UTHM
Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2018/2019

COURSE NAME	:	PHYSICS FOR ENGINEERING TECHNOLOGY
COURSE CODE	:	DAK 13003
PROGRAMME CODE	:	DAK
EXAMINATION DATE	:	DECEMBER 2018 / JANUARY 2019
DURATION	:	3 HOURS
INSTRUCTIONS	:	ANSWER **TWO (2)** QUESTIONS IN SECTION A AND **THREE (3)** QUESTIONS IN SECTION B

THIS QUESTION PAPER CONSISTS OF **SEVEN (7)** PAGES

SECTION A

Q1 (a) Name **three (3)** Elastic Moduli.

(3 marks)

(b) Sketch and label a general Stress-Strain Diagram.

(6 marks)

(c) A mild steel wire of radius 0.5 mm and length 3 meter is stretched by a force of 49 N. The Young modulus *Y* for the steel is 2.1×10^{11} Nm^{-2}. Calculate;

(i) longitudinal stress.

(ii) longitudinal strain.

(iii) elongation produced.

(11 marks)

Q2 (a) Define the Law of Conservation of Heat Energy.

(2 marks)

(b) A sheet of copper has a circular hole with a diameter of 30 cm. If the sheet is heated and underwent a change in temperature of 50 K, calculate the change of the hole area.
Given the coefficient of linear expansion of copper is $17 \times 10^{-6} K^{-1}$.

(5 marks)

(c) A 100 g copper container contains 250 g of water and a 30 g alumina spoon, all at 18°C. A 150 g of alumina cube at 200°C is added to the water in the container. Calculate the final temperature of the system. Assume there is no heat loss to surrounding.
Given the specific heat capacity of water = 4.186 kJ/kg/K, the specific heat capacity of copper = 0.39 kJ/kg/K, the specific heat capacity of alumina = 0.9 kJ/kg/K.

(13 marks)

SECTION B

Q3 (a) Give **two (2)** examples of vector quantity.

(2 marks)

(b) Given four vectors **A**, **B**, **C**, and **D**. Given **A** = 5 m ∠ 15°, **B** = 10 m bearing 200°, **C** = 15 m, N 20° W and **D** = 20 m ∠ −40°

(i) Draw all vectors in *x*-*y* axes.

(ii) Find the magnitude and direction of resultant vector **E** if **E** = **A** + **B** + **C** + **D**

(18 marks)

Q4 (a) *"Forces always come in pairs. The forces in pair are equal in magnitude and opposite in direction."*
State which Newton's Law of Motion that the statement above is referring to, and write its Newton's equation.

(2 marks)

(b) **Figure Q4 (b)** shows a photo frame is attached to a string through a smooth pulley. The other end of the string is attached to a box. The box is then pulled with 40 N force that is parallel to inclined plane that will cause the box to move down the rough inclined plane at an acceleration, a. Given the coefficient of friction, μ of incline plane surface is 0.25, the mass of photo frame is 850 gram, and the mass of the box is 2 kg. Calculate:

(i) the acceleration of the system.

(ii) the tension of the string.

(iii) the frictional force acted on the box.

(18 marks)

Q5 (a) Razu tries to slide a box by applying a 100 N horizontal force, F on the box as shown in **Figure Q5 (a)**. The plane is inclined 30° above the horizontal ground. The frictional force impeding the motion is 50 N and he targets to slide the box through a distance of 0.5 m.

(i) Sketch the Free-body diagram (FBD) of acting forces on the box.

(ii) Find the work done by horizontal force, F.

(iii) Find the work done by frictional force, f.

(iv) Find the work done by gravitational force, W_g.

(v) Find the total work done.

(12 marks)

(b) Consider a ball rolling on a smooth surface as shown in **Figure Q5 (b)**.

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

(ii) In other situation, if the ball reached point C with a speed of 7 $m.s^{-1}$. Find the initial velocity at point A.

(8 marks)

Q6 (a) Define Archimedes' Principle.

(2 marks)

(b) An aluminium sphere with radius 5 cm floats in water with one third of its volume out of the water as shown in **Figure Q6 (b)**. Given the density of aluminium and water are 2.7×10^3 kg. m^{-3} and 1000 kg. m^{-3} respectively. Calculate:

(i) the mass of the aluminium.

(ii) the buoyancy force acting on the aluminium sphere.

(iii) the buoyancy force if the aluminium sphere is fully immersed in the water.

(10 marks)

(c) A container contains a 20 cm layer of oil floating on water that is 40 cm deep. Given the density of the oil is 600 kg. m^{-3}, the density of water is 1000 kg. m^{-3} and the atmospheric pressure is 101.3×10^3 Pa. Calculate:

(i) the absolute pressure at the oil-water interface

(ii) the absolute pressure at the bottom of the container.

(8 marks)

- END OF QUESTION-

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LIST OF FIGURES

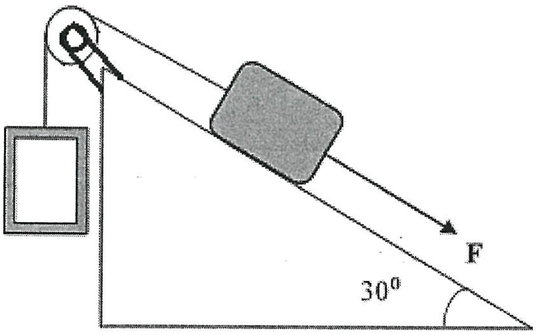

Figure Q4 (b)

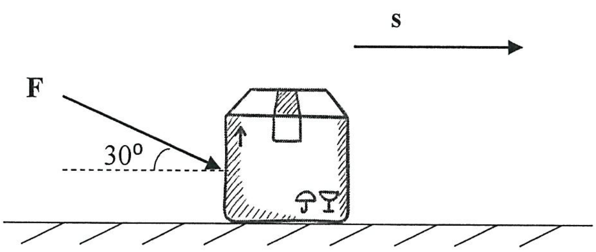

Figure Q5 (a)

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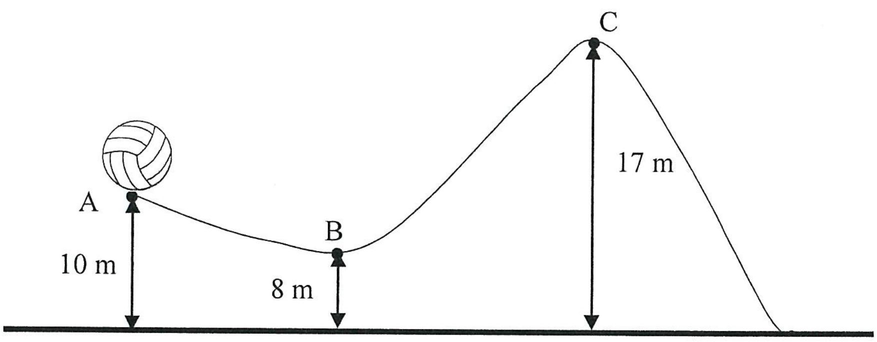

Figure Q5 (b)

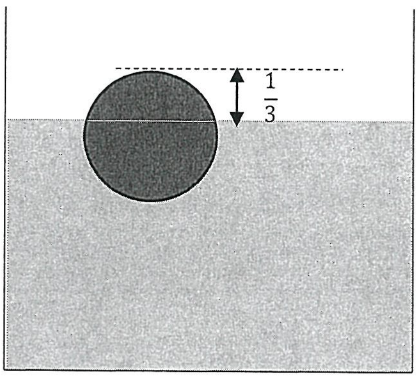

Figure Q6 (b)

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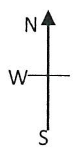
LIST OF FORMULA

$\lvert\vec{R}\rvert = \sqrt{x^2 + y^2}$	$Weight = mg$	$W = \Delta K = -\Delta U$
$\theta = tan^{-1}\frac{y}{x}$	$f = \mu N$	$\Sigma E_f = \Sigma E_i$
$\Sigma F = ma$	$W = Fscos\theta$	$K_f + U_f = K_i + U_i$
$\Sigma F = 0$	$\Delta K = K_f - K_i = \frac{1}{2}m\Delta v^2$	$\rho = \frac{m}{V}$
$\Sigma F_1 = -\Sigma F_2$	$\Delta U = U_f - U_i = mg\Delta h$	$SG = \frac{\rho_{substance}}{\rho_{reference}}$
$P = \frac{F}{A}$	$P = \rho gh$	$P_2 = P_1 + pgh$
$\frac{F_1}{A_1} = \frac{F_2}{A_2}$	$\frac{F_1}{A_1} + \rho gh = \frac{F_2}{A_2}$	$F_B = m_o g$
$\varepsilon = \frac{\Delta L}{L_o}$	$Y = \frac{\sigma}{\varepsilon}$	$F_B = \rho_f g V_f$
$F = -k\Delta x$	$S = \frac{\sigma_s}{\varepsilon_s}$	$B = -\frac{FV_o}{A\Delta V}$
$T_K = T_C + 273.15$	$T_F = 1.8T_C + 32$	$T_F = 1.8(T_K - 273.15) + 32$
$L = L_o(1 + \alpha\Delta T)$	$A = A_o(1 + \beta\Delta T)$	$V = V_o(1 + \gamma\Delta T)$
$Q = mc\Delta T$	$\Sigma Q_{gain} = \Sigma Q_{loss}$	$Q = mL$



$g = 9.81\ ms^{-2}$