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Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2017/2018

COURSE NAME	:	PHYSICS II
COURSE CODE	:	DAS 14203
PROGRAMME CODE	:	DAU/ DAA/ DAE/ DAM
EXAMINATION DATE	:	JUNE/ JULY 2018
DURATION	:	2 HOURS AND 30 MINUTES
INSTRUCTIONS	:	ANSWER ALL QUESTIONS IN SECTION A AND TWO QUESTIONS IN SECTION B

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THIS QUESTION PAPER CONSISTS OF **TWELVE (12)** PAGES

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SECTION A

Q1 (a) State **three (3)** differences between Interference and Diffraction.

(6 marks)

(b) A monochromatic radiation with wavelength λ passes through a narrow slit. The diffraction pattern is observed on a screen 3 meter from the slit. If the width of slit is 0.45 mm, calculate the width of the first dark band for the following wavelength;

(i) visible light of 500 nm wavelength.

(ii) infrared of 50 μm wavelength.

(5 marks)

(c) Based on the calculation in **Q1(b)(i)** and **Q1(b)(ii)**, conclude the relation between the width of the central bright band y_c and the λ.

(1 mark)

(d) Give an example of tool that uses diffraction grating.

(1 mark)

(e) Two narrow slits are 0.05 mm apart. A monochromatic light of wavelength 450 nm is used to illuminate the slits. A fringe pattern is formed on a screen 4 meter away.

(i) Define monochromatic light and name the phenomenon that occurred as in the statement **Q1 (e)**.

(ii) Calculate the distance between adjacent bright fringes.

(iii) From your answer in **Q1 (e)(ii)**, calculate the distance between the third bright fringes form on a screen.

(iv) If one of the slits is covered, sketch a graph of the intensity of light of the fringe pattern versus its position, θ.

(v) Name the phenomenon that occurred in **Q1 (e)(iv)**.

(12 marks)

Q2 (a) State **two (2)** conditions for total internal reflection to occur.

(2 marks)

(b) A 4 cm tall light bulb is placed X cm from a convex mirror. The mirror has a focal length of 12 cm. The image formed is virtual and is located 9 cm from the mirror.

(i) Determine the value of X.

(ii) Determine the image size.

(iii) By using the answer in **Q2 (ii)**, state the characteristics of the imaged formed.

(8 marks)

(c) Define a virtual image.

(1 mark)

(d) A ray of light in air is approaching a cup made of glass at an angle of 40° to the normal. The cup is filled with water. Given the refractive index of air is 1.00, the refractive index of water is 1.33 and the refractive index of glass is 1.50. Determine the angle of refraction of the light ray upon;

(i) entering the wall of the glass cup.

(ii) leaving the wall of the glass cup and entering the water.

(5 marks)

(e) A 4 cm long spoon is placed 8 cm in front of a thin converging lens of focal length 4 cm.

(i) Draw the ray diagram for this situation.

(ii) By using the answer from **Q2(i),** state the characteristic of image formed.

(6 marks)

(f) Calculate the refractive index of ethyl alcohol if light travels in this substance with a speed of $2.20 \times 10^{8}\ ms^{-1}$. Given the speed of light in vacuum is $3.00 \times 10^{8}\ ms^{-1}$.

(3 marks)

SECTION B

Q3 (a) Define term 'Stress' and 'Strain' and state the mathematical representatives.

(4 marks)

(b) A boy of mass 20 kg in **Figure Q3 (b)** play swing under a roof made of two cable made of 2 m nylon with Young Modulus 1.150 kPa and cross sectional area 100 cm^2. Calculate the elongation of each rope.

(6 marks)

(c) Refer to **Figure Q3 (c)** person push downward a hydraulic jack using his hand by exerted 30 N of force at $A_{in} = 0.1 cm^2$. Given the car stand on the other side of the hydraulic jack with area 1.5 m^2 has mass 2.2 tonne.

(i) Calculate the force exerted on the car.

(ii) If he push downward the jack until it lowered 20 cm. Compute the height of the car can raised.

(7 marks)

(d) (i) Define Archimedes Principle and list **two (2)** of its applications.

(4 marks)

(ii) A ball with radius 3 cm and is attached with weight scale and found the reading of the ball mass is given by 500 g. Initially the ball is placed inside an empty beaker. After a while a person fill the beaker with an oil with density 700kg/m^3. Calculate the reading of the weight scale if the ball completely immersed.

(4 marks)

Q4 (a) **Figure Q4 (a)** shows some ice cubes removed from a fridge and steam resulting from boiling water.

(i) Sketch a phase transition graph of both ice cube and steam if this two matter is mixed together inside a container.

(ii) Calculate the equilibrium temperature when 20 g of ice is mixed with 5 g of steam.

Given the specific heat capacity of ice is 2.10 $kJ.kg^{-1}.K^{-1}$, the latent heat of fusion of ice at 0 °C is 333.70 $kJ.kg^{-1}$, the specific heat capacity of water is 4.186 $kJ.kg^{-1}.K^{-1}$ and the latent heat of vaporization of water at 100 °C is 2256 $kJ.kg^{-1}$.

(18 marks)

(b) A 100 g copper container contains 250 g of water and a 30 g aluminium spoon, all at 18 °C. A 150 g aluminium cube at 200 °C is added into the water. By assuming there is no heat lost to surrounding, calculate the final temperature of the system.

Given the specific heat capacity of water is 4.186 $kJ.kg^{-1}.°C^{-1}$, the specific heat capacity of copper is 0.390 $kJ.kg^{-1}.°C^{-1}$, the specific heat capacity of aluminium is 0.900 $kJ.kg^{-1}.°C^{-1}$

(7 marks)

Q5 (a) Give the **three (3)** states of matter.

(3 marks)

(b) Define thermal expansion.

(3 marks)

(c) A hollow steel cylinder is filled to the brim with a water at 20.0°C. If the water and the container are heated to a temperature 91°C, calculate the water spills over the top of the container.

(Given : $\alpha_{steel} = 13 \times 10^{-6} K^{-1}$, $\alpha_{water} = 69 \times 10^{-6} K^{-1}$)

(12 marks)

πr²h

(d) A square brass plate, 8.00 cm on a side, has a hole cut into its center of area 4.90867 cm^2 at 20.1° C. The hole in the plate is to slide over a cylindrical steel shaft of cross-sectional area 4.91071 cm^2 also at 20.1° C as shown in the figure **Figure Q5 (d)**. Calculate the temperature must the brass plate be heated so that it can just slide over the steel cylinder which remains at 20.1° C. Given $\alpha_{brass} = 18 \times 10^{-6} K^{-1}$.

(7 marks)

Q6 (a) Name **two (2)** types of mechanical waves. Give an example for each.

(4 marks)

(b) The string shown in **Figure Q6 (b)** is one method for producing a sinusoidal wave on a string. The left end of the string is connected to a blade that is set into oscillation. Every element of the string, such as that at point *P*, oscillates with simple harmonic motion in the vertical direction. It is driven at a frequency of 5.00 Hz. The amplitude of the motion is 12.0 cm, and the wave speed is 20.0 m/s.

(i) Write an expression for the wave function for this wave.

(ii) Calculate maximum transverse speed.

(iii) Determine the maximum transverse acceleration of a point on the string.

(13 marks)

(c) A taut rope has a mass of 0.180 kg and a length of 3.60 m. Calculate the power must be supplied to the rope in order to generate sinusoidal waves having an amplitude of 0.100 m and a wavelength of 0.500 m and traveling with a speed of 30.0 m/s.

(8 marks)

$A = 0.100$ m

$\lambda = 0.500$ m

$v = 30.0$ ms^{-1}

Q7 (a) Define the phenomena of Doppler Effect.

(3 marks)

(b) A train is moving parallel to a highway with a constant speed of 20.0 m/s. A car is traveling in the same direction as the train with a speed of 40.0 m/s. The car horn sounds at a frequency of 510 Hz, and the train whistle sounds at a frequency of 320 Hz. Given the speed of sound in air is 343m/s.

(i) When the car is behind the train, calculate the frequency does an occupant of the car observe for the train whistle.

(ii) After the car passes and is in front of the train, calculate the frequency does a train passenger observe for the car horn.

(8 marks)

(c) As the people sing in hall, the sound level everywhere inside is 101 dB. No sound is transmitted through the massive walls, but all the windows and doors are open on a summer morning. Their total area is 22.0 m^2.

(i) Calculate the sound energy radiated in 20.0 minutes.

(ii) Suppose the ground is a good reflector and sound radiates uniformly in all horizontal and upward directions. Compute the sound level 1 km away.

(11 marks)

(d) If the speed of light in glass is 2×10^8 m/s and the value of μ is the same as μ_o, calculate the permittivity, ε of the glass.

(3 marks)

-END OF QUESTIONS –

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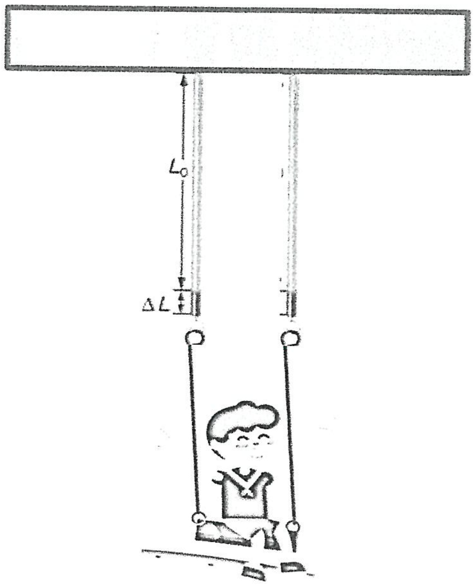

Figure Q3 (b)

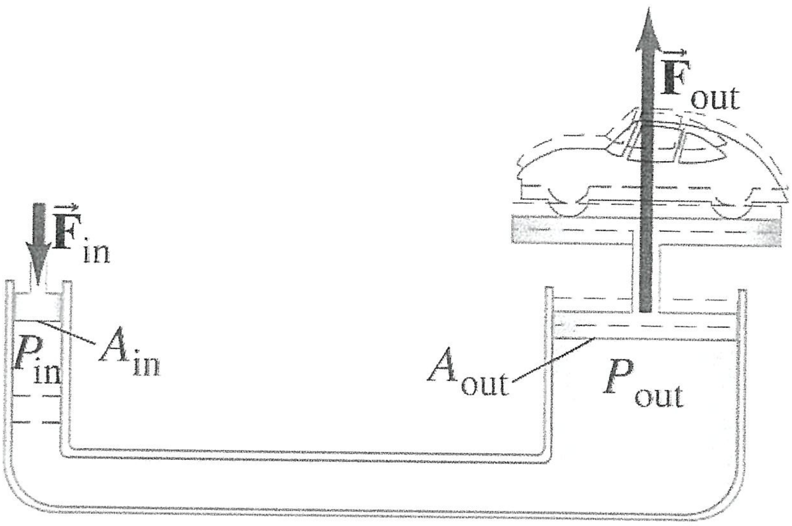

Figure Q3 (c)

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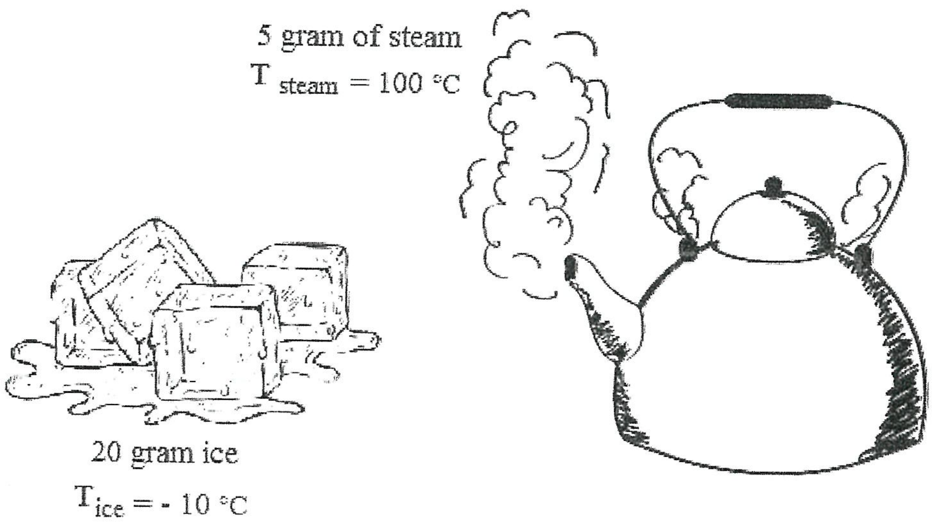

Figure Q4 (a)

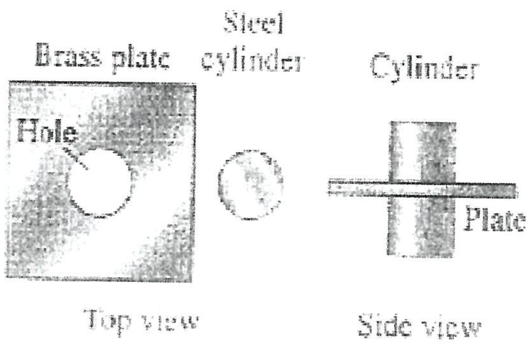

Figure Q5 (d)

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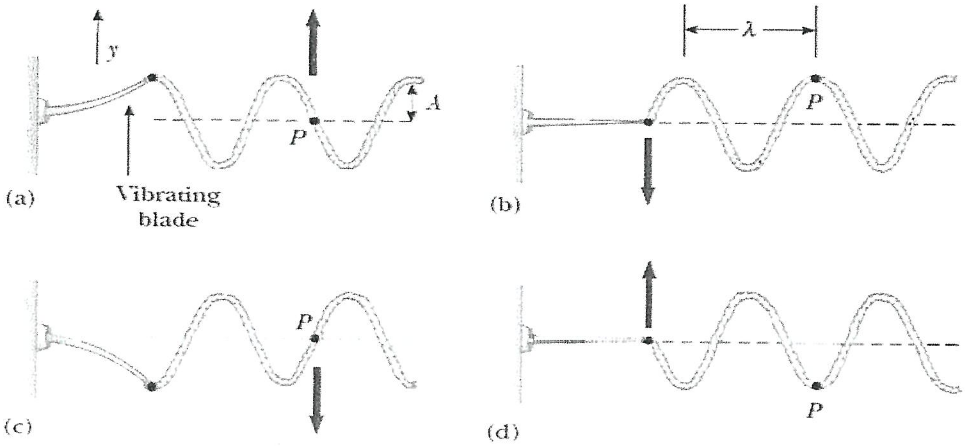

Figure Q6 (b)

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LIST OF FORMULA

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

$\varepsilon = \frac{\Delta L}{L}$

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

$T_F = 1.8T_C + 32$

$T_K = T_C + 273.15$

$L = \frac{Q}{m}$

$T_C = \frac{T_F - 32}{1.8}$

$P = \frac{F_1}{A_1} = \frac{F_2}{A_2}$

$\mu = \frac{m}{L}$

$v = \sqrt{\frac{B}{\rho}}$

$v = \sqrt{\frac{T}{\mu}}$

$v = \sqrt{\frac{Y}{\rho}}$

$k = \frac{2\pi}{\lambda}$

$P = \rho gh$

$P = P_{atm.} + \rho gh$

$F_B = \rho gV$

$F_B = F_2 - F_1 = mg$

$Q = mc(T_2 - T_1)$

$\frac{Q}{t} = \frac{\kappa A(T_{hot} - T_{cold})}{d}$

$Q = C(T_2 - T_1)$

$y(x,t) = A\sin(\omega t \pm kx)$

$y(x,t) = 2A\sin\omega t\cos kx$

$L = \frac{\lambda}{4}n$

$L = \frac{\lambda}{2}n$

$n = \frac{f_n}{f_o}$

$I = \frac{E/t}{A} = \frac{P}{A}$

$V = \pi r^2 h$ cylinder

$V = \frac{4}{3}\pi r^3$

$A = \pi r^2$

$A = 4\pi r^2$

$\Delta L = L_o\alpha(T_f - T_i)$

$\Delta A = A_o\beta(T_f - T_i)$

$\Delta V = V_o\gamma(T_f - T_i)$

$\gamma_{apparent} = \gamma_L - \gamma_C$

$v = f\lambda = \frac{\omega}{k}$

$\omega = 2\pi f$

$f_n = \frac{v}{4L}n$

$f_n = \frac{v}{2L}n$

$\beta = 10\log_{10}\frac{I}{I_o}$

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LIST OF FORMULA

$sin\theta_c = \frac{n_2}{n_1}$

$f = \pm\frac{1}{2}R$

$\frac{1}{v} + \frac{1}{u} = \frac{1}{f}$

$M = -\frac{v}{u} = \frac{h_i}{h_o}$

$f' = f\left(\frac{v \pm v_o}{v}\right)$

$f' = f\left(\frac{v}{v \pm v_s}\right)$

$y_m = \frac{\lambda Lm}{d}$

$\Delta y = \frac{\lambda L}{d}$

$I = I_o cos^2\theta$

$y_{m+½} = \frac{\lambda L}{d}(m+½)$

$sin\theta = \frac{m\lambda}{d}$

$n_1 sin\theta_1 = n_2 sin\theta_2$

$f' = f\left(\frac{v \pm v_o}{v \pm v_s}\right)$

$tan\theta = \frac{y}{D}$

$a\frac{y}{L} = m\lambda$

$y = \frac{(m+½)\lambda L}{a}$

$V_{max} = A\omega$

$a_{max} = A\omega^2$

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