Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2018/2019

COURSE NAME	:	PHYSICS I
COURSE CODE	:	DAS 14103
PROGRAMME CODE	:	DAU
EXAMINATION DATE	:	DECEMBER 2018 / JANUARY 2019
DURATION	:	2 HOURS AND 30 MINUTES
INSTRUCTIONS	:	ANSWER **ALL** QUESTIONS IN SECTION A AND **TWO (2)** QUESTIONS IN SECTION B

THIS QUESTION PAPER CONSISTS OF **TEN (10)** PAGES

SECTION A

Q1 (a) State a difference between longitudinal wave and transverse wave and give an example of each.

(4 marks)

(b) At t = 0 and x = 0, a progressive wave with a velocity of 340 ms^{-1} an amplitude of 0.20 m and frequency of 450 Hz is propagating to the right.

(i) Calculate the wavelength of the wave.

(3 marks)

(ii) Write the wave equation.

(8 marks)

(iii) Draw a graph of the wave at t = 0s.

(4 marks)

(c) A string of length 2.0 m has a mass of 125 mg. The string is attached to the ceiling and an object of mass 4.0 kg hangs from the other end as shown in **Figure Q1 (c)**. A child whacks the piñata sideways with a stick as a result, a transverse pulse travels up the string towards the ceiling. Calculate the speed of the pulse travel.

(6 marks)

Q2 (a) Define simple harmonic motion.

(2 marks)

(b) The displacement of an oscillating object as a function of time is shown in **Figure Q2 (b)**. Determine:

(i) the amplitude, period, frequency and angular frequency.

(7 marks)

(ii) the equation of displacement, x, as a function of time, t.

(2 marks)

(iii) the equation of velocity, v, as a function of time, t.

(3 marks)

(iv) the equation of acceleration, a, as a function time, t.

(3 marks)

(c) A spring with constant, k, is hanging vertically. A 20 N weight is attached at the end of the spring is stretched by 10 cm. Calculate the time taken to complete one oscillation.

(8 marks)

SECTION B

Q3 (a) Define the followings:

(i) Energy and Power

(2 marks)

(ii) Work-Energy Theorem

(2 marks)

(b) **Figure Q3 (b)** shows a ball of mass 2 kg rolling on the smooth surface.

(i) If the ball starts from rest at point A, finds its speed at point B.

(5 marks)

(ii) If the ball is observed to reach point C with speed 5 ms^{-1}, calculate initial velocity at point A.

(6 marks)

(c) A body P of mass 300 g shown in **Figure Q3 (c)** is placed on an inclined plane of angle 30° from horizontal. The coefficient of friction between the body and surface is 0.1. The body is released from rest. After P has moved down the plane for a distance of 60 cm.

(i) Draw free body diagram of the force acting on the body.

(2 marks)

(ii) Calculate work done by gravity.

(4 marks)

(iii) Calculate work done by friction.

(4 marks)

Q4 (a) Define centripetal acceleration and centripetal force.

(4 marks)

(b) Calculate the angular velocity of a 0.300 m radius tyre when the car travels at 15.0 m s^{-1}.

(3 marks)

(c) A car with mass 900 kg moves at curve of a road with radius 500 m and a speed of 25 m s^{-1} as shown in **Figure Q4 (c).**

(i) Draw free body diagram acting on the car.

(4 marks)

(ii) Calculate the magnitude of the centripetal acceleration of a car following a curve of radius.

(4 marks)

(iii) Calculate the centripetal force exerted by the car.

(4 marks)

(iv) Determine the minimum coefficient of static friction between the tyres and the road.

(6 marks)

Q5 (a) State **three (3)** equations of Newton's Law of motion.

(3 marks)

(b) A box of orange and a box of apples are connected by a light string that passes over a frictionless pulley as shown in **Figure Q5 (b)**. Both of the boxes contain 3 kg of oranges and 4 kg of apples respectively. A horizontal force of magnitude 40 N is applied to pull the box of orange to the left. Assume the surface is frictionless.

(i) Draw a FBD of the boxes.

(3 marks)

(ii) Calculate the tension in the string.

(11 marks)

(iii) Calculate the acceleration of the box of apples.

(3 marks)

(c) A 2.50 kg toy car moving on a smooth surface reaches a speed of 20 ms^{-1} in 2 s. The toy car starts with a speed of 10 ms^{-1}. If 3 N kinetic frictional force is acting on the toy car, calculate the net force acting on it.

(5 marks)

Q6 (a) Define acceleration and give its SI unit.

(2 marks)

(b) A cannon ball fired from a cannon with an initial speed 200 ms^{-1} and makes an angle $\theta = 60°$ to the horizontal ground as shown in **Figure 6 (b)**. Determine:

(i) the magnitude and direction of its velocity when t = 2s.

(7 marks)

(ii) the time taken for the cannon ball to reach the maximum height, H.

(3 marks)

(iii) the value of height, H.

(3 marks)

(iv) the horizontal range, R.

(4 marks)

(v) the magnitude and direction of its velocity when the cannon ball reached the ground.

(6 marks)

Q7 (a) State **two (2)** categories of physical quantity.

(2 marks)

(b) The equation,

$$V = F^a L^b m^{-c}$$

shows the relationship between velocity of the wave, v, tensile force in the string, F, its length, L, and its mass, m. Analyzes the values of a, b and c by using dimensional analysis.

(8 marks)

(c) A pack of five lions are fighting over the carcass of a dead zebra. Top view of the magnitude and direction of the five forces are shown in **Figure Q7 (c)**.

(i) Calculate the force along horizontal motion.

(5 marks)

(ii) Calculate the force along vertical motion.

(5 marks)

(iii) Determine the net force acting upon the carcass.

(3 marks)

(iv) Determine the direction of the net force acting upon the carcass.

(2 marks)

-END OF QUESTIONS –

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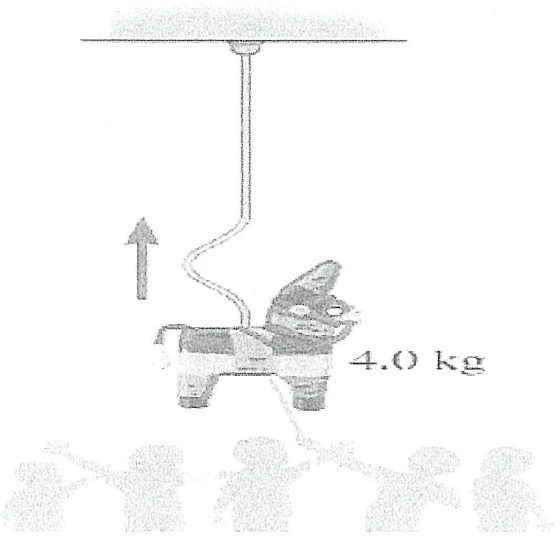

Figure Q1 (c)

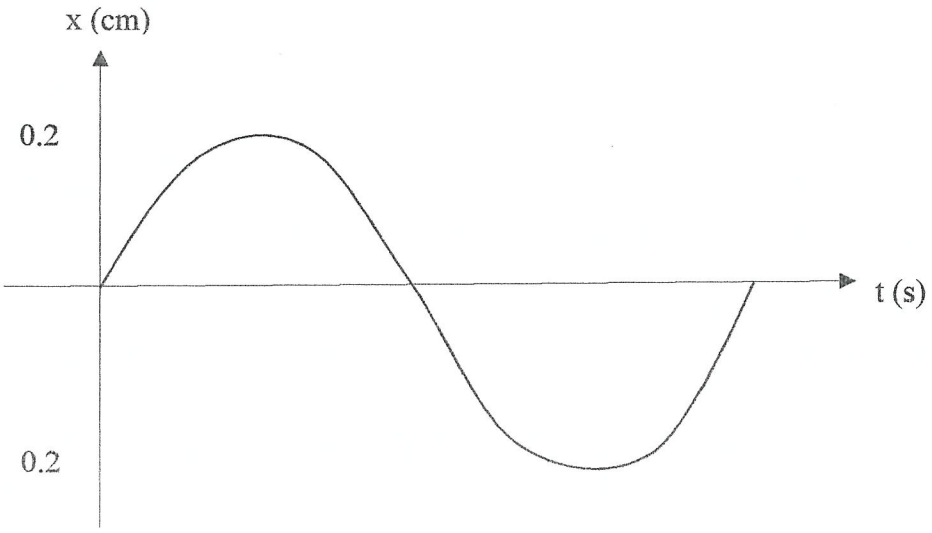

Figure Q2 (b)

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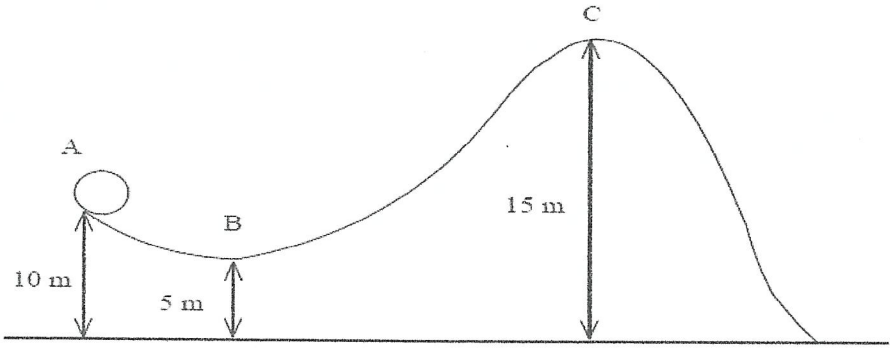

Figure Q3 (b)

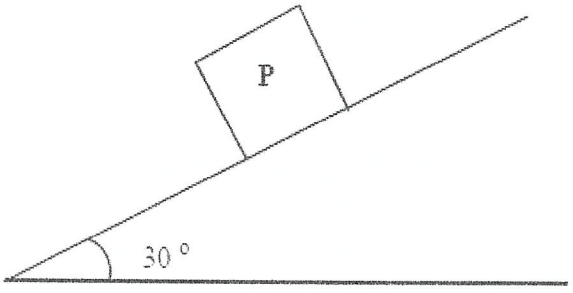

Figure Q3 (c)

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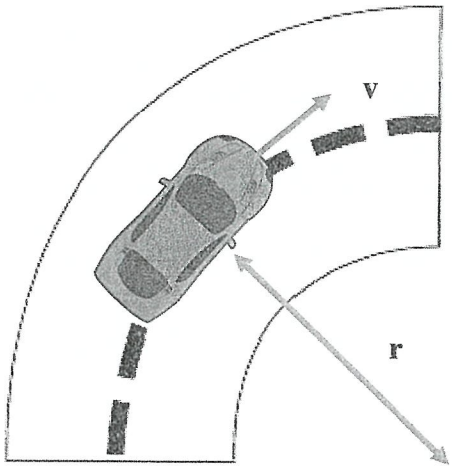

Figure Q4 (c)

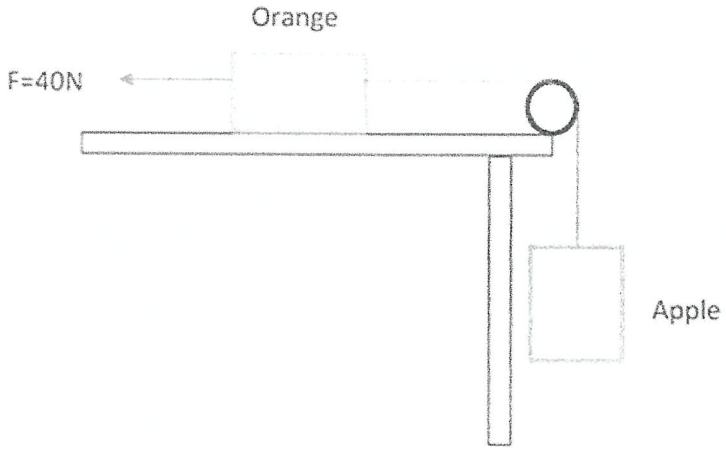

Figure Q5 (b)

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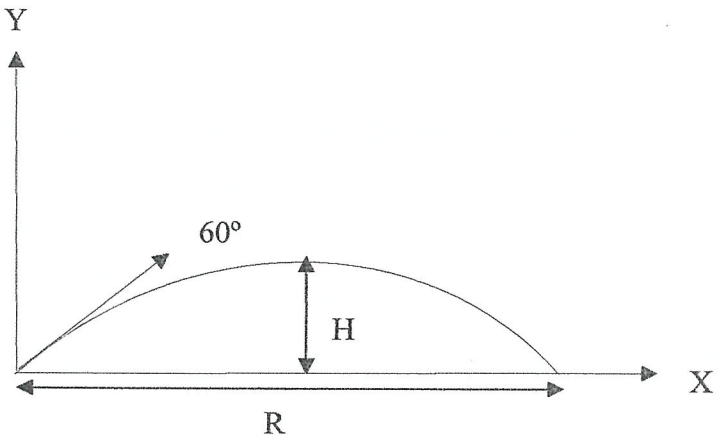

Figure Q6 (b)

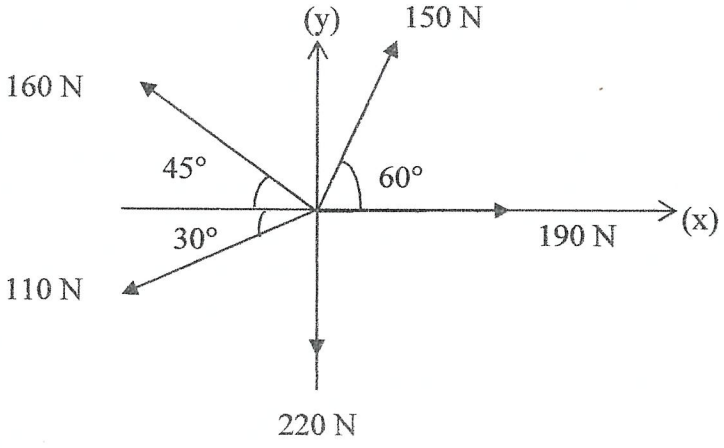

Figure Q7 (c)

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LIST OF FORMULA

$v = u + a\ t$

$s = ut + \frac{1}{2}at^2$

$v^2 = u^2 + 2as$

$\vec{a} = \frac{\sum \vec{F}}{m} = \frac{\vec{F}_{net}}{m}$

$T_K = T_C + 273.15$

$a_c = \frac{v^2}{r}$

$T_C = \frac{T_F - 32}{1.8}$

$\vec{p} = m\vec{v}$

$K = \frac{1}{2}mv^2$

$\Delta E = W = F_{\parallel} = Fs\cos\theta$

$\omega = \omega_0 + \alpha t$

$U_s = \frac{1}{2}kx^2\sqrt{\frac{Y}{\rho}}$

$F_b = \rho g V$

$\rho = \frac{m}{V}$

$s = \frac{1}{2}(u + v)t$

$\theta = \frac{s}{r}$

$\omega = \frac{\Delta\theta}{\Delta t}$

$\alpha = \frac{\Delta\omega}{\Delta t}$

$a_{tan} = r\alpha$

$a_R = \frac{v^2}{r}$

$c = \sqrt{x^2 + y^2}$

$tan\theta = \frac{y}{x}$

$F_c = \frac{mv^2}{r}$

$v = r\omega$

$T = \frac{2\pi}{\omega}$

$\omega = 2\pi f$

$F = ma$

$a = \sqrt{a_R{}^2 + a_{tan}{}^2}$