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UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2019/2020

COURSE NAME	:	PHYSICS FOR ENGINEERING TECHNOLOGY
COURSE CODE	:	DAK 13003
PROGRAMME CODE	:	DAK
EXAMINATION DATE	:	DECEMBER 2019 / JANUARY 2020
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **FIVE (5)** QUESTIONS ONLY

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

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Q1 (a) SI unit a standard unit used by scientists and engineers worldwide.

(i) State the base unit for force, pressure and acceleration.

(ii) An acre is defined such as 640 acres = 1 miles^2. Calculate how much square meters (m^2) are there in 2.5 acres. (Given 1 mile = 1609 meter).

(iii) The mass of a solid cube is 1207 g. The cube as even length, width and height of 2 inch. Calculate the density of the cube in SI units. (Given 1 inch = 2.54 cm).

(10 marks)

(b) Explain value, dimensions and unit in a table form, using suitable examples.

(6 marks)

(c) Write these values in scientific notations.

(i) 3 079 000 000 000 000 000 000 000 seconds.

(ii) 0.000 000 000 000 635 meter.

(4 marks)

Q2 (a) Give **two (2)** examples of vector quantity.

(2 marks)

(b) Given four vectors of **A**, **B**, **C**, and **D**. The value of **A** = 5 m $\angle$ 15°, **B** = 10 m $\angle$ 240°, **C** = 15 m, N 20° W and **D** = 20 m $\angle$ – 30°.

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

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

(18 marks)

Q3 (a) *"Forces always come in pairs. The forces in pair are equal in magnitude and opposite in direction."*. Sketch a diagram to explain this statement.

(2 marks)

(b) **Figure Q3 (b)** shows a wooden frame is attached to a 950-gram box through a smooth, frictionless pulley. The box is located on an inclined, rough surface with the coefficient of friction 0.3. The direction of the system movement is shown in the figure above.

(i) Calculate the wooden frame mass (kg) if the system accelerates at 3 ms^{-2}.

(ii) Calculate the tension of the string, T in Newton.

(iii) Calculate the normal force of the box, N in Newton.

(12 marks)

(c) A 15.0 N force is applied at an angle of 30° to the horizontal to push a 0.75 kg block to the right side on a frictionless surface.

(i) Sketch the free-body diagram (FBD) for this scenario.

(ii) Calculate acceleration of the system.

(6 marks)

Q4 (a) A girl tries to slide a box by applying a 120 N horizontal force, *F* on the box as shown in **Figure Q4 (a)**. The force is applied 30° above the horizontal surface. The frictional force opposing the motion is 50 N and he targets to slide the box 1.5 m to the right.

(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 Q4 (b)**.

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

(ii) Find the initial velocity at point A if the ball reached the end point, C with a speed of 10 $m.s^{-1}$.

(8 marks)

Q5 (a) Define Archimedes' Principle.

(2 marks)

(b) An aluminium sphere with a radius of 5 cm floats in water while 75% of its volume submerged in the water. The density of aluminium and water are 2.7×10^3 kg.m^{-3} and 1000 kg.m^{-3} respectively.

(i) Calculate the mass of the sphere.

(ii) Calculate the buoyant force acting on the sphere.

(iii) Calculate the buoyant force of the sphere when it is fully immersed in the water.

(10 marks)

(c) A 30 cm layer of oil floats on top of a water layer of 50 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 101×10^3 Pa.

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

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

(8 marks)

Q6 (a) Define the terms below.

(i) Stress.

(ii) Strain.

(iii) Elasticity.

(6 marks)

(b) Two rectangular rods of 2.0 m long have a cross sectional area of 4 cm^2. One of them is a steel rod ($Y = 20\times10^{10}$ Pa) and another one is an aluminium rod ($Y = 7\times10^{10}$ Pa). Both rods are pressed by a milling machine with 1000 N of force. Compare which has the higher elongation between the two rods.

(8 marks)

(c) A rectangular block of jelly has an original dimension of 10 cm x 10 cm x 3 cm when no force is applied to it. When a shear force of magnitude 0.45 N is applied to the upper surface of the block, the surface is displaced 0.9 cm relative to the fixed lower surface as shown in **Figure Q6 (c)**.

(i) Calculate the shear stress.

(ii) Calculate the shear strain.

(iii) Calculate the shear modulus of the jelly.

(6 marks)

Q7 (a) Convert the following temperature values.

(i) $-50\ ^\circ F$ to $^\circ C$.

(ii) $130\ ^\circ C$ to $^\circ F$.

(iii) $-293\ ^\circ C$ to $^\circ F$.

(iv) $75\ ^\circ C$ to K.

(v) 80 K to $^\circ C$.

(10 marks)

(b) A certain amount of heat is added to a mass of aluminium and its temperature is raised by 50 K. Suppose that the same amount of heat is added to the same mass of a copper. Calculate how much does the copper temperature raise? Given that C_{Al} = 0.90 kJ/(kg.K) and C_{Cu} = 0.585 kJ/(kg.K).

(6 marks)

(c) A copper rod has a length of 9.00 cm at 25 ° C (α copper = $17\text{x}10^{-6}/\ ^\circ C$).

(i) Calculate the new rod length when it is placed in a boiling water.

(ii) Calculate required temperature to make the rod length to be 9.03 cm.

(4 marks)

– END OF QUESTIONS –

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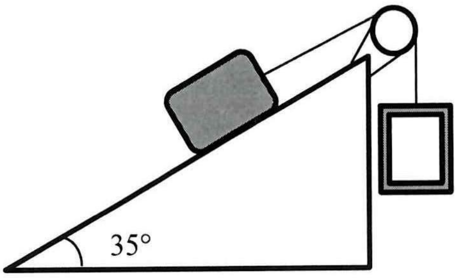

Figure Q3(b)

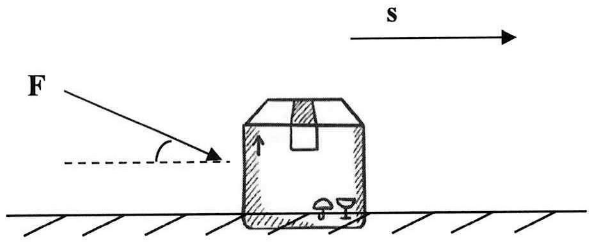

Figure Q4(a)

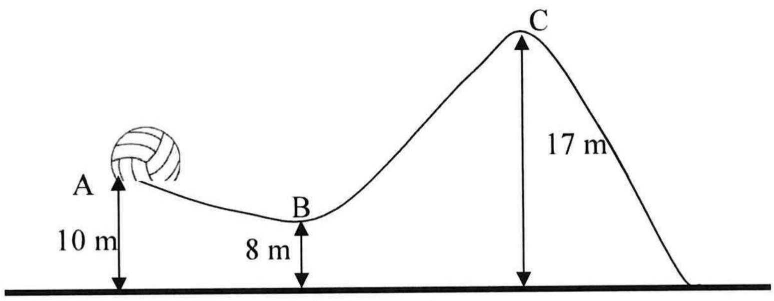

Figure Q4(b)

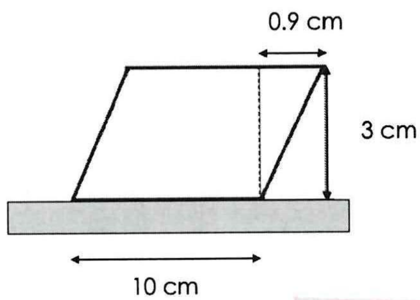

Figure Q6 (c)

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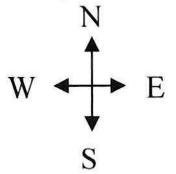
List of formula

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



$|R| = \sqrt{\Sigma R_x{}^2 + \Sigma R_y{}^2}$

$\tan\theta = \frac{\Sigma R_y}{\Sigma R_x}$

$\Sigma F = \Sigma m \times a$

$f = \mu N$

$W = mg$

$g = 9.81\ m.s^{-2}$

$W = Fd$

$W = Fs$

$PE = mgh = Joule$

$KE = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2$

$PE = KE$

$F_B = \rho_f V_{obj} g$

$W = \rho_{obj} V_{obj} g$

$V_{sphere} = \frac{4}{3}\pi r^3$

$P = \frac{F}{A}$

$P = P_{atm} + \rho gh$

$Stress, \sigma = \frac{F}{A}$

$Strain, \varepsilon = \frac{\Delta L}{L_0}$

$Y = \frac{\sigma}{\varepsilon}$

$\sigma s = \frac{F}{A}$

$\varepsilon s = \frac{\Delta x}{y}$

$S = \frac{\sigma s}{\varepsilon s}$

$T_F = 1.8\,T_C - 32$

$T_K = T_C + 273.15$

$Q = mC_p\Delta T$

$L = L_o(1 + \alpha\Delta T)$