its volume V submerged and in oil with $0.90V$ submerged. The density of water is 1000 kg/m^3. Find the density of

(i) the wood. (5 marks)

(ii) the oil. (4 marks)

Question 5

(a) A mass of 78 g is suspended from a fixed point by means of a spring, as illustrated in Figure 5(a).

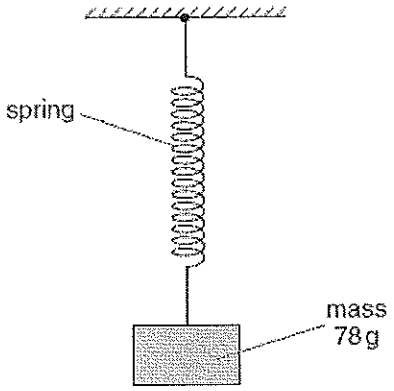

Figure 5(a)

The stationary mass is pulled vertically downwards through a distance of 2.1 cm and then released. The mass is observed to perform simple harmonic motion with a period of 0.69 s. The mass is released at time $t = 0$. For the oscillations of the mass,

(i) calculate the angular frequency ω. (2 marks)

(ii) determine the numerical equation for the variation with time t of the displacement x in cm. (2 marks)

(iii) determine the numerical equation for the variation with time t of the speed v in m/s. (3 marks)

(iv) calculate the total energy of oscillation of the mass. (3 marks)

(b) The pressure in a traveling sound wave is given by the equation

$$P = (1.50 \text{ Pa}) \sin \pi [(0.900 \text{ m}^{-1}) x + (315 \text{ s}^{-1})t].$$

Find the

(i) pressure amplitude. (1 mark)

(ii) frequency. (2 marks)

(iii) wavelength. (2 marks)

(iv) speed of wave. (2 marks)

(c) An ambulance with a siren emitting a whine at 1600 Hz overtakes and passes a cyclist pedaling a bike at 2.44 m/s. After being passed, the cyclist hears a frequency of 1590 Hz. The speed of sound in air is 343 m/s. How fast is the ambulance moving? (4 marks)

(d) The length of an aluminum bar is 2.725 cm at 0°C. The coefficient of linear expansion of aluminum is $\alpha_{Al} = 23 \times 10^{-6}/C°$. What is its length when the temperature of the bar is raised to 100°C? (4 marks)

~ The End ~