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) On an air track, a glider of mass 680 g is connected 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

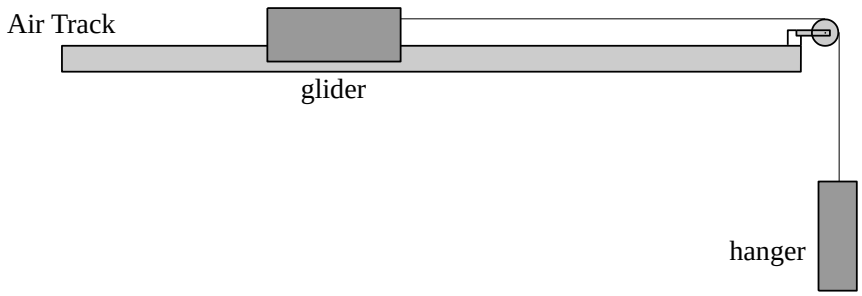

Figure Q1(b)

(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 its angular momentum relative to the origin.

(4 marks)

(d) The rubber on a slingshot is stretched 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 around the Sun 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^o from horizontally rightward. 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^o 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) Determine 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 launching 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 rev/min and takes 17 s to come to rest. Given that the radius of the turntable is 6.2 cm.

(i) Determine the angular acceleration of the turntable in the unit of rad/s^2, 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) $\vec{P} \bullet \vec{Q}$,

(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(b). 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^o above the plane that will just start to move the mass.

(5 marks)

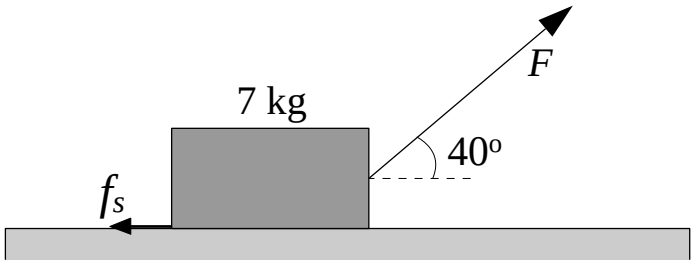

Figure Q3(b)

(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 $\rho_{water} = 1\times10^3$ 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 m) cos[(3π rad/s)t + π/3 rad] gives the simple harmonic motion of a body. At t = 3 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) Determine the 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 acted to 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 ^{o}C is mixed into a container containing 1200 ml of water at 50 ^{o}C. Calculate the final temperature of the mixed 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 as shown in Figure Q5(e) and moves at a new speed of v_f . Calculate the final speed v_f.

(4 marks)

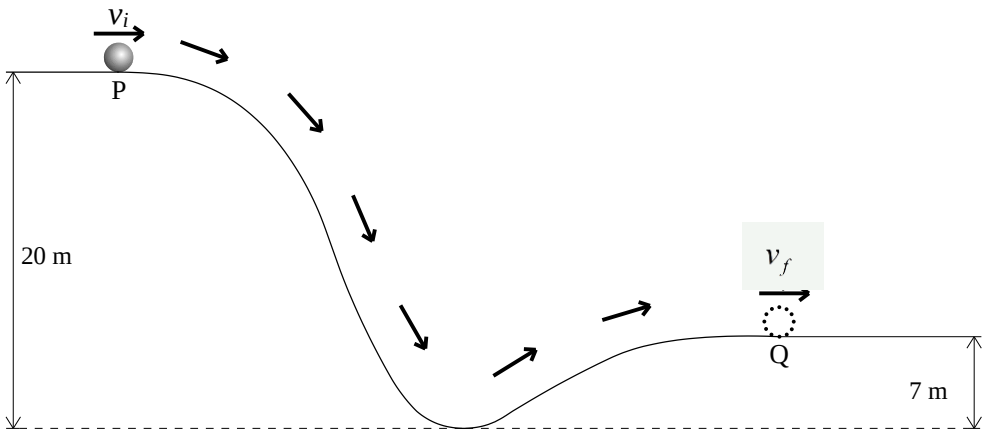

Figure Q5(e)

(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) Write the expression of the instantaneous velocity of the object as a function of time *t*.

(2 marks)

(iii) Determine the instantaneous velocity of the object at *t* = 3 s.

(2 marks)

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