



INTI
International College Penang

FINAL
Examination Paper

(COVER PAGE)

Session : April 2018

Programme : Foundation in Science (CFSI)

Course : PHY1203: Physics 1

Date of Examination : 1st August 2018 (Wednesday)

Time : 5:00pm- 7:00pm 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: APRIL 2018 SESSION

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Question 1

- (a)
- (i) Earth is approximately a sphere of radius 6.37×10^6 m. What is its surface area in square kilometers? (4 marks)
 - (ii) A scientist weighs a 1.00 cubic ft piece of granite on a scale and finds that it weighs 171 lbs. Thus he determines that the granite has a density of 171 lb/ft^3 . Convert the granite's density to g/cm^3 . (1 kg = 2.2 lbs, 1 m = 3.28 ft). (4 marks)
- (b) Tony is riding his bicycle at a constant velocity of 18 km/h when he passes Eric who is stationary on his racer bike. Eric races to catch up with Tony with a constant acceleration of 1.0 m/s^2 .
- (i) How long does it take Eric to catch up with Tony? (6 marks)
 - (ii) What is Eric's speed at that point? (2 marks)
- (c) A car is driven east for a distance of 50 km, then north for 30 km, and then in a direction 30° east of north for 25 km.
- (i) Sketch the vector diagram that represents this motion. (2 marks)
 - (ii) How far is the car from the starting point? (5 marks)
 - (iii) In what direction is the car from its starting point? (2 marks)

Question 2

- (a) A projectile is fired horizontally from a gun that is 45.0 m above flat ground, emerging from the gun with a speed of 250 m/s. Neglect air resistance.

- (i) How long does the projectile remain in the air? (2 marks)
- (ii) At what horizontal distance from the firing point does it strike the ground? (2 marks)
- (iii) What is the magnitude of the vertical component of its velocity as it strikes the ground? (4 marks)

- (b) In Figure 2(b), three ballot boxes are connected by cords, one of which wraps over a pulley having negligible friction on its axle and negligible mass. The three masses are $m_A = 30.0$ kg, $m_B = 40.0$ kg, and $m_C = 10.0$ kg.

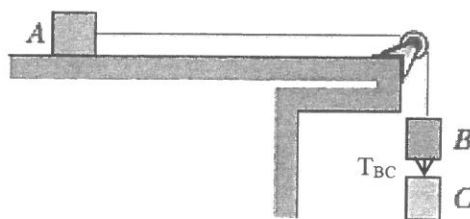


Figure 2(b)

When the assembly is released from rest,

- (i) What is the tension in the cord connecting B and C ? (6 marks)
 - (ii) How far does A move in the first 0.250 s (assuming it does not reach the pulley)? (2 marks)
- (c) A block M_1 with mass 3 kg sits atop an inclined plane as shown in Figure 2(b). The inclined plane is at an angle of $\theta = 30^\circ$ from the horizontal. The coefficient of kinetic friction, μ_k , between block M_1 and the inclined plane is 0.10 . Block M_1 is connected to block M_2 of mass 2 kg through a massless string around an ideal, frictionless pulley. Once they are released, the blocks move with M_2 falling downwards. Determine the acceleration of the blocks.

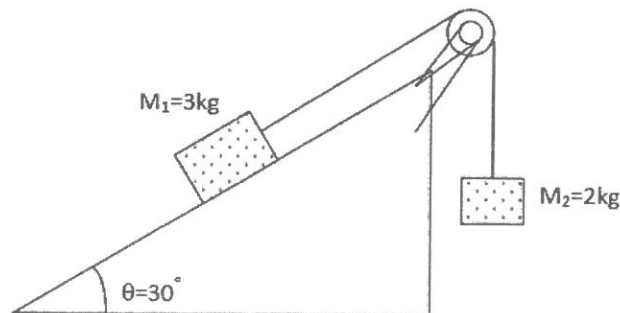


Figure 2(b)

(9 marks)

Question 3

- (a) A box of mass 60 kg starts from rest at a height h and slides down a rough slope of length 10 m, which makes an angle of 25° with the horizontal as shown in Figure 3(a). It undergoes a constant acceleration of magnitude 2 m/s^2 while sliding down the slope.

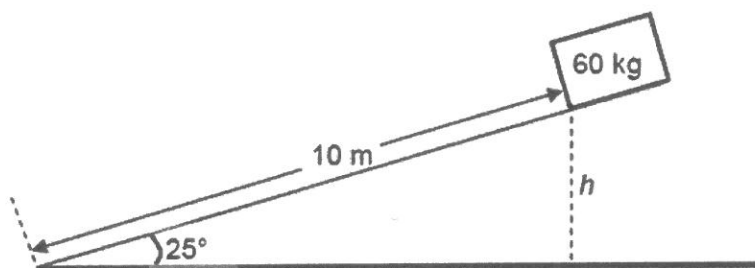


Figure 3(a)

When the box reaches the bottom of the slope, determine the

- (i) kinetic energy of the box. (4 marks)
 - (ii) work done on the box by the gravitational force. (3 marks)
 - (iii) work done on the box by the frictional force. (2 marks)
 - (iv) magnitude of the frictional force acting on the box. (2 marks)
- (b) The drivers of two trucks traveling at the same speed, with truck A having a mass double that of truck B, apply equal forces on the brakes of the trucks to stop them. Explain by relevant equations, which truck would take a longer distance to stop. (6 marks)
- (c) A hammer thrower accelerates the 7.50 kg hammer from rest within four turns and releases it at the speed of 25.0 m/s. Assume a uniform rate of increase in angular velocity and a horizontal circular path of radius 1.20 m. Just before the release, calculate the
- (i) angular acceleration (4 marks)
 - (ii) tangential acceleration (2 marks)
 - (iii) centripetal acceleration (2 marks)

Question 4

- (a) A uniform solid cylinder of mass 3.8 kg has been given just enough energy so that it can roll smoothly up along an incline as shown in Figure 4(a). It moves a total distance of 4.2 m from the bottom of the incline before it starts to roll back down. The initial translational speed of the cylinder is 5.6 m/s. Determine the angle of the incline. Given $I_{cylinder} = \frac{1}{2}MR^2$.

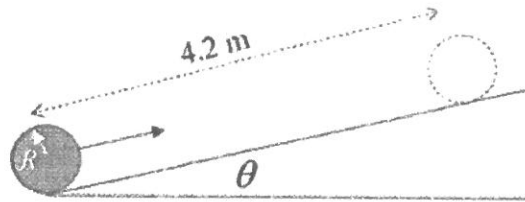


Figure 4(a)

(8 marks)

- (b)
- (i) Find the gravitational force of attraction between the moon and the earth if the mass of the moon is 1/81 times the mass of Earth. Radius of moon's orbit is 3.58×10^5 km. (4 marks)
- (ii) Satellite A is 7 times farther from a planet than satellite B. If satellite B takes 4 weeks to complete a full orbit around the planet, how long (in weeks) will it take satellite A to travel around the planet once? (4 marks)
- (c) Three liquids that will not mix are poured into a cylindrical container. The volumes and densities of the liquids are 0.50 L, 2.5 g/cm³; 0.30 L, 1.2 g/cm³; and 0.40 L, 0.60 g/cm³. What is the force on the bottom of the container due to these liquids? One liter = 1 L = 1000 cm³. (Ignore the contribution due to the atmosphere.) (9 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).

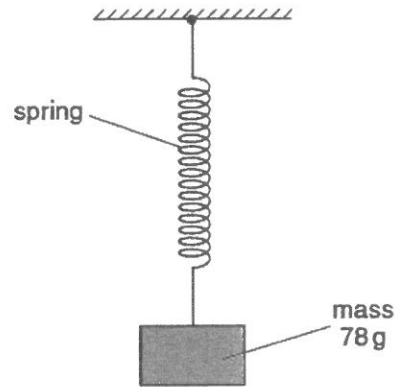


Figure 5(a)

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

$$y = 7.8 \sin(0.040 \pi x + 6.0 \pi t)$$

where x and y are expressed in centimeters 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) The length of an aluminum bar is 3.422 cm at 0°C. The coefficient of linear expansion of aluminum is $\alpha_{Al} = 23 \times 10^{-6}/\text{C}^\circ$. What is its length when the temperature of the bar is raised to 125°C? (4 marks)
- (ii) A 45 L sealed cylinder contains 120 moles of helium gas. Its pressure at 0°C is 4.54×10^6 Pa. What is the change in pressure when the gas is heated to 210°C? (1L = 1000 cm³). (4 marks)

~ The End ~

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