INTI INTERNATIONAL UNIVERSITY

FOUNDATION IN SCIENCE (CFSI)
PHY1203: GENERAL PHYSICS 1
FINAL EXAMINATION: JUNE 2015 SESSION

Instruction: 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) Three forces are acting to an object at the magnitude and direction below.

Force	Magnitude	Direction
F_1	100 N	30^o
F_2	150 N	240^o
F_3	80 N	150^o

(i) Draw a free body diagram to show the forces acting on the object.

(3 marks)

(ii) Calculate the magnitude of the net force acting on the object.

(6 marks)

(iii) Find the direction of the net force acting on the object.

(2 marks)

(b) A ball is thrown up vertically from ground level to rise to a maximum height of 50 m.

(i) With what magnitude of speed must the ball be thrown?

(2 marks)

(ii) How long does it take to reach the maximum height?

(2 marks)

(iii) How long will it be in the air?

(2 marks)

(c) Two gliders are moving on an air track at difference velocities as shown in Figure Q1(c). The glider *A* then crashes the glider *B* and undergoes an elastic collision. Calculate the velocity of each glider after the collision.

(8 marks)

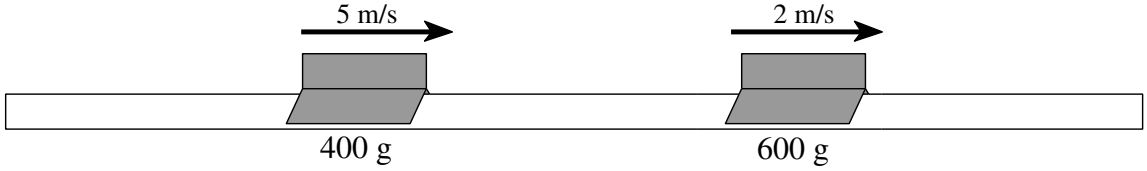

Figure Q1(c)

Question 2

(a) Calculate the altitude above the Earth's surface would the gravitational acceleration be 7 m/s^2.
(4 marks)

(b) A bicycle tire is 66 cm in diameter and its center travels at a speed of 32 km/h.

(i) How long does the tire take to make one full rotation
(2 marks)

(ii) How many revolutions does the tire make per second?
(2 marks)

(iii) Calculate the tire's angular velocity.
(2 marks)

(c) A sphere in such dimensions that its volume is equal to a cube with 4 cm in length. Calculate the radius of the sphere.
(4 marks)

(d) A 3 kg block is dropped from a height of 50 cm onto a spring of spring constant k = 1900 N/m.

(i) Calculate the total potential energy of the block had provided to the spring.
(2 marks)

(ii) Calculate the maximum distance the spring is compress.
(4 marks)

(e) A 1.2 kg hammer moving at a downward speed of 1.5 m/s drives a nail into a wooden board an additional 4.0 mm. Calculate

(i) The hammer's kinetic energy just before it hits the nail.
(2 marks)

(ii) The average resisting force exert on the nail.
(3 marks)

Question 3

(a) A rotating fan completes 226 revolutions every minute. Consider the tip of a blade, at a radius of 54.0 cm.

(i) Through what distance does the tip move in one revolution?
(2 marks)

(ii) Calculate the tip's linear speed.
(2 marks)

(iii) Calculate the magnitude of its centripetal acceleration.
(2 marks)

(iv) Calculate the period of the motion.

(2 marks)

(b) A ball slides on a frictionless track from rest at point A as shown in Figure Q3(b). Calculate its speed when it reaches the bottom of the track at point B.

(3 marks)

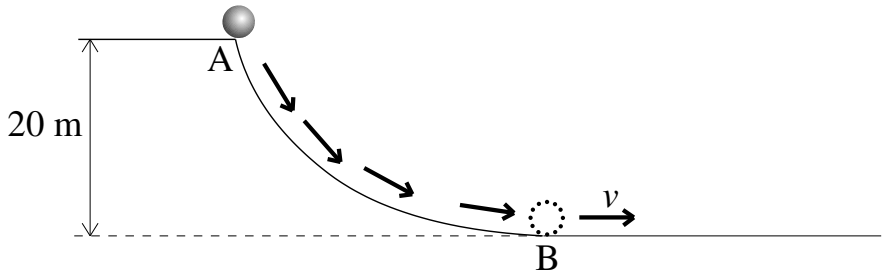

Figure Q3(b)

(c) Two vector are given as $\vec{P} = 3\hat{i} + 6\hat{j} - 5\hat{k}$ and $\vec{R} = 7\hat{i} - 4\hat{j} + 2\hat{k}$. Find

(i) $\left|\vec{P}\right|$ and $\left|\vec{R}\right|$

(4 marks)

(ii) $\vec{P} \bullet \vec{R}$

(2 marks)

(iii) Angle between $\vec{P}$ and $\vec{R}$

(2 marks)

(iv) $\vec{P} \times \vec{R}$

(3 marks)

(v) $2\vec{P} - \vec{R}$

(3 marks)

Question 4

(a) An 8 kg mass is placed on an incline frictionless surface as shown in Figure Q4(a). A light string runs parallel to the surface from the mass over a light, frictionless pulley to a 4 kg mass.

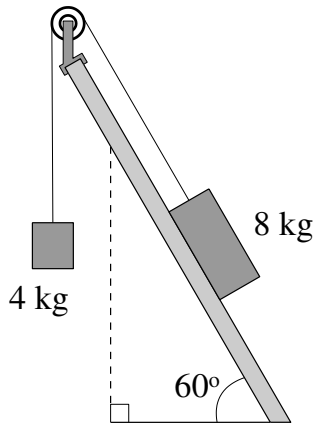

Figure Q4(a)

(i) Calculate the acceleration of the masses.

(6 marks)

(ii) Calculate the magnitude of the tension in the string.

(2 marks)

(b) A football player kicks a football so that it will have a 'hang time' of 12 s and land 45 m away. Given that the ball leaves the player's foot from the ground.

(i) Calculate the magnitude of the ball's initial velocity.

(6 marks)

(ii) Find the direction of the ball's initial velocity.

(4 marks)

(c) A spherical shell has a mass of 500 g and 22 cm in diameter. It is rotating about an axis passing through its center of mass. Calculate the rotational inertia of the shell.

(3 marks)

(d) A 2 m string is under a tension of 35 N. Given that the total mass of the string is 170 g.

(i) Calculate the linear mass density of the string.

(2 marks)

(ii) A pulse is sent from one end of the string toward the other, calculate the speed of the wave through the string.

(2 marks)

Question 5

(a) Water is moving with a speed of 5 m/s through a horizontal pipe with a cross-sectional area of 4 cm^2. As the pipe increases in diameter to 10 cm, what is the speed of the water in the bigger pipe?

(3 marks)

(b) A car of mass 2000 kg is moving at a speed of 30 m/s and then accelerates to 32 m/s, calculate

(i) The car's initial kinetic energy.

(2 marks)

(ii) The car's final kinetic energy.

(2 marks)

(iii) The energy that the car supplied while accelerating.

(2 marks)

(c) Figure Q5(c) shows a 60 g block is accelerated by a compressed spring whose spring constant is 65 N/m. after leaving the spring, it travels over a horizontal surface with a coefficient of kinetic friction of 0.35 for a distance of 8 cm before stopping.

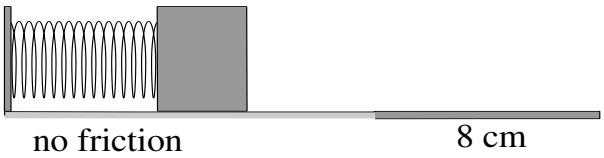

Figure Q5(c)

(i) Calculate the friction force exerted onto the block to stop it.

(3 marks)

(ii) Calculate the maximum kinetic energy of the block.

(3 marks)

(iii) Through what distance is the spring compressed before the block begins to move.

(3 marks)

(d) Two objects with the mass of $m_1 = 2$ kg and $m_2 = 6$ kg are attached to an Atwood machine with a frictionless pulley by a massless string as shown in Figure Q5(d). The system is then released,

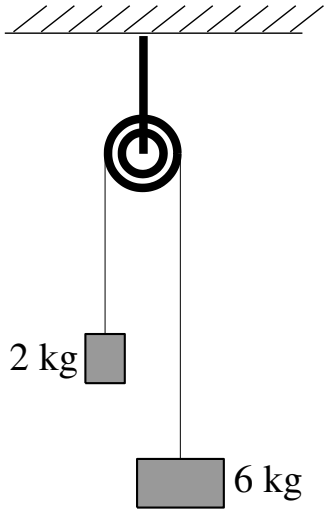

Figure Q5(d)

(i) Calculate the acceleration of the system.

(5 marks)

(ii) Find the tension in the string.

(2 marks)

-- **THE END** --

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