Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2016/2017

COURSE NAME	:	PHYSICS I
COURSE CODE	:	DAS 14103
PROGRAMME CODE	:	1 DAU / 1 DAA / 1 DAE / 1 DAM
EXAMINATION DATE	:	DECEMBER 2016/ JANUARY 2017
DURATION	:	2 HOURS AND 30 MINUTES
INSTRUCTIONS	:	**SECTION A)** ANSWER **ALL** QUESTIONS **SECTION B)** ANSWER **TWO (2)** QUESTIONS ONLY

THIS QUESTION PAPER CONSISTS OF **NINE (9)** PAGES

SECTION A

Q1 (a) **Figure Q1 (a)** shows a trolley of weight 60 N passing through point A with a velocity of 6 ms^{-1}. It slides down a rail to point C. From A to C, 250 J of energy is lost due to friction. Calculate

(i) The total energy at point A (4 Marks)

(ii) The velocity of the trolley at point C. (6 Marks)

(b) Define the followings

(i) Work-Energy Theorem (2 marks)

(ii) Conservation of Mechanical Energy (2 marks)

(c) **Figure Q1 (c)** shows a 20 N force drags an 8 kg bag through a horizontal distance of 40 m. The force acts an angle of 30° with the horizontal floor. The floor is rough with kinetic coefficient of friction 0.20 .

(i) Draw the free body diagram of the bag. (3 marks)

(ii) Compute the work done by the force. (2 marks)

(iii) Determine the normal force exerted by the bag. (3 marks)

(iv) Calculate work done by frictional force. (3 marks)

Q2 (a) A spring stretches 0.150m when a 0.3 kg mass is gently attached to it as in **Figure Q2 (a)**. The spring is then set up horizontally with the 0.3 kg mass resting on a frictionless table as in **Figure Q2 (b)**. The mass is pushed so that the spring is compressed 0.1 m from the equilibrium point, and released from rest. Determine

(i) The spring stiffness constant k and angular frequency, ω (4 marks)

(ii) The amplitude of the horizontal oscillation, A (2 marks)

(iii) The magnitude of the maximum velocity, v_{max} (2 marks)

(iv) The magnitude of the maximum acceleration, a_{max} of the mass (2 marks)

(v) The period T and the frequency f (5 marks)

(vi) The displacement x as a function of time (5 marks)

(vii) The velocity at $t = 0.15$ s (5 marks)

SECTION B

Q3 (a) A sphere with radius, r is 400 mm is floating in oil with density, ρ = 0.78 g/cm^3. Given; gravity g = 9.81 m s^{-2} and $V_{sphere} = \frac{4}{3}\pi r^3$.

(i) Convert the density of oil in SI unit.

(3 marks)

(ii) Determine the buoyancy force of the sphere in SI unit.

(5 marks)

(b) A pack of five lions are fighting over the carcass of a dead zebra. A top view the magnitude and direction of the three forces are shown in **Figure Q3 (b).**

(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)

(v) Calculate the acceleration of the 750 kg zebra carcass.

(2 marks)

Q4 (a) Define Newton's Third Law

(2 mark)

(b) **Figure Q4 (b)** shows a box of weight 5000 N lying on an inclined plane with an angle of 35° above the horizontal plane. The box is connected to a ball of weight 70 N by a light string passing over a smooth pulley. Assume the coefficient of kinetic friction for the inclined plane is 0.15.

(i) Draw a free body diagram for the system

(4 marks)

(ii) Calculate the normal force, N for the box

(3 marks)

(iii) Calculate the frictional force, f experienced by the box

(3 marks)

(iv) Calculate the acceleration of a ball as the box moves down the inclined plane

(10 marks)

(v) Calculate the tension in the string

(3 marks)

Q5 (a) Define the following and state the S.I unit

(i) Displacement

(2 marks)

(ii) Velocity

(2 marks)

(b) A person standing on the edge of a cliff throw a rock straight up with an initial velocity of 13.0 m/s. The rock misses the edge of the cliff as it falls back to earth.

(i) Calculate the position of the rock for time 1.00 s, and 3.00 s after it is thrown.

(6 marks)

(ii) Sketch the vertical position versus time and velocity versus time for the rock from the moment it leaves the person's hand until it fall to earth.

(6 marks)

(c) A long jumper leaves the ground at an angle of 20° to the horizontal and at speed of 11.0 m/s

(i) How long does it take for him to reach maximum height?

(3 marks)

(ii) What is the maximum height he can reach?

(3 marks)

(iii) How far does he jump?

(3 marks)

Q6 (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} as shown in **Figure Q6 (b)**

(3 marks)

(c) A car with mass 900 kg move at curve of road with radius 500 m at speed of 25 m s^{-1} as shown in **Figure Q6 (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) What is the minimum coefficient of static friction between the tyres and the road (static friction being the reason that keep the car from slipping)

(6 marks)

-END OF QUESTIONS –

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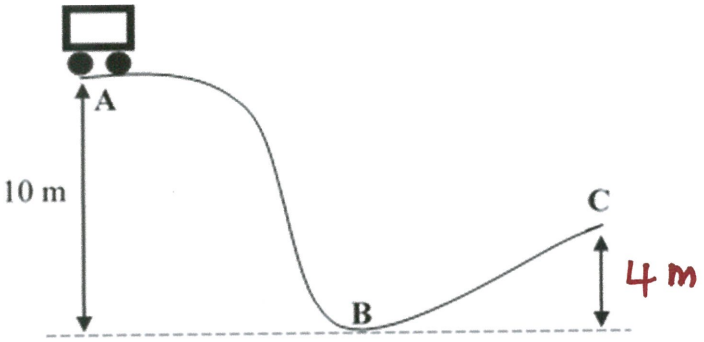

Figure Q1 (a)

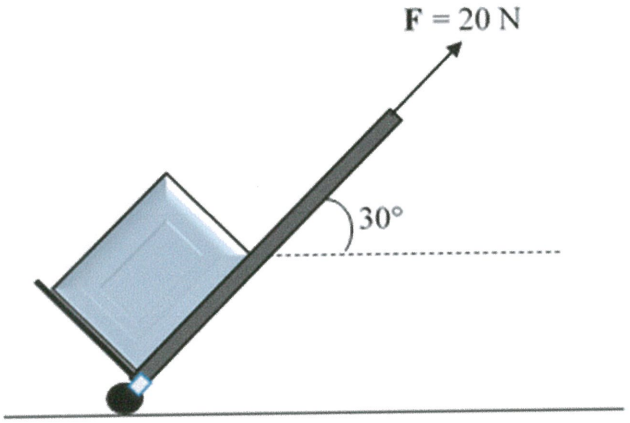

Figure Q1 (c)

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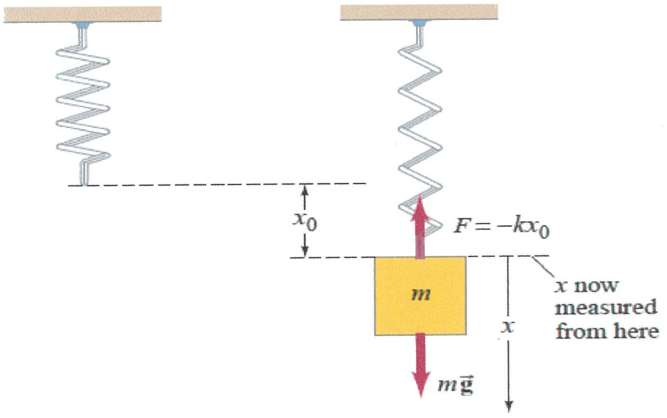

Figure Q2 (a)

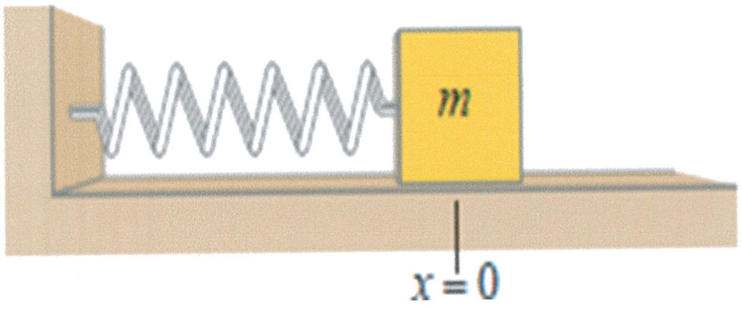

Figure Q2 (b)

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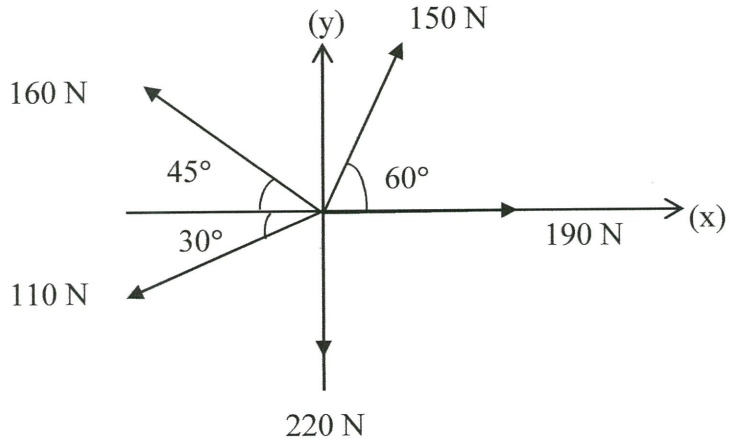

Figure Q3 (b)

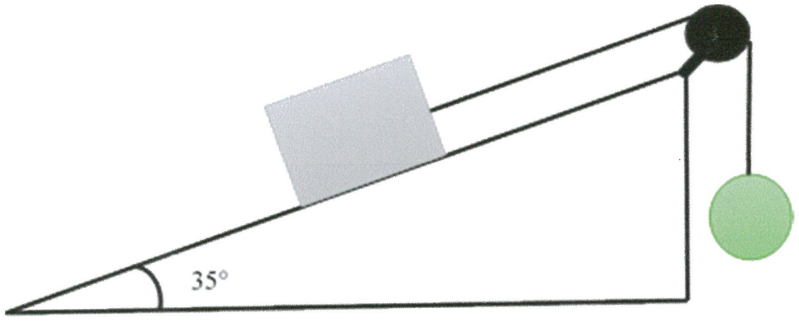

Figure Q4 (b)

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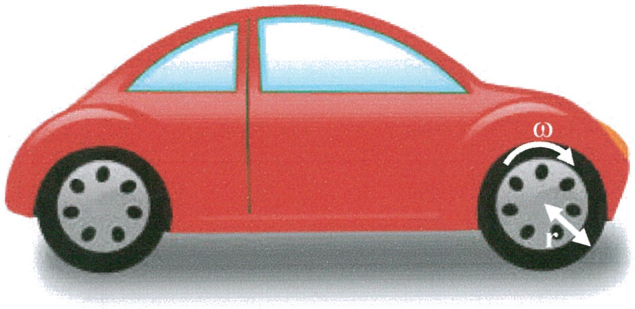

Figure Q6 (b)

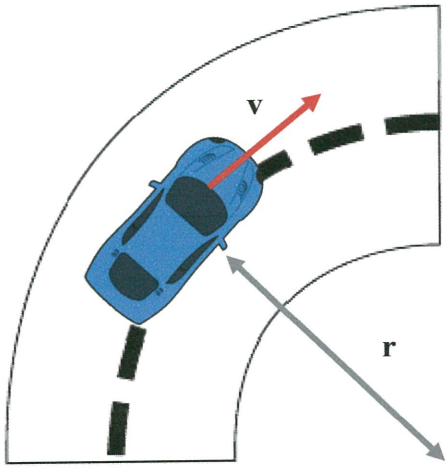

Figure Q6 (c)

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LIST OF FORMULA

$v_x = v_{0x} + a_x t$

$x = x_0 + v_{x0}t + \frac{1}{2}a_x t^2$

$v_x^2 = v_{x0}^2 + 2a_x(x - x_0)$

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

$T_K = T_C + 273.15$

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

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

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

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

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

$\omega = \omega_0 + \alpha t$

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

$F_b = \rho g V$

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