

INTI INTERNATIONAL UNIVERSITY
 FOUNDATION IN SCIENCE (CFSI)
 PHY1203: GENERAL PHYSICS 1
 FINAL EXAMINATION: MAY 2014 SESSION

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) A ball is thrown directly downward with a speed of 4 m/s, from a height of 50 m. After what time interval does the ball strike the ground? (3 marks)
- (b) A glider of mass 680 g is connect by a massless string over a frictionless pulley to a weight hanger of mass 250 g as shown in Figure Q1(b). The system is then released from rest. Calculate

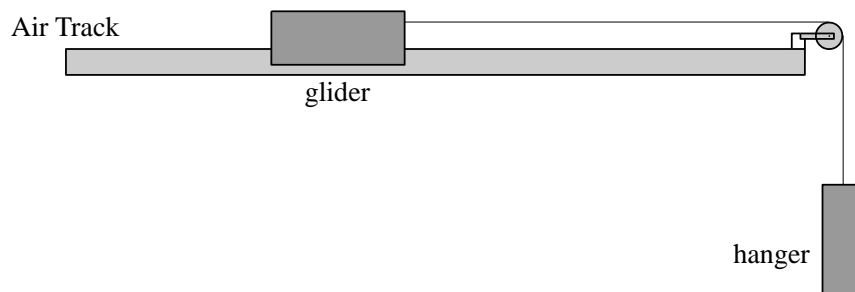


Figure Q1(b)

- (i) the acceleration of the whole system, and (4 marks)
- (ii) the tension in the string. (2 marks)
- (c) A 30 g particle moves on x - y plane with velocity $\vec{v} = (30\hat{i} + 50\hat{j})$ m/s as it passes through a point of coordinates $(-3, 4)$ m. Calculate the angular momentum relative to the origin. (4 marks)
- (d) The rubber on a slingshot is stretch for 17.5 cm to shoot out a 25 g stone. Given that the spring constant k of the rubber is 730 N/m.
- (i) How much force needed to stretch the rubber for 17.5 cm? (2 marks)
- (ii) With what speed was the stone shot out? (3 marks)

- (e) If the period for Uranus is 84 years, calculate the radius of its orbit about the Sun. Given that the period of the Earth around the Sun is 1 year and the Earth is 1.5×10^{11} m away from the Sun.
(3 marks)
- (f) The sound wave of a car is measured to be 2300 Hz. A stationary motion detector detected sound waves from an approaching car as 2600 Hz. Given that the speed of sound in air at standard air pressure is 330 m/s. Calculate the speed of the car.
(4 marks)

Question 2

- (a) A solid piece of lead has a mass of 23.94 g and a volume of 2.1 cm^3 . Calculate the density of lead in kg/m^3 .
(3 marks)
- (b) Given that vector \vec{A} has a magnitude of 6 units making an angle of 25° from horizontal. Another vector \vec{B} has 13 units of magnitude and point leftward. Vector \vec{C} has 8 units of magnitude making an angle of 55° below horizontal.
- (i) Find the magnitude of the resultant vector, $\vec{R} = \vec{A} + \vec{B} + \vec{C}$.
(6 marks)
- (ii) To what direction does the resultant vector \vec{R} point to respect to the horizontal?
(2 marks)
- (c) What is your average velocity when you walk at a speed of 1.2 m/s for 3 minutes, rest for 5 minutes and then run at a speed of 1.5 m/s for 2 minutes along a straight track?
(5 marks)
- (d) A hunter aims at a target on the same level located 420 m away. If the bullet leaves the gun at a speed of 240 m/s, what are the lurching angles should he aim on the target in order to hit the target accurately?
(5 marks)
- (e) The turntable of a record player rotates initially at a rate of 33 revolutions/min and takes 17 s to come to rest. Given that the radius of the turntable is 6.2 cm.
- (i) What is the angular acceleration of the turntable, assuming the acceleration is uniform.
(2 marks)
- (ii) How many rotations does the turntable make before coming to rest?
(2 marks)

Question 3

(a) Two vectors are given as: $\vec{P} = 3\hat{i} - 6\hat{j} + 4\hat{k}$ and $\vec{Q} = 4\hat{i} - 2\hat{j} + 5\hat{k}$. Determine

(i) $\vec{P} \cdot \vec{Q}$,

(2 marks)

(ii) angle between \vec{P} and \vec{Q} ,

(4 marks)

(iii) $\vec{Q} \times \vec{P}$, and

(3 marks)

(iv) $\vec{P} - 3\vec{Q}$.

(2 marks)

(b) A 7 kg mass rests on a horizontal plane as shown in Figure Q3(c). Between the mass and the surface of the plane, the coefficient of static friction is 0.32. Calculate the minimum magnitude of the force F at a direction 40° above the plane that will just start to move the mass.

(5 marks)

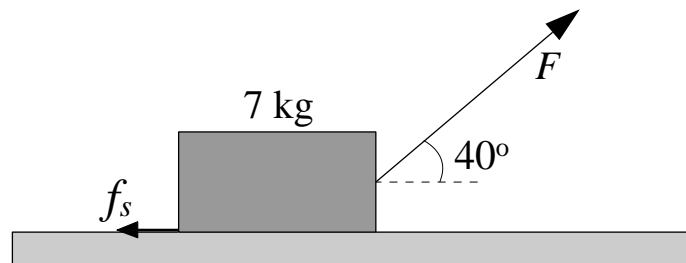


Figure Q3(c)

(c) A 2800 kg car is moving at a speed of 75 km/h.

(i) Calculate its kinetic energy.

(3 marks)

(ii) If the car accelerates to 95 km/h. Calculate the energy that the car supplied while accelerating.

(3 marks)

(d) Table Q3(d) shows the masses and the coordinates of three particles:

Particle	Mass (kg)	Coordinates (m)
1	10	(5 , 10)
2	20	(5 , 0)
3	40	(10 , 0)

Table Q3(d)

Find the center of mass of the system of particles.

(3 marks)

Question 4

- (a) The actual weight of an iron anchor is 6020 N in air and its apparent weight is 5250 N in water. Given that the density of water is $\rho_{\text{water}} = 1 \times 10^3 \text{ kg/m}^3$.
- (i) Calculate the volume of the iron anchor. (3 marks)
 - (ii) Calculate the density of the iron anchor. (3 marks)
- (b) The function $x(t) = (6 \text{ m}) \cos[(3\pi \text{ rad/s})t + \pi/3 \text{ rad}]$ gives the simple harmonic motion of a body. At $t = 3 \text{ s}$, Calculate the
- (i) displacement, (2 marks)
 - (ii) velocity, (3 marks)
 - (iii) acceleration, (3 marks)
 - (iv) frequency, and (1 mark)
 - (v) period of the motion (1 mark)
- (c) A 470 g solid cylinder rolls along a horizontal floor so that its center of mass is moving at a speed of 5 m/s. How much work must be done on the cylinder to stop it? (4 marks)
- (d) A 1.3 kg ball drops vertically onto a floor, hitting with a speed of 24 m/s. the ball rebounds with a speed of 9.3 m/s just after it left the floor.
- (i) What impulse act on the ball during the contact? (3 marks)
 - (ii) If the ball is in contact with the floor for 20 ms, what is the magnitude of the average force on the floor from the ball? (2 marks)

Question 5

- (a) Two glass marbles are moving along a straight line toward each other undergo a complete elastic collision. The speed of one marble is 1.4 m/s and its mass is 13 g, the speed of the other marble is 1.6 m/s and its mass is 16 g. Calculate the speeds of the marbles after the collision and mention also whether they change direction or not. (4 marks)
- (b) Given that particle A has a mass of 65 kg and located at (8 m , 15 m). Particle B has a mass of 47 kg and located at (36 m , 7 m). Calculate the gravitational force between the particles. (4 marks)
- (c) Calculate the speed of a transverse wave on a string of length 70 cm and mass 21 g under a tension of 420 N. (3 marks)
- (d) Given that 1 ml of water has a mass of 1 g. In an experiment, 800 ml of water at 90 °C is mixed into a container containing 1200 ml of water at 50 °C. Calculate the final temperature of the 2000 ml of water. (4 marks)
- (e) A particle initially moves at a horizontal speed of $v_i = 15$ m/s. It then slides down a frictionless cliff of height shown in Figure Q5(e) and moves at a new speed of v_f . Calculate the final speed v_f . (4 marks)

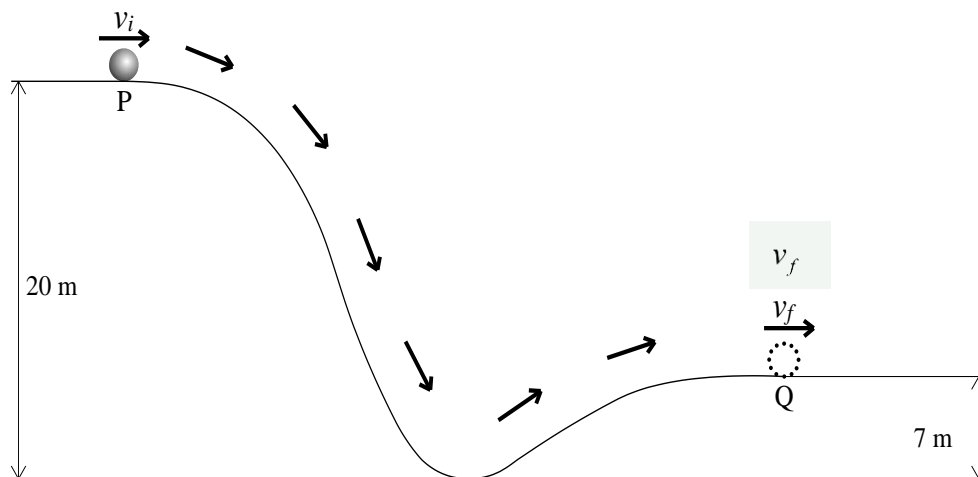


Figure Q5(e)

- (f) The instantaneous position of a small object respect to an origin is given by $x(t) = 7t - 2 - 3t^2$ where t is in seconds and x in meter.
- (i) Determine the position of the object at $t = 3$ s. (2 marks)
- (ii) What is the instantaneous velocity of the object? (2 marks)
- (iii) Determine the instantaneous velocity of the object at $t = 3$ s. (2 marks)

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