CONFIDENTIAL

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2013/2014

COURSE NAME	:	PHYSIC 2
COURSE CODE	:	DAS 14203
PROGRAMME	:	2 DAE
EXAMINATION DATE	:	DECEMBER 2013/JANUARY 2014
DURATION	:	2 ½ HOURS
INSTRUCTION	:	ANSWER **ALL** QUESTIONS IN SECTION A AND **TWO (2)** QUESTIONS IN SECTION B

THIS QUESTION PAPER CONSISTS OF **NINE (9)** PAGES

SECTION A

Q1 (a) A double slits interference experiment is used to determine the unknown wavelength of laser light source. The slits separated by 0.2 mm apart and a screen at a distance of 1.00 m. The third bright band out of central bright band is found to be 9.49 mm from the center of the screen. Find

(i) the definition of interference and give two type of interference.
(ii) the wavelength of the light.
(iii) the distance between the $m = 0$ and $m = 1$ bright fringes.
(iv) how far apart would the slit have to be so that the fourth minimum (dark fringe) would occur at 9.49 mm from the center of the screen?

(12 marks)

(b) A beam of unpolarized light of intensity Io passes through a series of ideal polarizing filters with their polarizing directions turned to various angles as shown in **Figure Q1 (b)**. If the light that emerges from the system has an intensity of 23.0 Wm^{-2}, use $I = I_o \cos^2\theta$. Find

(i) the definition of Malus's law on polarization of light.
(ii) the intensity of the incident of the light.
(iii) the light intensity at point C after the middle filter was removed

(13 marks)

Q2 (a) State the law of reflection and define the index of refraction of a material.

(5 marks)

(b) **Figure Q2 (b)(i)** shows a beam of light incident upon a film of oil at $\theta_1 = 60\ °$ from the vertical. The light is refracted in the oil and then refracted again as it enters the water. **Figure Q2 (b)(ii)** shows the light going from water to oil and then totally internal reflecting at the oil / air interface. Determine the

(i) angle refraction in water (**Figure Q2 (b)(i)**).

(ii) incident angle in the water (**Figure Q2 (b)(ii)**).
Given $n_{water} = 1.33,\ n_{air} = 1.00,\ n_{oil} = 1.48$

(10 marks)

(c) After leaving some presents under a tree, Santa notices his image in a shiny, spherical Christmas ornament. The ornament is 8.50 cm in diameter and 1.10 m away from Santa as shown in **Figure Q2 (c).** He curious to know the location and size of his image, Santa consults a book on physics. Knowing that Santa likes to check it twice, what result should he obtain assuming his height is 1.75m? Determine the

(i) type of mirror.

(ii) focal length of ornament, f.

(iii) image distance, d_i.

(iv) magnification, m of the image.

(v) image height.

(10 marks)

SECTION B

Q3 (a) It is reasonable to assume that the bulk modulus of blood is about the same as that of water. As one goes deeper and deeper in the ocean, the pressure increases by 1.0 x 10^4 Pa for every meter below the surface. The reciprocal of the bulk modulus B of a liquid is compressibility, k so $k = \frac{1}{B}$. Given the Bulk Modulus of water is 2.2 GPa and 1 atm is equal 1.013 x 10^5 Pa is the pressure exerted y earth's atmosphere at sea level. Find the

(i) compressibility, k of bulk modulus of water per atmosphere of pressure (answer in atm^{-1})
(ii) If a diver goes down 33 m in the ocean, how much each cubic centimeter of her blood change in volume?
(iii) How deep must a diver go so that each drop of blood compresses to half its volume at the surface?

(12 marks)

(b) When a block of volume 1.00 x 10^{-3} m^3 is hung from a spring scale as shown in **Figure Q3 (c)(i),** the scale reads 10.0 N. When the same block is then placed in an unknown liquid, it floats with 2/3 of its volume submerged as suggested in **Figure Q3 (c)(ii),** The density of water is 1.00 x 10^3 kgm^{-3}. Determine the mass of the block and the density of the unknown liquid

(13 marks)

Q4 (a) At 20 °C, a steel sphere bearing is 4.0 cm in diameter is 6 x 10^{-4} cm larger than the inside of a bronze ring. Determine the single temperature of both ball and ring at which the sphere just slips through the ring.
[Given the α_{Al} = 11 x 10^{-6} °C $^{-1}$, α_{Br} = 19 x 10^{-6} °C $^{-1}$]

(13 marks)

(b) A glass flask filled "to the mark" with 50.0 cm^3 of mercury at 18 °C. If the flask and its contents are heated to 38 °C, find

(i) how much mercury will be above the mark.
(ii) if use 150 cm^3 glass test tube and replace the mercury with water, how much water will be above the mark.
[Given the coefficient of thermal expansion, α_{glass} = 9.0 x 10^{-6} °C^{-1} and $\gamma_{mercury}$ = 182 x 10^{-6} °C^{-1} and γ_{water} = 207 x 10^{-6} °C^{-1}]

(12 marks)

Q5 (a) A student prepares a standing waves experiment. He is using a metal string under a tension of 88.2 N. Its length is 50.0 cm and its mass is 0.5 g. When the vibrator is turned on the string is found to rapidly develop a large, stable transverse standing waves consisting of four equal sections. Determine the

(i) velocity for transverse waves on the string
(ii) frequencies of its fundamental, first overtone, second overtone.

(10 marks)

(b) A source transmitted sound wave with an output power 3 Watt. Calculate the

(i) sound intensity at a distance 6.5 m from the source.
(ii) intensity level of the sound heard by the observer
(iii) for the maximum sound intensity level in the workplace is 90.0 dB. Within one factory, 32 identical machines produce a sound intensity level of 92.0 dB. How many machines must be removed to ensure the sound intensity must not exceed the maximum?

(15 marks)

- END OF QUESTION -

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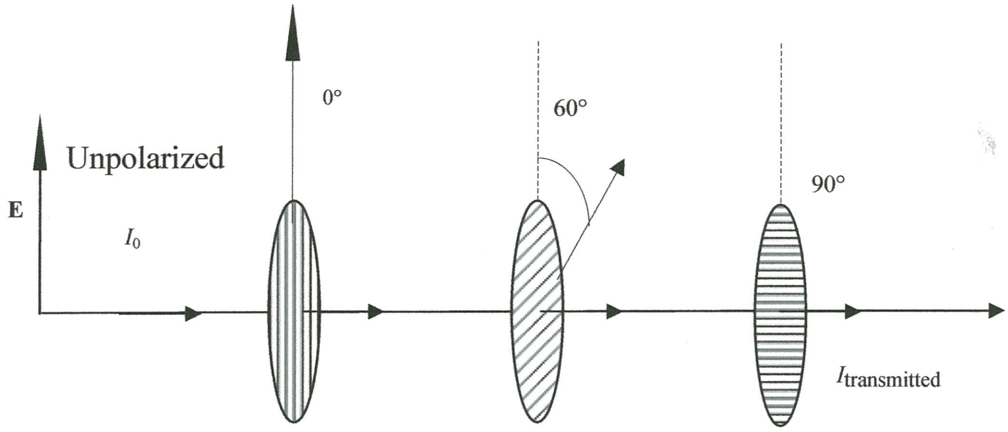

FIGURE Q1 (b)

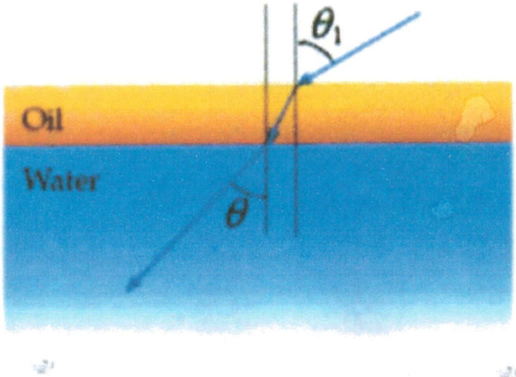

FIGURE Q2(b)(i)

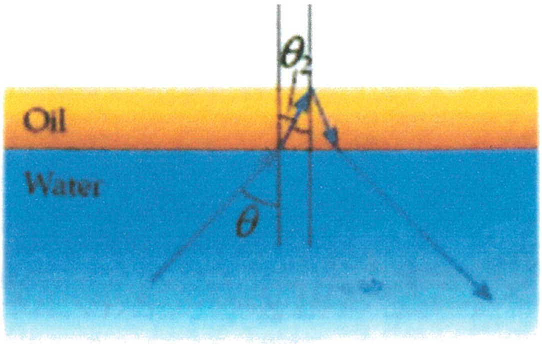

FIGURE Q2(b)(ii)

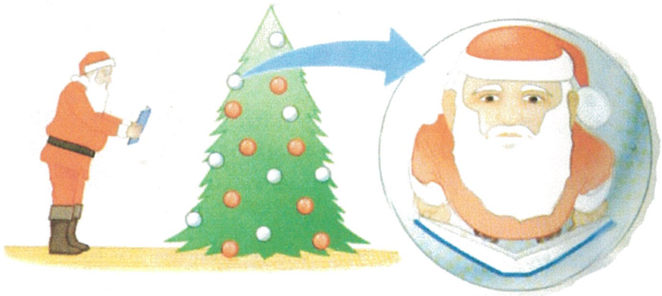

FIGURE Q2 (c)

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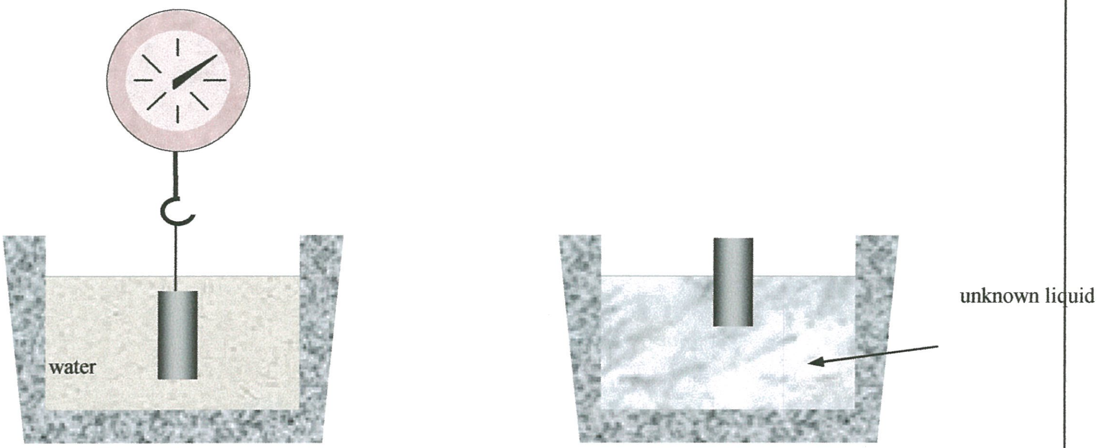

(i) (ii)

FIGURE Q3(b)(i) in water and (ii) in unknown liquid.

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LIST OF CONSTANTS

1. Gravity acceleration, $g = 9.81$ m/s^2
2. Speed of light in air, $c = 3 \times 10^8$ m/s
3. Speed of sound, $v_{\text{sound}} = 335$ m/s
4. Threshold of sound intensity, $I_o = 1 \times 10^{-12}$ W/m^2
5. Atmospheric pressure, $P_{atm} = 1.0 \times 10^5$ Pa
6. Specific heat of water, $c_{water} = 4.186$ kJkg^{-1}K^{-1}
7. Specific heat of copper, $c_{copper} = 0.385$ kJkg^{-1}K^{-1}
8. Specific heat of lead, $c_{lead} = 0.13$ kJkg^{-1}K^{-1}
8. Latent heat of fusion of water, $L_f = 333.7 \times 10^3$ J/kg
10. Latent heat of vaporization of water, $L_v = 2256 \times 10^3$ J/kg
11. Density of seawater, $\rho_{seawater} = 1030$ kg/m^3
12. Density of water, $\rho_{water} = 1000$ kg/m^3
13. Refractive index (n_{air}) of air = 1.00
14. Refractive index (n_{water}) of water = 1.333
15. Refractive index (n_{ice}) of ice = 1.304

FORMULA

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$y = \frac{(m+\frac{1}{2})\lambda D}{d}$	$Sin\,\theta = \frac{m\lambda}{d}$	$y = \frac{m\lambda L}{d}$
$T_F = 1.8T_C + 32^o F$	$\Delta L = \alpha L_o \Delta T$	$\Delta A = \beta A_o \Delta T$
$Q = mc\Delta T$	$Q = mL_f$	$Q = mL_v$
$\Delta V = \gamma V_o \Delta\theta$	$\gamma = \gamma_{apparent} + \gamma_{glass}$	$I = I_0 \cos^2\theta$
$A_{circle} = \pi r^2$	$F_{net} = W - F_B$	$A_{sphere} = 4\pi r^2$
$P = \rho gh$	$F = \rho gV$	$n_1 \sin\theta_1 = n_2 \sin\theta_2$
$\mu = \rho\pi r^2$	$V_{sphere} = \frac{4}{3}\pi r^3$	$\frac{Q}{t} = \frac{\Delta T}{\sum R_n}$
$\lambda = \frac{v}{f}$	$\mu = \frac{m}{l}$	$\beta = 10\log\left(\frac{I}{I_o}\right)$
$m = -\frac{d_i}{d_o}$	$f_o = f_s \frac{(v \pm v_o)}{(v \mp v_s)}$	$\frac{1}{d_o} + \frac{1}{d_i} = \frac{1}{f}$
$\frac{Q}{t} = \kappa A \frac{\Delta T}{d}$	$\frac{Q}{t} = kA(\frac{T_{hot} - T_{cold}}{d})$	$T = (\frac{X_T - X_o}{X_{100} - X_o})x100^oC$
$P = \frac{F}{A}$	$\rho = \frac{m}{V}$	$\Delta P = \frac{F_1}{A_1} = \frac{F_2}{A_2}$