CONFIDENTIAL

UTHM
Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION (ONLINE) SEMESTER I SESSION 2020/2021

COURSE NAME	:	PHYSICS FOR ENGINEERING TECHNOLOGY
COURSE CODE	:	DAK 13003
PROGRAMME CODE	:	DAK
EXAMINATION DATE	:	JANUARY / FEBRUARY 2021
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **FIVE (5)** QUESTIONS ONLY. **OPEN BOOK EXAMINATION**

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

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

(i) An athlete ran 10 km in half an hour while losing 3 kg of body mass. State **TWO (2)** derived units based on this statement.

(4 marks)

(ii) A 2.0 kg of water fills a volume of 195 mL. Calculate its density in SG. [$1 \text{ mL} = 1 \times 10^{-6} \text{ m}^3$]

(4 marks)

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

(6 marks)

(c) Show the steps to obtain the final SI units of force ($kgms^{-1}$), pressure ($kgm^{-1}s^{-2}$) and work (kgm^2s^{-2}) from the base unit of mass (kg), length (m) and time (s).

(6 marks)

Q2 (a) Write the magnitude and direction when a student walks 5 meter to the west.

(2 marks)

(b) Given four vectors of **A**, **B**, **C**, and **D**. The value of **A** = 7 m ∠ 30, **B** = 10 m ∠ 240°, **C** = 15 m, N 20° W and **D** = 18 m bearing of 220°.

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

(4 marks)

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

(14 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 1.2 kg 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 $1.3\ ms^{-2}$.

(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 25.0 N force with an angle of 30^{o} is pushing a 800-gram block to the right side on a rough surface.

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

(ii) Calculate the coefficient of friction to achieve zero acceleration.

(6 marks)

Q4 (a) A girl tries to slide a box by applying a 200 N horizontal force, F on the box as shown in **Figure Q4 (a)**. The force is applied 30^{o} above the horizontal surface. The frictional force opposing the motion is 50 N and he targets to slide the box 2.5 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 total work done.

(8 marks)

(b) Consider a ball rolling on a smooth surface as shown in **Figure Q4 (b)**.

(i) Calculate the ball speed at point B if it starts from rest at point A.

(4 marks)

(ii) Calculate the ball initial velocity at point A if the ball reached the end point, C with a speed of $9\ m.s^{-1}$.

(8 marks)

Q5 (a) Define buoyant force.

(2 marks)

(b) A 5 cm radius of plastic sphere floats in water while 20% of its volume is above the water surface. The plastic and water density are 1.7×10^3 kg.m^{-3} and 1000 kg.m^{-3}.

(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 130 cm depth of oil sit on top of a water with 150 cm deep. The oil and water density are 600 kg.m^{-3} and 1000 kg.m^{-3} while 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) Sketch a diagram for each of 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 = 20×10^{10} Pa) and another one is an aluminium rod (Y = 7×10^{10} Pa). Both rods are pressed by a milling machine with 3000 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 0.50 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) – 45 ° F to ° C.

(ii) 150 ° C to ° F.

(iii) – 283 ° C to ° F.

(iv) 65 ° C to K.

(v) 90 K to ° C.

(10 marks)

(b) A certain amount of heat is added to a mass of aluminium and its temperature is raised by 70 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 10 cm at 25 ° C (α copper = 17×10^{-6}/ ° 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 10.05 cm.

(4 marks)

– END OF QUESTIONS –

FINAL EXAMINATION

SEMESTER/SESSION : SEM I 2020/2021
COURSE NAME : PHYSICS FOR ENGINEERING TECHNOLOGY
PROGRAMME CODE : DAK
COURSE CODE : DAK 13003

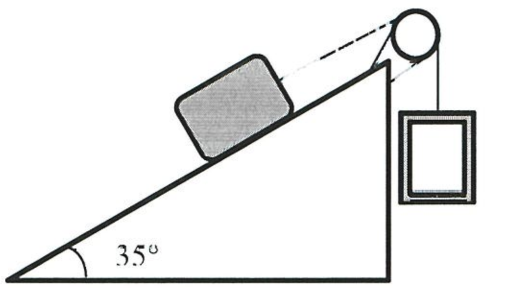


Figure Q3(b)

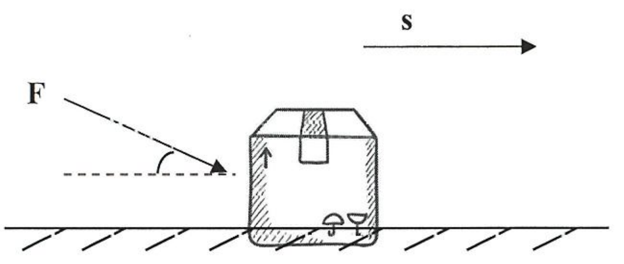


Figure Q4(a)

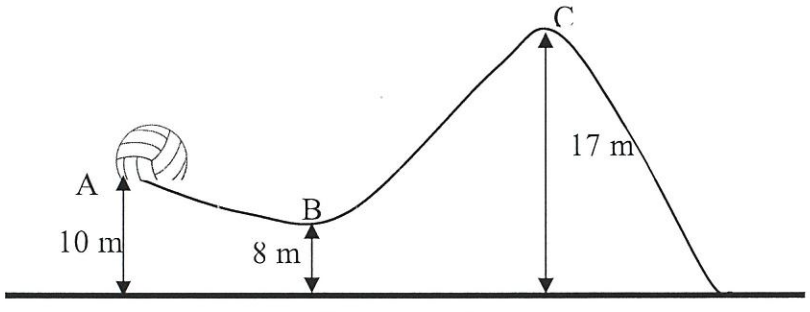


Figure Q4(b)

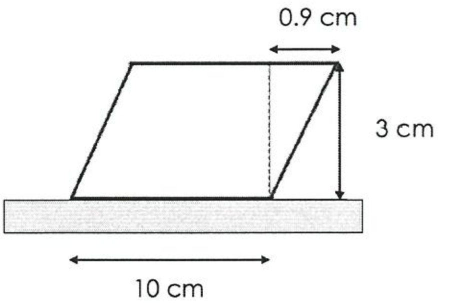


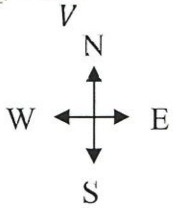
Figure Q6 (c)

FINAL EXAMINATION

SEMESTER/SESSION : SEM I 2020/2021 PROGRAMME CODE : DAK
COURSE NAME : PHYSICS FOR ENGINEERING TECHNOLOGY COURSE CODE. : DAK 13003

List of formula

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



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

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

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

$$f = \mu N$$

$$W = mg$$

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

$$W = Fd$$

$$W = Fs$$

$$PE = mgh = Joule$$

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

$$PE = KE$$

$$F_B = \rho_f V_{obj} g$$

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

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

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

$$P = P_{atm} + \rho g h$$

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

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

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

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

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

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

$$T_F = 1.8\, T_C - 32$$

$$T_K = T_C + 273.15$$

$$Q = mC_p \Delta T$$

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