UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2017/2018

COURSE NAME	:	PHYSICS 1
COURSE CODE	:	DAS 14103
PROGRAMME CODE	:	DAU / DAA / DAE / DAM
EXAMINATION DATE	:	DECEMBER 2017 / JANUARY 2018
DURATION	:	2 HOURS 30 MINUTES
INSTRUCTION	:	**SECTION A)** ANSWER **ALL** QUESTIONS **SECTION B)** ANSWER **TWO (2)** QUESTIONS ONLY

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

SECTION A

Q1 (a) An object undergo simple harmonic motion (SHM) according to equation

$x(t) = 10\sin(20\pi t)$, where x is in meter and t is in second.

(i) Define SHM?
(ii) Determine the maximum displacement and the angular frequency of the SHM.
(iii) Calculate the period.
(iv) Sketch the SHM graph and show the maximum displacement and the period in the graph.

(12 marks)

(b) A box of 0.25 kg is attached to one end of a spring and produced an extension of 2 cm. The box is then pulled down 1 cm vertically and released. Calculate:

(i) The spring constant and the angular frequency.
(ii) The period and frequency of the oscillation.
(iii) The maximum kinetic energy.

(13 marks)

Q2 (a) A stationary object of mass 4 kg is pulled upwards by a constant force of magnitude 60 N. The object has moved upwards through 5 m.

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(i) Calculate the net force acting on the object.
(ii) Analyze the speed of the object.
(iii) State the definition of work-energy theorem.

(8 marks)

(b) A box is pulled from rest across the horizontal surface with an applied force of 150 N at an angle of 30° above the horizontal. If the box has a mass of 10 kg, the coefficient of kinetic friction is 0.25 and the distance that the box being pulled is 5 m (see in **Figure Q2 (b)**).

(i) Sketch the free body diagram for the system.
(ii) Calculate the net work acting on the box.

(11 marks)

(c) A 200 kg steel ball 55 m above the bottom of a dip starting to roll from rest at a point A. If track AB has a smooth surface, while track BC has a rough surface and the speed of the ball at point C is 22 ms^{-1} (see in **Figure Q2 (c)**).

(i) Calculate the speed of the ball at point B.
(ii) Analyze the amount of energy between tracks BC

(6 marks)

SECTION B

Q3 (a) Define 'Rotational Motion' and name **THREE (3)** rotational variables.

(4 marks)

(b) A 1.50 mm drill bit rotates at 6.20×10^4 rpm with a constant rate. Determine;

(i) The linear velocity of the drill bit.
(ii) The number of rotations made by the drill bit in 1 minute.

(10 marks)

(c) A 90 cm radius roulette wheel is initially turning at 3 rev/s then slow down uniformly and finally stop after turning 26 revolutions. Determine the following:

(i) Initial tangential speed of the wheel.
(ii) The net acceleration of the wheel.

(11 marks)

Q4 (a) A skier with a mass of 62 kg is sliding down a snowy slope at a constant velocity as showed in **Figure Q4 (a)** above .If friction is known to be 45.0 N.

(i) Draw the Free Body Diagram (FBD) of the skier.
(ii) Determine the Normal force acting on the skier.
(iii) Calculate the coefficient of kinetic friction for the skier.

(13 marks)

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(b) A football is kicked at an angle $\theta = 37°$ with a initial velocity of 20 ms^{-1}. A football player was punted and left the punter's foots at a height of 1.0 m above the ground as shown in figure **Figure Q4 (b)**. Assume the ball leaves the foot at kick level and ignored air resistance and rotation on the ball.

(i) Discuss the concept of projectile at horizontal and vertical component.
(ii) Determine the time taken for the ball to reach the top of trajectory.
(iii) Calculate the time flight of the ball before striking the ground.
(iv) Find the range of the ball travel before hitting the ground.

(12 marks)

Q5 (a) Ali is on the roof of the physics building of UTHM, 46 m above the ground. His friend, Karim is 1.8 m tall, is walking along side the building at a constant speed of 1.2 ms^{-1} as shown in **Figure Q5 (a).** If he wishes to drop an egg on Karim's head.

(i) Determine the time taken for the egg to fall at Karim's head.

(ii) Analyze Karim distance from the building when Ali release the egg. Assume that the egg encounters no appreciable air drag.

(iii) If Ali release small object from rest and falls 100m near the surface of the earth, determine the speed of the object be moving after falling through the 100m mentioned. Neglect air resistance.

(9 marks)

(b) A skier is accelerating down a 30° hill at 3 ms^{-2}.

(i) Determine the vertical component of her acceleration.

(ii) Calculate the time taken for the skier to reach the bottom of the hill, assuming she starts from rest and accelerates uniformly, if the elevation is 300 m.

(8 marks)

(c) A 4 kg particle moves along the x axis. Its velocity varies with time according to $v = 5t - 8t^3 + 2t^2$ where v is in meters per seconds and t is in seconds. Calculate the following:

(i) The position at t = 4 s

(ii) The acceleration at t = 8 s

(iii) Plot the graph acceleration versus time at range of t = 0 s to t = 4 s.

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(8 marks)

Q6 (a) (i) Define the derive quantities.

(ii) Write the SI unit for acceleration, force, power, and wave number.

(4 marks)

(b) (i) State the different between scalar quantities and vector quantities.

(ii) The speed, v of a body is given by the equation, $v = At^3 - Bt$, where t refers to time. Identify the dimension of A and B.

(iii) A paint sprayer can paint a surface at the rate of 6.00 gal/h. Express this rate in liters per minute (L/min). Given: 7.48 gal = 0.0283 m^3 and 1 L = 10^{-3} m^3

(iv) Suppose that a person has an average heart rate of 72.0 beats/min. Determine the beats does he or she have in 2.0 year. Write your answer with correct significant figures.

(12 marks)

(c) A boat radioed a distress call to a Coast Guard station. At the time of the call, a vector **A** from the station to the boat had a magnitude of 45.0 km and was directed 15.0° east of north. A vector from the station to the point where the boat was later found is **B** = 30.0 km, 15.0° north of east. **Figure Q6 (c)** show the compass of the direction.

(i) Determine the components of the vector from the point where the distress call was made to the point where the boat was found? In other words, what are the components of vector **C** = **B** − **A**?

(ii) How far did the boat travel from the point where the distress call was made to the point where the boat was found. In other words, what is the magnitude of vector **C**?

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(9 marks)

-END OF QUESTIONS –

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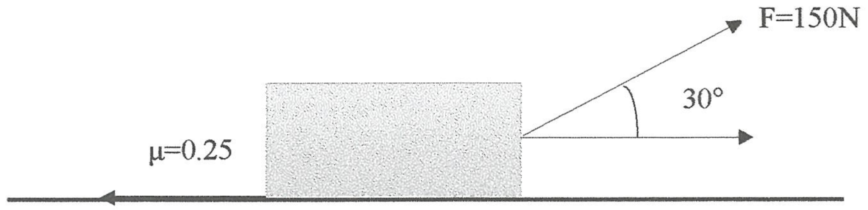

Figure Q2 (b)

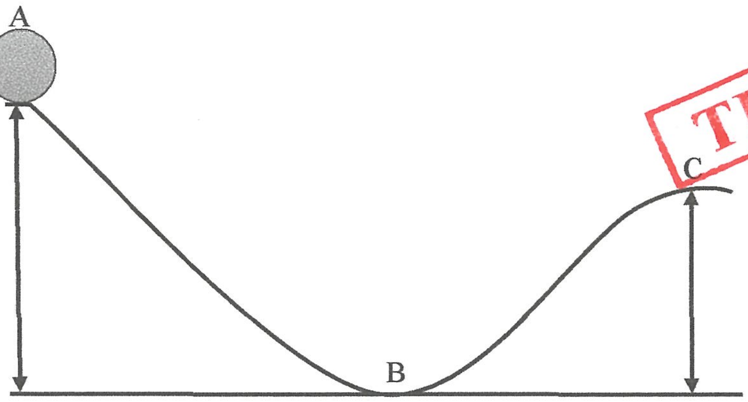

Figure Q2 (c)

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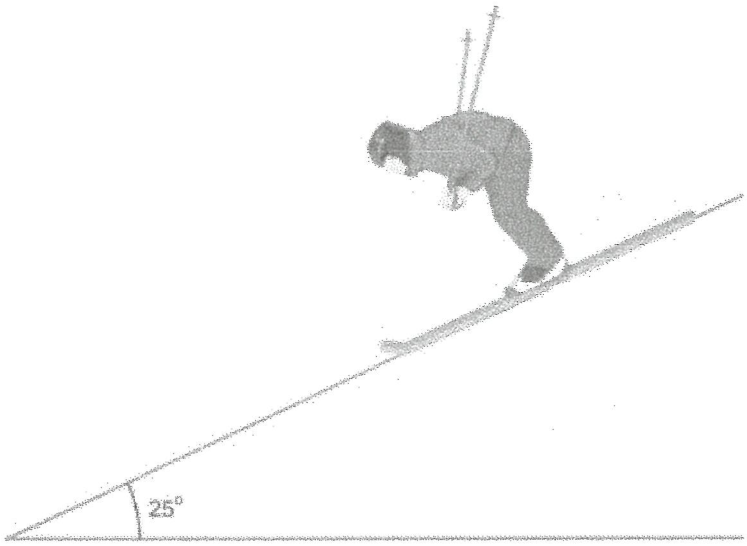

Figure Q4 (a)

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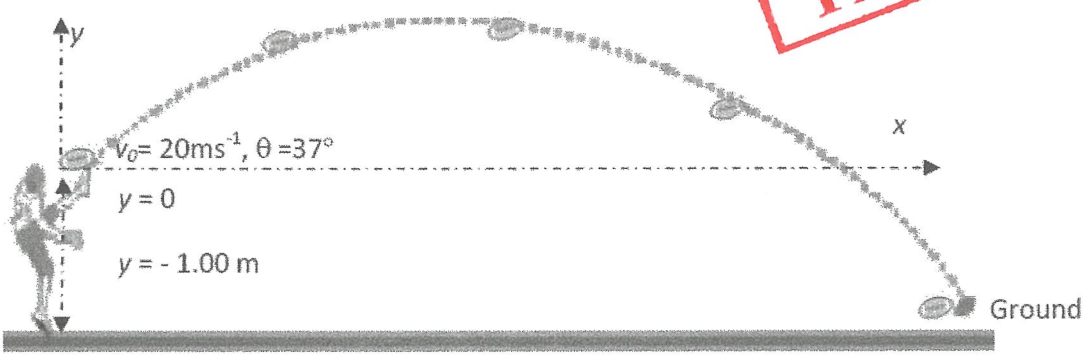

Figure Q4 (b)

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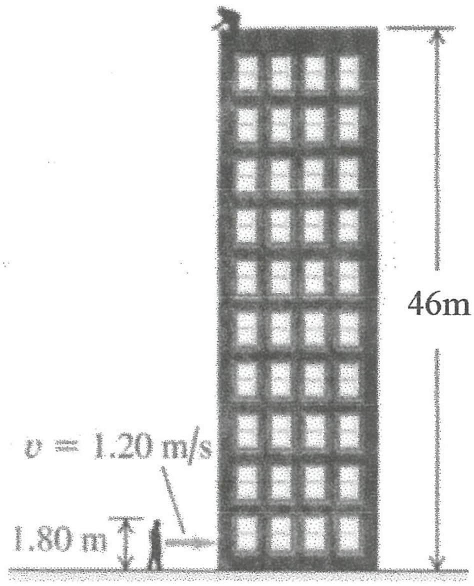

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Figure Q5 (a)

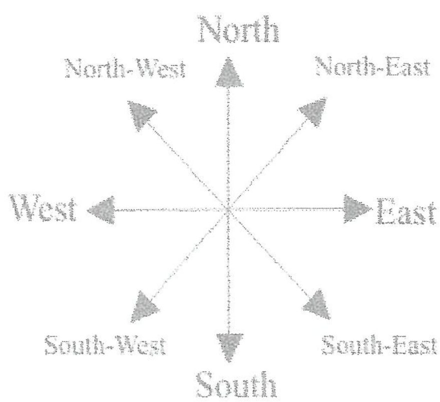

Figure Q6 (c)

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Gravity acceleration, $g = 9.81\ m/s^2$	$V_{sphere} = 4/3\ \pi\ r^3$	$\vec{p} = m\vec{v}$
$W = F \cdot s = Fs\cos\theta$	$E_u = \frac{1}{2}kx^2 = \frac{1}{2}m\omega^2x^2$	$s = r\theta$
$K = \frac{1}{2}mv^2$	$E_J = E_k + E_u = \frac{1}{2}m\omega^2A^2$	$v = r\omega$
$U = mgh$	$R = \sqrt{R_x^2 + R_y^2}$	$a = r\alpha$
$\Delta K = -\Delta U$	$\theta = \tan^{-1}\left(\frac{R_y}{R_x}\right)$	$\omega = \frac{d\theta}{dt}$
$W_n = \Delta K$	$v = u + at$	$\alpha = \frac{d\omega}{dt}$
$\frac{1}{2}mv_2^2 - \frac{1}{2}mv_1^2 = -(mgh_2 - mgh_1)$	$s = ut + \frac{1}{2}at^2$	$a_c = \frac{v^2}{r} = \omega^2 r$
$a = -\omega^2 \cdot x$	$v^2 = u^2 + 2as$	$a = r\sqrt{\omega^4 + \alpha^2}$
$f = \frac{1}{T} = \frac{\omega}{2\pi}$	$\sum F = ma$	$\omega = \omega_o + \alpha t$
$v = \omega\sqrt{A^2 - x^2}$	$W = mg$	$\theta = \omega_o t + \frac{1}{2}\alpha \cdot t^2$
$E_k = \frac{1}{2}mv^2 = \frac{1}{2}m\omega^2(A^2 - x^2)$	$f_k = \mu_k . N;\ f_s = \mu_s . N$	$\omega^2 = \omega_o^2 + 2\alpha \cdot \Delta\theta$

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