INTI INTERNATIONAL UNIVERSITY

FOUNDATION IN SCIENCE (CFSI)
PHY1203: GENERAL PHYSICS 1
FINAL EXAMINATION: JANUARY 2014 SESSION

Instructions: 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) Given that the initial length of a spring hang vertically is 20 cm. When a mass of 70 g is attached onto the spring, the new length of the spring is measured to be 28.5 cm.

(i) What is the extension of the spring?

(1 mark)

(ii) Calculate the spring constant of the spring.

(2 marks)

(iii) Calculate the work done onto the spring in extending the spring to 28.5 cm.

(2 marks)

(iv) Calculate the additional mass needed to extend the spring for another 5 cm.

(5 marks)

(b) An oscillator consists of a block of mass 500 g connected to a spring. When set into oscillation, it shows amplitude of 30 cm and repeats its motion every 0.4 s. Find

(i) the period,

(1 mark)

(ii) the frequency,

(2 marks)

(iii) the angular frequency,

(2 marks)

(iv) spring constant of the spring,

(2 marks)

(v) maximum speed, and

(2 marks)

(vi) maximum acceleration of the oscillation.

(2 marks)

(c) A projectile is shot from the ground level with an initial speed of 22 m/s at an angle of 40^{o} above the horizontal. The projectile dropped at the ground level.

(i) Calculate the maximum height reached by the projectile respect to the ground level.

(2 marks)

(ii) Determine the range of the projectile as measured from the launching point.

(2 marks)

Question 2

(a) From a very high altitude, an object falls freely from rest. Find

(i) the distance it falls in 3 s,

(3 marks)

(ii) its velocity after 5 s,

(3 marks)

(iii) its velocity after falling 80 m,

(3 marks)

(iv) the time required to reach a speed of 25 m/s, and

(3 marks)

(v) the time taken to fall 200 m.

(3 marks)

(b) Two gliders are moving with constant speed toward each other on an air track as shown in Figure Q2(b). Given that glider *P* has a mass of 420 g and moving at speed 3 m/s. Glider *Q* has a mass of 360 g and moving at a speed of 4 m/s. The gliders undergo an elastic collision. Determine the speed and the direction of each glider after the collision.

(8 marks)

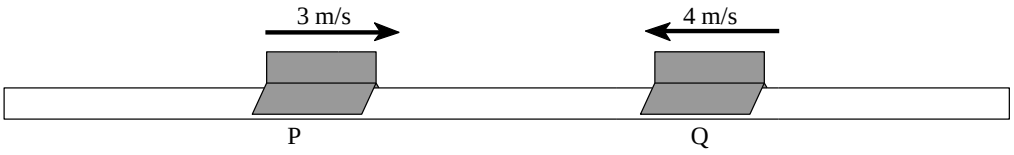

Figure Q2(b)

(c) An ideal gas is admitted into a tank containing a movable piston. The initial volume, pressure, and temperature of the gas are 18 liters, 1 atm, and 300 K, respectively. If the gas is compressed to a final volume of 15 liters and the temperature is increased to 373 K, find the final pressure of the gas in the unit of Pa.

(2 marks)

Question 3

(a) A 2 kg mass was tied with a rope passes over a pulley to another 8 kg mass as shown in Figure Q3(a). The masses were then released and move with an acceleration. Assuming the pulley is frictionless and the rope is massless.

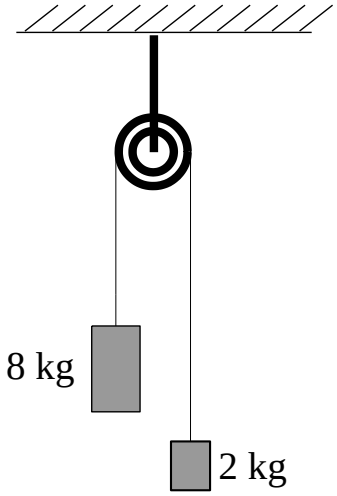

Figure Q3(a)

(i) Calculate the acceleration of the masses.

(5 marks)

(ii) Calculate the tension in the rope after they were released.

(2 marks)

(b) Two vectors are given as: $\vec{A} = +4\hat{i} - 7\hat{j} - 5\hat{k}$ and $\vec{B} = 2\hat{i} + 6\hat{j} - 3\hat{k}$. Determine

(i) $\vec{A} \bullet \vec{B}$,

(2 marks)

(ii) angle between $\vec{A}$ and $\vec{B}$,

(5 marks)

(iii) $(\vec{B} \times \vec{A})$, and

(3 marks)

(iv) $3\vec{B} - \vec{A}$.

(2 marks)

(c) A locomotive moving at 30 m/s approaches and passes a person standing beside the track. Its whistle is emitting a note of frequency 1.5 kHz. Given that the speed of sound is 340 m/s. Calculate the frequency the person hear,

(i) as the train approaching, and

(3 marks)

(ii) as the train leaving.

(3 marks)

Question 4

(a) A force F make an angle of 35^o respect to the horizontal is attempting to move a 5 kg block along the floor as shown in Figure Q4(a). Given that the coefficient of static friction and kinetic friction between the block and the floor are 0.35 and 0.27, respectively.

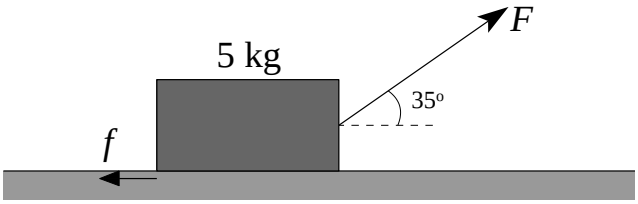

Figure Q4(a)

(i) Find the minimum magnitude of the force F that must exert on the block just to start the motion along the floor.

(5 marks)

(ii) Find the magnitude of the force F that must exert on the block to move it along the floor at constant speed.

(5 marks)

(iii) Find the magnitude of the force F that must exert on the block to accelerate it along the floor at 4 m/s^2.

(5 marks)

(iv) Find the magnitude of the force F that must exert on the block to yield minimum frictional force.

(5 marks)

(b) A disk of mass 15 kg with the radius of 12 cm spins at 800 rev/min on axis perpendicular to its plan through its center.

(i) Convert 800 rev/min to rad/s.

(1 mark)

(ii) Calculate its rotational inertia.

(2 marks)

(iii) Calculate its rotational kinetic energy

(2 marks)

Question 5

(a) A car with a mass of 3200 kg is moving with a speed of 95 km/h. Given that 15% of the car's kinetic energy lost when the driver press the brake of the car. Calculate its final speed.

(5 marks)

(b) A particle initially moves at level *A* with a horizontal speed of v_i = 28 m/s. It then slides down a frictionless incline cliff and moves at a different speed at each level as shown in Figure Q5(b).

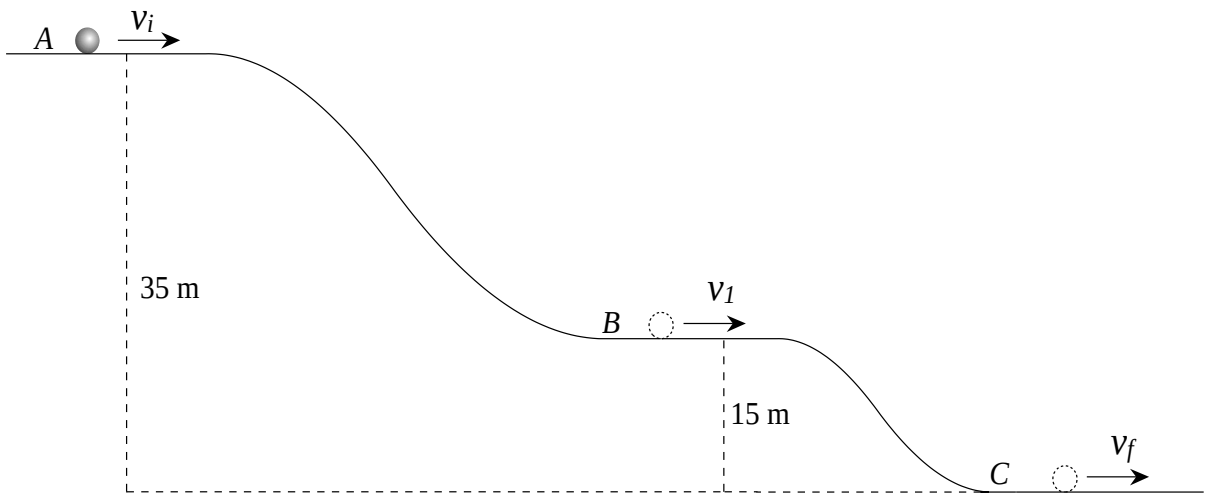

Figure Q5(b)

(i) Calculate the speed v_1 of the particle at level *B*.

(4 marks)

(ii) Calculate the final speed v_f of the particle at level *C*.

(4 marks)

(c) A horizontal cord 5 m long has a mass of 1.54 g. When a transverse wave of 120 Hz is sent through the cord, its wavelength is measured to be 60 cm. Determine

(i) the linear mass density of the cord,

(3 marks)

(ii) the speed of the wave, and

(2 marks)

(iii) the tension in the cord for the wave to travel at such speed.

(3 marks)

(d) Given that particle A has a mass of 100 kg and located at (80 m , 150 m). Particle B has a mass of 470 kg and located at (360 m , 70 m). Calculate the attractive force between the particles.

(4 marks)

-- THE END --

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