INTI International College Penang

FINAL
Examination Paper

(COVER PAGE)

Session	:	August 2018
Programme	:	Foundation In Science (CFSI)
Course	:	**PHY1205: Physics 1**
Date of Examination	:	12 December 2018 (Wednesday)
Time	:	8:00AM – 10:00AM Reading Time : -
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)
PHY1205: PHYSICS 1
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Question 1

(a) (i) The diameter of a dust particle is 0.5 μm. Assuming the dust particle to be spherical, determine its volume in mm^3. (4 marks)

(ii) A 64 in^3 (4in x 4in x 4in) block of basalt weighs 116 ounces. Convert the basalt's density to g/cm^3. (1 g = 0.035274 oz, 1 cm = 0.3937 inches). (5 marks)

(b) Is it possible for a car to have accelerated from rest to 90 km/h within 200 m if the car can only accelerate from 0 to 100 km/h in 15 s? Explain by showing relevant calculations. (8 marks)

(c) Three forces act on a point: 3 N at 0°, 4 N at 90°, and 5 N at 217° as shown in Figure 1(c). Calculate the magnitude and direction of the net force.

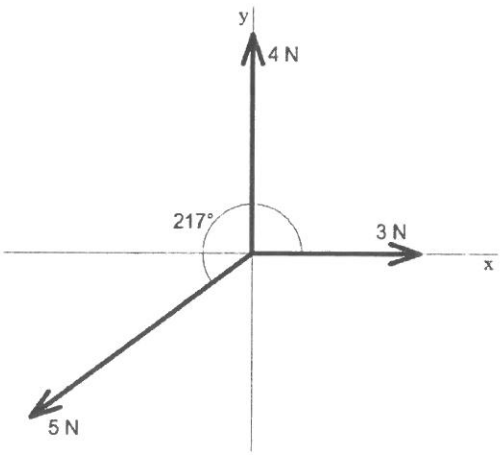

Figure 1(c)

(8 marks)

Question 2

(a) An object is launched at a velocity of 20 m/s in a direction making an angle of 25° upward with the horizontal.

(i) What is the maximum height reached by the object? (4 marks)

(ii) What is the total flight time (between launch and touching the ground) of the object? (4 marks)

(iii) What is the magnitude of the velocity of the object just before it hits the ground? (4 marks)

(b) As shown in Figure 2(b), two blocks are connected by a rope that passes over a set of pulleys.

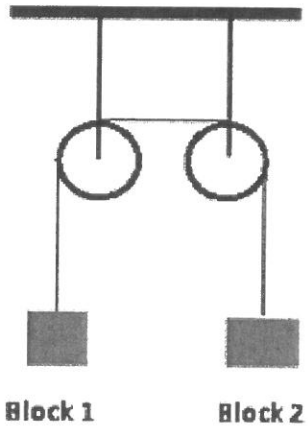

Figure 2(b)

Block 1 has a weight of 400 N, and the Block 2 has a weight of 600 N. The rope and the pulleys are massless and there is no friction. Determine the

(i) acceleration of the system of blocks. (3 marks)

(ii) tension of the string. (3 marks)

(c) A 35 kg crate, as shown in Figure 2(c), undergoes an acceleration of 1.5 m/s^2 along an incline when pulled by a 300.0 N force, F.

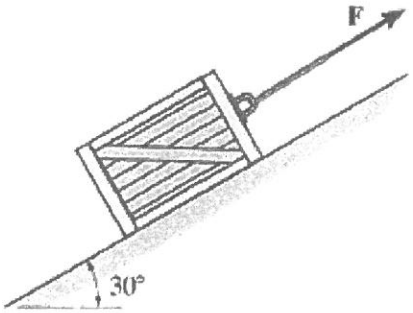

Figure 2(c)

(i) Draw a free body diagram and label all forces acting on the crate. (2 marks)

(ii) Determine the coefficient of kinetic friction between the crate and the incline surface. (5 marks)

Question 3

(a) A block of mass m = 2 kg is attached to a spring whose spring constant is k = 8 N/m. The block slides on an incline with $\mu_k = \frac{1}{8}$, $\theta = 37°$. If the block starts at rest with the spring unextended, what is its speed when it has slid a distance d = 0.5 m down the incline?

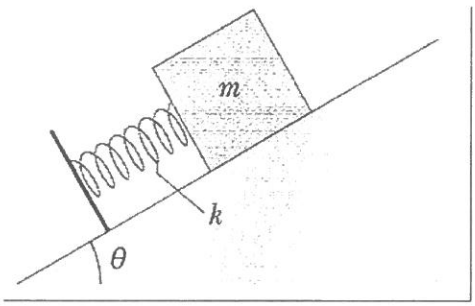

Figure 1(a) (9 marks)

(b) (i) A ball of mass 1.8 kg drops vertically and hits a steel plate at 26 m/s and bounces with an initial speed of 14 m/s. The collision with the steel plate lasts for 0.03 s. Determine the average force on the steel plate from the ball. (4 marks)

(ii) Toy car **A** of mass 0.30 kg moves along a frictionless surface with a velocity of 0.20 m/s. It collides with another toy car **B**, with a mass of 0.40 kg and a speed of 0.10 m/s in the same direction. After the collision, toy car **A** continues to move in the same direction with a velocity of 0.15 m/s. Calculate the speed of toy car **B** after the collision. (4 marks)

(c) A deep-sea fisherman hooks a big fish that swims away from the boat pulling the fishing line from his fishing reel. The whole system is initially at rest and the fishing line unwinds from the reel at a radius of 4.50 cm from its axis of rotation. The reel is given an angular acceleration of 110 rad/s^2 for 2.00 s.

(i) What is the final angular velocity of the reel? (2 marks)

(ii) At what speed is fishing line leaving the reel after 2.00 s elapses? (2 marks)

(iii) How many revolutions does the reel make? (4 marks)

Question 4

(a) Suppose an ice skater is spinning at 0.800 rev/s with her arms extended. She has a moment of inertia of 2.34 kgm^2 with her arms extended and of 0.363 kgm^2 with her arms close to her body. (These moments of inertia are based on assumptions about a 60.0 kg skater.)

(i) What is her angular velocity in revolutions per second after she pulls in her arms? (3 marks)

(ii) What is the increase in her rotational kinetic energy when she pulls her arms close to her body? (5 marks)

(b) Assume Mercury, Venus and the Sun are aligned in a right triangle, as shown in Figure 4(b). Calculate the vector sum of the forces on Venus due to both Mercury and the Sun. Given the Sun-Venus distance $r_v = 108 \times 10^9$ m, Sun-Mercury distance $r_m = 57.6 \times 10^9$ m, mass of Sun $M_s = 1.99 \times 10^{30}$ kg, mass of Mercury $M_m = 3.3 \times 10^{23}$ kg, and mass of Venus $M_v = 4.87 \times 10^{24}$ kg.

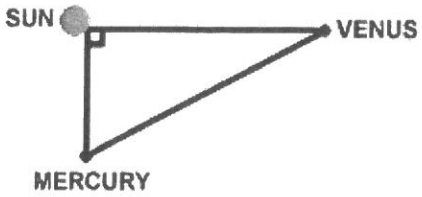

Figure 5(a)

(10 marks)

(c) A hydraulic lift in a garage has two pistons: a small one of cross sectional area 4.00 cm^2 and a large one of cross sectional area 250.0 cm^2.

(i) If this lift is designed to raise a 3500.00 kg car, what minimum force must be applied to the small piston? (4 marks)

(ii) If the force is applied through compressed air, what must be the minimum air pressure applied to the small piston? (3 marks)

Question 5

(a) A trolley is attached to two extended springs, as shown in Figure 5(a).

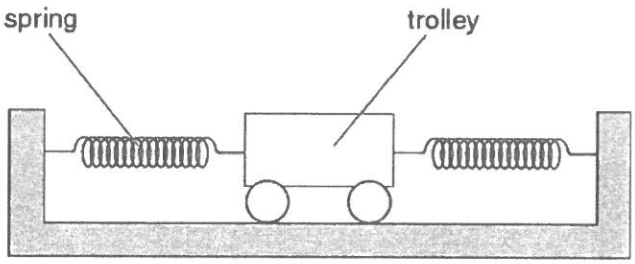

Figure 5(a)(i)

The trolley is displaced along the line joining the two springs and is then released. At one point in the motion, a stopwatch is started. The variation with time t of the velocity v of the trolley is shown in Figure 5(a)(ii).

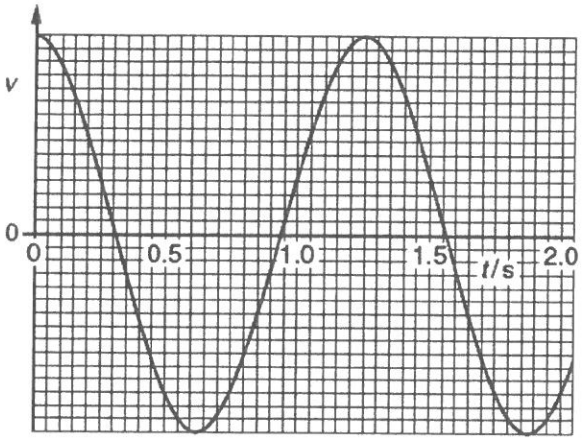

Figure 5(a)(ii)

The motion of the trolley is simple harmonic. The amplitude of vibration of the trolley is 3.2 cm. Determine the

(i) maximum speed, in cm/s, v_0 of the trolley. (4 marks)

(ii) displacement, in cm, of the trolley for a speed of $\frac{1}{2}v_0$. (5 marks)

(b) A rope, under tension of 180 N and fixed at both ends, oscillates in a third-harmonic standing wave pattern. The displacement of the rope is given by

$$y\,(x,t) = 0.30\,(\sin\,(\pi/4)x\,)\,\cos\,8\pi t$$

where $x = 0$ at one end of the rope, x and y are in meters, and t is in seconds. Determine the

(i) length of the rope (4 marks)

(ii) speed of the waves on the rope (2 marks)

(i) mass of the rope (2 marks)

(d) (i) The conduction rate per unit area through a wood slab 50 mm thick, whose inner and outer surface temperatures are 40°C and 20°C, respectively, has been determined to be 40 W/m^2. What is the thermal conductivity of the wood? (3 marks)

(ii) A surface of area 0.5 m^2, emissivity 0.8, and temperature 150°C is placed in a large, evacuated chamber whose walls are maintained at 25°C. What is the net rate at which radiation is exchanged between the surface and the chamber walls? (5 marks)

~ The End ~