UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2009/2010

SUBJECT	:	BASIC PHYSICS I
CODE	:	DSF 1983
COURSE	:	1 DFT / 2 DFT
EXAMINATION DATE	:	NOVEMBER 2009
DURATION	:	2 ½ HOURS
INSTRUCTION	:	ANSWER **ALL** QUESTIONS IN **PART A** AND **THREE (3)** QUESTIONS IN **PART B**

THIS PAPER CONSISTS OF 8 PAGES

PART A

Q1 (a) A bell produces sound energy at a rate of 4.00×10^{-3} W and radiates it uniformly in all directions. What is the intensity of the wave 100.0 m from the bell?

(6 marks)

(b) The decibel level of a jackhammer is 130 dB relative to the threshold of hearing, $I_o = 1 \times 10^{-12}$ Wm^{-2}. Determine the sound intensity produced by the jackhammer.

(8 marks)

(c) An ambulance moved towards the station with a constant velocity of 50 ms^{-1} and releases the siren at 500 Hz. What is the frequency heard by the stationary observer at the station when the ambulance
(i) is approaching the observer.
(ii) is moving away from the observer.
(Given: the velocity of sound in air is 343 ms^{-1})

(6 marks)

Q2 (a) A ray of light is reflected from two plane mirror surfaces as shown in **Figure Q2 (a).** What are the correct values of α and β?

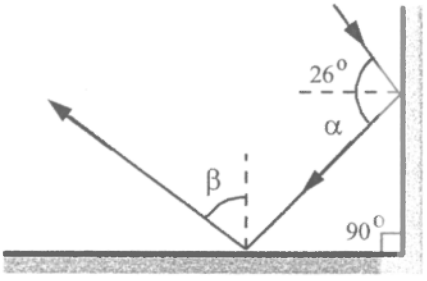

Figure Q2 (a)

(6 marks)

(b) **Figure Q2 (b)** shows the path of a portion of a ray of light as it passes through three different materials. What can be concluded concerning the refractive indices of these three materials?
(**Note**: The figure **is** drawn to scale.)

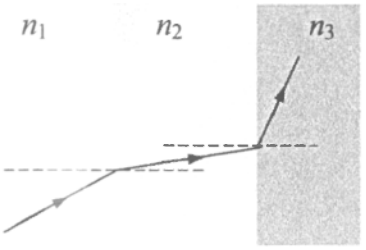

Figure Q2 (b)

(6 marks)

(c) A beam of light in the water makes an angle of incidence as it enters a piece of unknown transparent material as illustrated in **Figure Q2 (c)**. The beam is refracted at an angle of 34.5° in the material. If the refraction index of water, n = 1.33, find the index of refraction of the unknown material.

(8 marks)

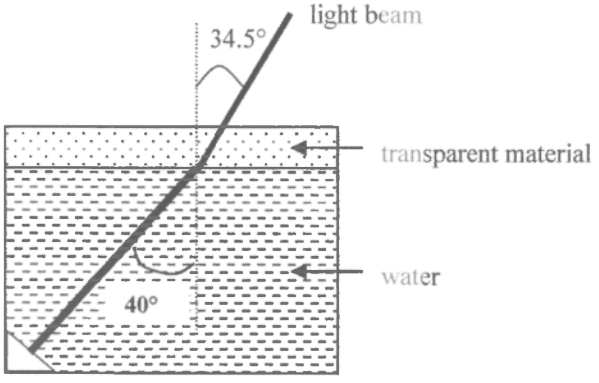

Figure Q2 (c)

PART B

Q3

(a) Young's modulus of nylon is 5×10^9 N/m^2. A force of 5×10^5 N is applied to a 2-m length of nylon of cross sectional area 0.1 m^2. By what amount does the nylon stretch?

(7 marks)

(b) The brick shown in **Figure Q3 (b)** is glued to the floor. A 3500-N force is applied to the top surface of the brick as shown. If the brick has a shear modulus of 5.4×10^9 N/m^2, how far to the right does the top face move relative to the stationary bottom face?

(8 marks)

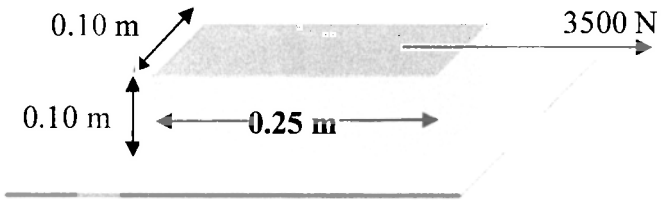

Figure Q3 (b)

(c) A plastic box has an initial volume of 2.00 m^3. It is then submerged below the surface of a liquid and its volume decreases to 1.96 m^3. What is the volume strain on the box?

(5 marks)

Q4 (a) The density of iron is 7860 kg/m^3. What is the mass of an iron sphere with a diameter of 0.50 m?

(6 marks)

(b) The radius of the smaller piston in a hydraulic system is 5.0 cm while its larger piston has a radius of 20.0 cm as illustrated in **Figure Q4 (b).** Determine the magnitude and the direction of the force on the larger piston, F_2 if a force, F_1 = 1,000 N is applied to the smaller piston.

(6 marks)

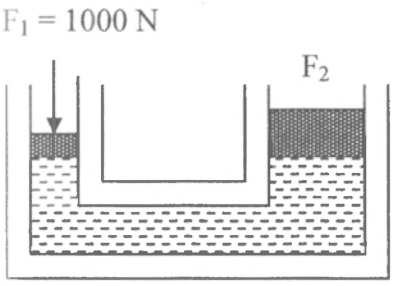

Figure Q4 (b)

(c) A block of a material with a dimension 8 cm x 4 cm x 5 cm is floated in a fluid of density 900 kgm^{-3}. After being partly immersed inside the fluid, 1/5 part of the block is floating above the fluid surface as illustrated in **Figure Q4 (c).** Find

(i) buoyant force on the block.
(ii) density of the material.

(8 marks)

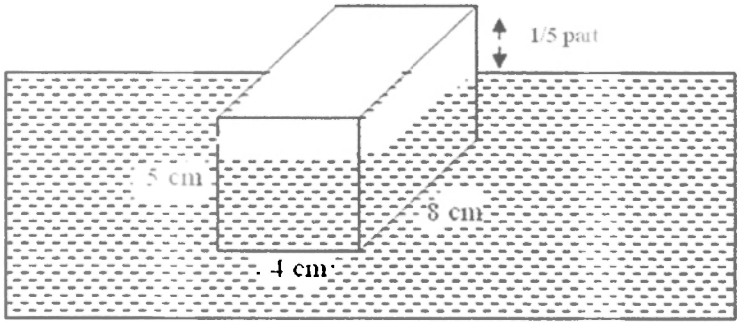

Figure Q4 (c)

Q5 (a) Define the following terms.
(i) Specific heat, *c.*
(ii) Latent heat, *L.*

(4 marks)

(b) What is the minimum amount of energy required to completely melt a 7.25-kg lead brick which has a starting temperature of 18.0 °C? The melting point of lead is 328 °C. The specific heat capacity of lead is 128 J/(kg °C) and its latent heat of fusion is 23 200 J/kg.

(8 marks)

(c) A thin, circular disc is made of lead and has a radius of 0.0350 cm at 20.0 °C. Determine the change in the area of the circle if the temperature is increased to 625.0 °C. The coefficient of linear thermal expansion for lead is 29.0×10^{-6} °C^{-1}.

(8 marks)

Q6 (a) A progressive wave is represented by the following equation.

$$y = 10 \sin 4\pi(40t + x)$$

where y and x are measured in centimeter and t in seconds.
Determine

(i) the amplitude, A.
(ii) the angular frequency, ω.
(iii) the frequency, f.
(iv) the wavelength, λ.

(10 marks)

(b) Standing waves is formed inside a pipe with open end at both side as illustrated in **Figure Q6 (b).** The length of the pipe is 1.0 m.

(i) If the third harmonics series of standing wave is occurred inside the pipe, draw an appropriate diagram of this particular standing wave.
(ii) Give a number of the node and antinode should be formed.
(iii) What is the distance between the adjacent antinodes and the nodes?
(iv) Calculate the wavelength of the pipe, λ.

(10 marks)

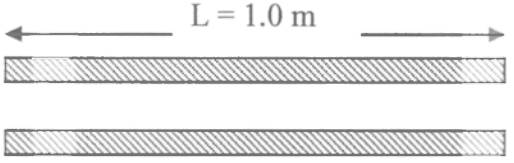

Figure Q6 (b)

LIST OF CONSTANTS

1. Gravity acceleration, $g = 10\ \text{m/s}^2$
2. Speed of light in air, $c = 3 \times 10^8\ \text{m/s}$
3. Speed of sound, $v_{sound} = 340\ \text{m/s}$
4. Threshold of sound intensity, $I_o = 1 \times 10^{-12}\ \text{W/m}^2$
5. Atmospheric pressure, $P_{atm} = 1.0 \times 10^5\ \text{Pa}$
6. Specific heat of water, $c_{water} = 4186\ \text{Jkg}^{-1}\text{K}^{-1}$
7. Specific heat of ice, $c_{ice} = 2100\ \text{Jkg}^{-1}\text{K}^{-1}$
8. Latent heat of fusion of water, $L_f = 333.7 \times 10^3\ \text{J/kg}$
10. Latent heat of vaporization of water, $L_v = 2256 \times 10^3\ \text{J/kg}$
11. Density of seawater, $\rho_{seawater} = 1030\ \text{kg/m}^3$
12. Density of water, $\rho_{water} = 1000\ \text{kg/m}^3$

LIST OF FORMULAS

$\frac{F}{A} = Y\frac{\Delta L}{L}$	$\frac{F}{A} = S\frac{\Delta x}{L}$	$\frac{F}{A} = -B\frac{\Delta V}{V}$
$T_F = 1.8T_C + 32^\circ F$	$\Delta L = \alpha L_o \Delta T$	$\Delta A = \beta A_o \Delta T$
$Q = mc\Delta T$	$Q = mL_f$	$Q = mL_v$
$\Delta V = \gamma V_o \Delta T$	$\gamma = \gamma_{apparent} + \gamma_{glass}$	$\frac{Q}{t} = \frac{\Delta T}{\sum R_n}$
$\frac{Q}{t} = \kappa A\frac{\Delta T}{d}$	$\Delta P = \frac{F_1}{A_1} = \frac{F_2}{A_2}$	$F = \rho g V$
$P = \frac{F}{A} = \rho g h$	$F_{net} = W - F_B$	$P_{abs} = P_{atm} + \rho g h$
$\rho = \frac{m}{V}$	$W = mg$	$f = \frac{1}{T}$
$\omega = \frac{2\pi}{T}$	$\lambda = \frac{v}{f}$	$k = \frac{2\pi}{\lambda}$
$v = \frac{\omega}{k}$	$y = A\sin(kx - \omega t)$	$I = \frac{P}{A}$

$\beta = 10\log\left(\frac{I}{I_o}\right)$	$A_{circle} = \pi r^2$	$A_{sphere} = 4\pi r^2$
$V_{sphere} = \frac{4}{3}\pi r^3$	$v = \sqrt{\frac{T}{\mu}}$	$v_{solid} = \sqrt{\frac{Y}{\rho}}$
$v_{liquid} = \sqrt{\frac{B}{\rho}}$	$\lambda = \frac{2L}{n}$	$f = \frac{nv}{2L}$
$f_o = f_s \frac{(v \pm v_o)}{(v \mp v_s)}$	$n_1 \sin\theta_1 = n_2 \sin\theta_2$	