UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION

SEMESTER I

SESSION 2012/2013

COURSE NAME	: BASIC ENGINEERING SCIENCE
COURSE CODE	: BWM 21702 / BSF 2812
PROGRAMME	: 2 BPC
EXAMINATION DATE	: DECEMBER 2012/ JANUARY 2013
DURATION	: 2 HOURS 30 MINUTES
INSTRUCTION	: ANSWER **ALL** QUESTIONS IN **SECTION A** AND **TWO (2)** QUESTIONS IN **SECTION B**

THIS QUESTION PAPER CONSISTS OF **SIX (6)** PAGES

SECTION A

Q1 (a) Write the following numbers in scientific notations,

(i) 1.156
(ii) 0.0068

(2 marks)

(b) A farmer hitches his tractor to a sled loaded with firewood and pulls it along a level ground. The tractor exerts a constant force of 1000 N at an angle 36.9° above the horizontal. The total weight of sled and load is 15,000 N. Find the speed of the sled after it moves 20 m if the initial speed, v_i= 2.0 m/s, Given gravity, g =10ms^{-2}.

(8 marks)

(c) A 54 kg marathon runner runs up the stairs to the top of a 656 m tall tower. Calculate his average power output for him to be at the top in 20.0 minutes in watts and kilowatts.

(6 marks)

(d) A diver swims to a depth of 8.0 m in a freshwater lake. Given, the area of the diver's body is 0.83 m^2 and the density of freshwater is 1000 kg/m^3. Find the increase in the force pushing in on his body, compared to what it was at the lake surface.

(4 marks)

Q2 (a) (i) Explain how is wave generated?

(ii) Describe the difference between transverse waves and longitudinal waves.

(6 marks)

(b) A transverse wave is described by,

$$y(x,t) = (6.50mm)cos2\pi\left(\frac{x}{28.0cm} - \frac{t}{0.036s}\right)$$

Determine the wave's,

(i) amplitude
(ii) wavelength
(iii) frequency
(iv) time
(v) speed of propagation

(10 marks)

(c) A transverse wave pulse travels to the right along a string. At t = 0 s the shape of the pulse is given by the function of,

$$D = 0.5sin2.1x$$

where D and x are in meters. Show the graph of this wave function.

(4 marks)

SECTION B

Q3 (a) Convert the following Kelvin temperatures to the Celsius and Fahrenheit scales.

(i) 400 K
(ii) 95 K

(6 marks)

(b) If 200 cm^3 of tea at 95°C is poured into a 150 g glass cup initially at 25°C as shown in **Figure Q3 (b)**, calculate the common final temperature, T of the tea and cup when equilibrium is reached, assuming no heat flows to the surroundings. The specific heat, C of water and glass are 4186 J/kg.°C and 750 J/kg.°C, respectively.

(10 marks)

(c) How much heat is needed to raise the temperature of an empty 20 kg basket made of iron from 10°C to 90°C. Given the specific heat, C of iron is 470 J/kg.°C.

(4 marks)

Q4 (a) Define,

(i) Newton's first law and give an example.
(ii) Newton's third law and give an example.

(6 marks)

(b) Two forces are applied at one point with the following condition; 30 N at 30° with respect to x-axis and 20 N at 140° with respect to x-axis. Using both graphical and analytical method, find the sum of these two vectors.

(6 marks)

(c) A box of mass m is placed on a frictionless incline that makes an angle θ with the horizontal, as shown in **Figure Q4 (c)**. Given gravity, g = 10 ms^{-2}.

(i) Determine the normal force on the box.
(ii) Determine the box's acceleration.
(iii) Evaluate the normal force and acceleration for a mass m = 10 kg and an incline of θ = 30°

(8 marks)

Q5 (a) An aluminum wire of 3 mm in diameter and 4 m long is used to support 50 kg mass. Given Young's modulus for an aluminum is 7×10^{10} Pa, find the elongation of the wire.

(6 marks)

(b) A Pyrex vessel filled to the brim with 1 L (1000 cm^3) of water at 20°C is heated to 90°C. Calculate the water overflow if the coefficients of volumes expansion, β of Pyrex and water are 9×10^{-6} $°C^{-1}$ and 207×10^{-6} $°C^{-1}$, respectively.

(6 marks)

(c) Determine the formula for the change in surface area of a uniform solid sphere of radius, r if its coefficient of linear expansion, α is (assumed constant) and its temperature is changes by ΔT.

(2 marks)

(d) An iron ring is to fit snugly on a cylindrical iron rod. At 20 °C, the diameter of the rod is 6.420 cm. To slip over the rod, the ring must slightly larger than the rod diameter by about 0.008 cm. Analyze the suitable temperature for that ring to make it slip over the rod. Given liner expansion, α of iron rod is 12×10^{-6} $°C^{-1}$.

(6 marks)

- END OF QUESTION -

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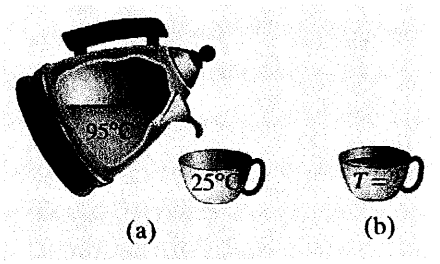

Figure Q3 (b)

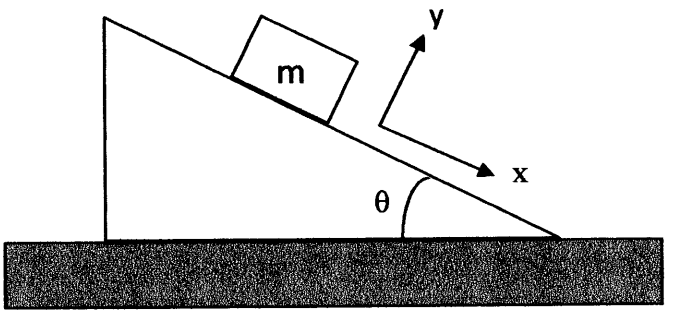

Figure Q4 (c)