



**UNIVERSITI KUALA LUMPUR
MALAYSIAN INSTITUTE OF INDUSTRIAL TECHNOLOGY**

**FINAL EXAMINATION
JANUARY 2016 SEMESTER**

COURSE CODE : JGD 20302
COURSE TITLE : FUNDAMENTALS OF ENGINEERING SCIENCE 2
PROGRAMME LEVEL : DIPLOMA
DATE : 24 MAY 2016
TIME : 2.30 PM – 5.30 PM
DURATION : 3 HOURS

INSTRUCTIONS TO CANDIDATES

1. Please read the instructions given in the question paper **CAREFULLY**.
 2. This question paper is printed on both sides of the paper.
 3. This question paper consists of **TWO (2)** sections.
 4. Answer **ALL** questions in Section A. Choose **TWO (2)** questions in section B.
 5. Please write your answers on the answer booklet provided.
 6. Table and formula are enclosed as reference.
 7. Please answer all questions in English only.
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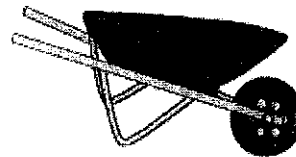
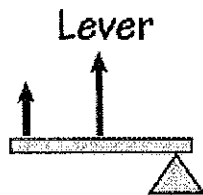
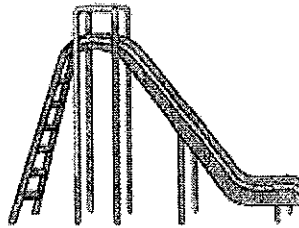
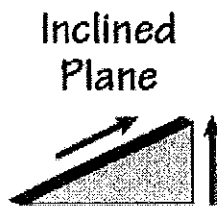
THERE ARE 4 PAGES OF QUESTIONS EXCLUDING THIS PAGE.

SECTION A (Total: 60 marks)

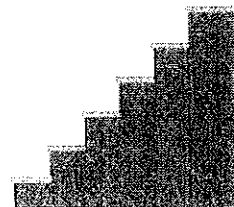
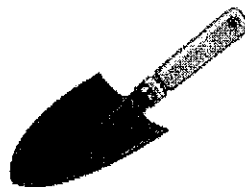
INSTRUCTION: Answer ALL questions.
Please use the answer booklet provided.

Question 1

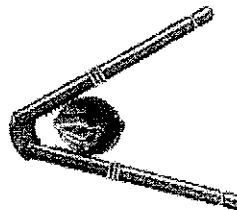
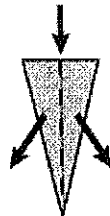
a) Match each example to the correct type of simple machine. Write the name of the machine below each object.



Screw



Wedge



(4 marks)

- b) A motorcycle uses 150 N to travel 300 meters in 30 seconds. A car however uses 200 N to travel 150 meters in 30 seconds.
- Estimate the work done by each vehicle. (4 marks)
 - Estimate the power developed by both vehicle. (4 marks)
- c) A long splitting wedge has a width of 2 cm, and the angle at the apex is 6° . The efficiency of the wedge is 95%.
- Estimate the ideal mechanical advantage of the wedge. (5 marks)
 - Estimate its actual mechanical advantage. (3 marks)

Question 2

- a) State Hooke's Law and describe briefly the elastic limit and breaking point. (3 marks)
- b) A square rod 2.50 m long has a tensile force of 60.0 N applied to it and this force produces a stress of 3.06 MPa in the rod.
- Estimate the side-length of the rod. (3 marks)
 - Estimate the strain percentage if the rod contracts by 0.5 cm axially. (3 marks)
- c) A 36,000 N shearing force is applied to a steel doorknob 4 cm long with a cross sectional area of $7.85 \times 10^{-5} \text{ m}^2$. Estimate the deflection (d) of the doorknob. Given the shear modulus = $8.27 \times 10^{10} \text{ Pa}$. (3 marks)
- d) Young's modulus for brass is $8.96 \times 10^{11} \text{ Pa}$. A 12 kg mass is attached to an 8 m length of brass wire. Find the diameter of the wire if it stretch 6 mm. (8 marks)

Question 3

- a) Estimate the mass of a solid iron ball with radius of 18 cm. ($\rho_{\text{iron}} = 7800 \text{ kg/m}^3$)
(5 marks)
- b) Estimate the Farenhiet and Kelvin temperature for a cold storage room ($-27 \text{ }^\circ\text{C}$).
(5 marks)
- c) A 2 m copper pipe change in length of $3.1 \times 10^{-2} \text{ m}$ when temperature is raised to $978 \text{ }^\circ\text{C}$. Estimate the initial temperature of the pipe. ($\alpha_{\text{copper}} = 1.6 \times 10^{-5} \text{ }^\circ\text{C}^{-1}$)
(5 marks)
- d) List down two (2) devices that can be uses for pressure measurement.
(5 marks)

SECTION B (Total: 40 marks)

INSTRUCTION: Choose TWO (2) questions only

Please use the answer booklet provided

Question 1

- a) A copper (Cu) weight is placed on top of a 0.5 kg block of wood floating in water. Calculate the mass of the copper if the top of the wood block is exactly at the water's surface? ($\rho_{\text{wood}} = 0.6 \times 10^3 \text{ kg/m}^3$; $\rho_{\text{water}} = 1000 \text{ kg/m}^3$)

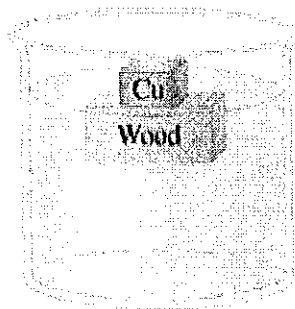


Figure 1: Block of wood and copper floating in water.

- (6 marks)
- b) A 4 kg brass block is attached to a string and submerged underwater. Given the density of brass is 8700 kg/m^3 . Find the buoyant force and the tension in the rope.
(6 marks)

- c) Given a new swimming pool of 22 m by 8.5 m with uniform depth 2 m.
- Calculate the total force and the absolute pressure on the bottom of the pool?
(5 marks)
 - Identify the pressure at the side of the pool near the bottom area.
(3 marks)

Question 2

- Explain how bimetallic strips work in fire alarms.
(4 marks)
- The 70 L steel gas tank of a car is filled up to the top with gasoline at 20 °C. The car sits in the sun and the tank reaches temperature of 40 °C. Compute how much gasoline do you expect to overflow from the tank? (the expansion by gas tank is neglected). ($\beta_{\text{gasoline}} = 950 \times 10^{-6} \text{ } ^\circ\text{C}^{-1}$)
(8 marks)
- The steel bed of a suspension bridge is 200 m long at 20 °C. The bridge might be exposed under extreme temperature of -30 °C to +40 °C. Calculate how much will it contract and expand. ($\alpha_{\text{steel}} = 12 \times 10^{-6} \text{ } ^\circ\text{C}^{-1}$)
(8 marks)

Question 3

- Find heat required to make 10g ice at -20 °C to steam at 120 °C. Support your answer with the phase transition graph. ($c_{\text{ice}} = 2060 \text{ J/kg}\cdot^\circ\text{C}$; $c_{\text{water}} = 4180 \text{ J/kg}\cdot^\circ\text{C}$; $c_{\text{steam}} = 2020 \text{ J/kg}\cdot^\circ\text{C}$; $L_f = 3.34 \times 10^5 \text{ J/kg}$; $L_v = 3.34 \times 10^5 \text{ J/kg}$)
(12 marks)
- A lead fishing weight $1 \times 10^2 \text{ g}$ was heated to a temperature of 100 °C. Then, it was placed in $1 \times 10^2 \text{ g}$ of water at 35 °C. The final temperature of the water change to 45 °C. Calculate the specific heat of the lead fishing.
(4 marks)
- In which liquid would an ice cube melt faster, water or methanol. Explain.
($c_{\text{water}} = 4180 \text{ J/kg}\cdot^\circ\text{C}$; $c_{\text{methanol}} = 2530 \text{ J/kg}\cdot^\circ\text{C}$)
(4 marks)

END OF EXAMINATION PAPER

FORMULA

Weight	$W = mg$	Density	$\rho = \frac{m}{V}$
Work	$W = Fs$	Pressure	$P = \frac{F}{A}$
Power	$P = \frac{W}{t}$	Fluid pressure	$P = \rho gh$
Mechanical advantage	$MA = \frac{F_o}{F_i}$	Buoyant force	$F_b = \rho_f g V_f$ $F_b + T = mg$
	$IMA = \frac{S_i}{S_o}$	Temperature (°C)	$T_c = (T_f - 32) \left(\frac{5}{9} \right)$ $T_c = T_k - 273.15$
Efficiency	$e = \frac{MA}{IMA}$	Heat	$Q = mc\Delta T$
Young's Modulus	$Y = \frac{\text{stress}}{\text{strain}}$ $= \frac{(F/A)}{(\Delta L/L)}$	Linear thermal expansion	$\Delta L = \alpha L_o \Delta T$
Bulk Modulus	$B = \frac{-PV}{\Delta V}$	Volume thermal expansion	$\Delta V = \beta V_o \Delta T$