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INTERNATIONAL COLLEGE PENANG (507232-U)
LAUREATE INTERNATIONAL UNIVERSITIES

FINAL
Examination Paper

(COVER PAGE)

Session : AUGUST 2016

Programme : DIPLOMA IN ELECTRICAL & ELECTRONIC ENGINEERING

Course : PHY 1121: PHYSICS

Date of Examination : 6 December 2016 (Tuesday)

Time : 2:00pm – 4:00pm Reading Time : Nil

Duration : 2 Hours

Special Instructions :

This paper consists of FIVE (5) questions. Answer any FOUR (4) questions in the answer booklet provided. All questions carry equal marks.

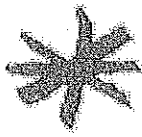
Materials permitted : Non-Programmable Calculator

Materials provided : Physics Formula Booklet

Examiner(s) : Chong Mee Teng

Moderator :

This paper consists of 6 printed pages, including the cover page.



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INTI INTERNATIONAL COLLEGE PENANG

DIPLOMA IN ELECTRICAL AND ELECTRONIC ENGINEERING PROGRAMME

PHY 1121: PHYSICS

FINAL EXAMINATION: AUGUST 2016 SESSION

Instructions: This paper consists of **FIVE (5)** questions. Answer any **FOUR** questions in the answer booklet provided. All questions carry equal marks.

Question 1

- (a) A solid piece of lead has a mass of 23.94 g and a volume of 2.10 cm³. From these data, calculate the density of lead in SI units (kgm⁻³). (6 marks)
- (b) A particle moving along an x-axis has a position: $x = t^2 - 4t + 3$, where x is in meters and t is in seconds. Calculate:
- the instantaneous velocity of the particle at $t = 0.5$ s, (3 marks)
 - the average acceleration of the particle from $t = 0.5$ s to $t = 2.5$ s. (3 marks)
- (c) The force of attraction, F between two particles of masses m_1 and m_2 situated a distance d apart is given by $F = \frac{Gm_1m_2}{d^2}$. Show that the dimension of G are $M^{-1}L^3T^{-2}$. (4 marks)
- (d) A student rides her bike on some rural roads. She begins her trip by riding due north for 3.0 km. Then, She turns east and travelling in a straight line for 2.0 km. On her last leg of trip, she rides northeast for a distance of 5.0 km.
- Sketch a vector diagram showing the graphical method in determining the total displacement vector D for the entire trip. (3 marks)
 - What are the magnitude and direction of the total displacement vector D ? (6 marks)

Question 2

- (a) A gun, aimed horizontally, fires a bullet with a speed of 900 ms⁻¹. The gun is 2.0 m above ground level.
- What is the time of flight of this bullet? (2 marks)
 - Find the horizontal distance of the bullet from the gun when the bullet is released. (2 marks)
 - Find the velocity with which the bullet hits the ground. (4 marks)

- (b) Figure (1) shows a block A of mass, $m_A = 5.0$ kg on a horizontal surface with coefficient of kinetic friction, $\mu_k = 0.25$ connected by a string through a smooth pulley to another block B of mass, $m_B = 4.0$ kg. The system is released from rest.

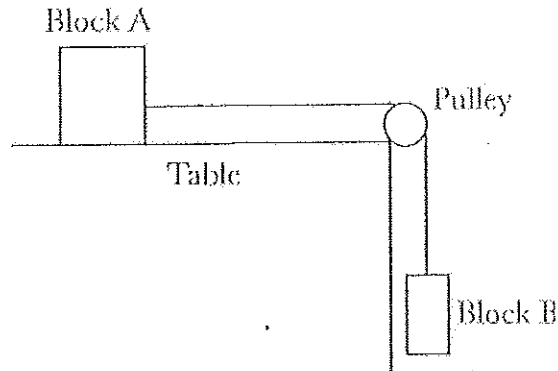


Figure (1)

- (i) Draw a free body diagram for the blocks when they are in motion. (3 marks)
- (ii) What is the acceleration of the blocks? (5 marks)
- (iii) What is the tension in the string? (2 marks)
- (c) A 200 g sphere is released from a height of 3.0 m. After striking the floor, the sphere rebounds vertically upwards, but it lost 30% of its initial energy. For the first rebound, calculate:
- (i) the initial velocity of the sphere, (2 marks)
- (ii) the maximum height of the sphere. (3 marks)
- (iii) State two ways to increase the potential energy of a body. (2 marks)

Question 3

- (a) A body of mass, m moving with a velocity, u makes a head-on collision with another body of mass, $2m$ which is initially at rest. After collision, the bodies move off together with a common velocity.
- (i) What is the common velocity after collision? (3 marks)
- (ii) Calculate the ratio of kinetic energy of the system after collision to the kinetic energy before collision. (3 marks)
- (iii) Account for the decrease in kinetic energy. (2 marks)

- (b) A glass flask has a volume of 210 cm^3 . After heating 210 cm^3 of olive oil from 21°C to 100°C , the oil is poured into the glass flask. Assuming that the change in volume of the flask is negligible, how much olive oil will overflow? (Given the coefficient of volume expansion of olive oil, $\beta = 6.8 \times 10^{-4} \text{ K}^{-1}$) (3 marks)
- (c) A physics student wants to cool 0.25 kg of Diet Omni-Cola (mostly water), initially at 25°C , by adding ice initially at -20°C . The temperature finally becomes 0°C with all the ice melted. What is the mass of ice need to be added? (neglected the heat capacity of the container). (Given the specific heat capacity of water, $c_w = 4190 \text{ Jkg}^{-1}\text{K}^{-1}$, specific heat capacity of ice, $c_i = 2.1 \times 10^3 \text{ Jkg}^{-1}\text{K}^{-1}$ and heat of fusion of water, $L_f = 3.34 \times 10^5 \text{ Jkg}^{-1}$). (6 marks)
- (d) In Figure (2), two charges q_1 and q_2 , of magnitudes $30 \mu\text{C}$ and $50 \mu\text{C}$ respectively, are placed 40 cm apart in a vacuum. A third charge, $q_3 = +40 \mu\text{C}$, is placed between q_1 and q_2 and 10 cm from q_1 . Find the force on q_3 if:

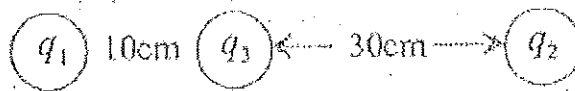


Figure (2)

- (i) q_1 and q_2 are both positive. (5 marks)
- (ii) If the distance between q_1 and q_3 was increased to 20 cm , what would be the effect on the magnitude of force between q_1 and q_3 ? (3 marks)

Question 4

- (a) A gas confined in a cylinder with a tight-fitting piston is initially in the state $P_1 = 2000 \text{ Pa}$, $V_1 = 2.0 \times 10^{-3} \text{ m}^3$ and $T_1 = 300 \text{ K}$. (Given gas constant, $R = 8.31 \text{ Jmol}^{-1}\text{K}^{-1}$)
- (i) How many moles of gas were in the cylinder? (2 marks)
- (ii) If the volume is decreased to $0.50 \times 10^{-3} \text{ m}^3$ while the temperature is held fixed, find the new pressure. (2 marks)
- (iii) Suppose that the gas is heated to 700 K while the volume is changed to a new value. But, there is 20% of the gas leaked out while the changes were being brought about. If the final pressure is measured to be 6000 Pa , what is the new volume? (4 marks)

- (b) Figure (3) shows a proton moving with a speed of $1.0 \times 10^6 \text{ ms}^{-1}$ in a direction perpendicular to a uniform magnetic field, B of flux density 0.25 T out of the plane of this page. Given the mass of proton, $m_p = 1.67 \times 10^{-27} \text{ kg}$, charge of proton, $p = +1.60 \times 10^{-19} \text{ C}$.

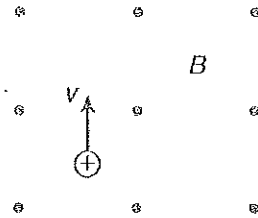


Figure (3)

- (i) Show on a diagram the direction of the magnetic force, F on the proton. (2 marks)
 - (ii) Show on a diagram the subsequent path of the proton. (2 marks)
 - (iii) Calculate the radius of the circular path. (3 marks)
 - (iv) An electron moves with the same speed in the same direction in the magnetic field. State and explain two differences between the paths of the electron and the proton. (4 marks)
- (c) A potential difference of 9.0 V is causing electrons to flow through a steel wire so that 1.0×10^{20} electrons pass a point in the wire in 60 s . Calculate:
- (i) the charge which passes the point in 60 s , (2 marks)
 - (ii) the electric current in the wire, (2 marks)
 - (iii) the resistance of the wire. (2 marks)

Question 5

- (a) An air-filled parallel capacitor with each plate having an area of 40 cm^2 and the separation of the two plates is 3.0 mm . The capacitor is connected to a 15 V battery. Given the permittivity of free space, $\epsilon_0 = 8.85 \times 10^{-12} \text{ Fm}^{-1}$, calculate:
- (i) the capacitance of the capacitor, (2 marks)
 - (ii) the charge stored in the capacitor, (2 marks)
 - (iii) the electric field between the plates. (2 marks)

(b) From Figure (4), find:

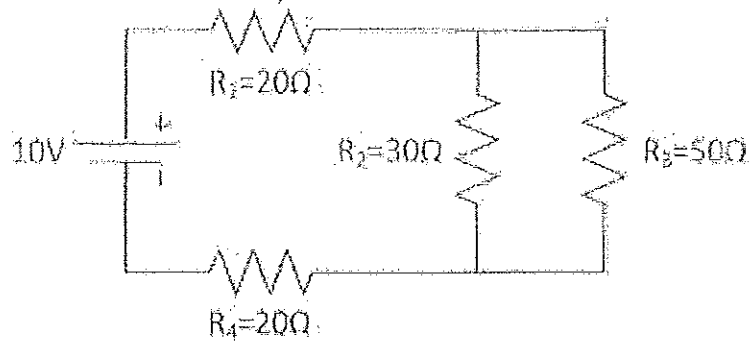


Figure (4)

- (i) The equivalent resistance in the circuit. (5 marks)
- (ii) The total current in the circuit. (2 marks)
- (c) An object is placed 100 cm from a converging lens with 20 cm focal length.
- (i) Find the position of the image. (3 marks)
- (ii) Define the characteristic of the image formed. (3 marks)
- (d) What is the speed of light in water? Find the angle of refraction of light incident on a water surface at an angle of 48° to the normal. (Given index of refraction of water, $n_{\text{water}} = 1.33$) (6 marks)

—THE END—

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