INTI
International College Penang
LAUREATE INTERNATIONAL UNIVERSITIES

FINAL
Examination Paper

(COVER PAGE)

Session	:	**August 2017**
Programme	:	Diploma in Electrical & Electronic Engineering (DEEI)
Course	:	**PHY 1131: Physics**
Date of Examination	:	14 December 2017 (Thursday)
Time	:	11:00am – 1:00pm 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	:	Assoc. Prof. Dr. Khoo Bee Ee

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

INTI INTERNATIONAL COLLEGE PENANG

DIPLOMA IN ELECTRICAL & ELECTRONIC ENGINEERING PROGRAMME
PHY 1131: PHYSICS
FINAL EXAMINATION: AUGUST 2017 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) State the number of significant digits in the following measurements.

(i) 3.01×10^7 m (1 mark)

(ii) 0.00060 m (1 mark)

(iii) 4.070 m (1 mark)

(b) A sports car burns fuel at a rate of 11.2 g/s. Calculate the consumption rate in kg/hr. (3 marks)

(c) The position of an object as a function of time is given by $x(t) = at^3 - bt^2 + ct - d$, where $a = 3.6$ m/s^3, $b = 4.0$ m/s^2, $c = 60$ m/s and $d = 7.0$ m.

(i) Find the average acceleration over the first 2.4 seconds. (5 marks)

(ii) Find the instantaneous acceleration at $t = 2.4$ s. (3 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.

(i) Sketch a vector diagram showing the graphical method in determining the total displacement vector ***D*** for the entire trip. (3 marks)

(ii) What are the magnitude and direction of the total displacement vector ***D***? (8 marks)

Question 2

(a) A child throws a ball with an initial speed of 8.00 m/s at an angle of 40.0° above the horizontal. The ball leaves her hand 1.00 m above the ground and experience negligible air resistance.

(i) How long is the ball in flight before it hits the ground? (2 marks)

(ii) How far from where the child is standing does the ball hit the ground? (2 marks)

(iii) What is the ball's velocity just before it hits the ground? (5 marks)

(b) In **Figure 2(b)**, two blocks connected by a cord passing over a small, frictionless pulley rest on frictionless planes.

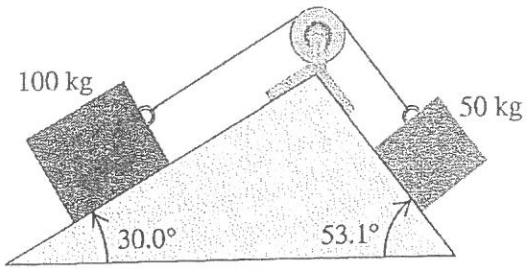

Figure 2(b)

(i) Sketch a free body diagram for each of the blocks. (4 marks)

(ii) What is the acceleration of the blocks? (5 marks)

(iii) What is the tension in the cord? (2 marks)

(c) A crate of auto parts is sitting on a horizontal frictionless frozen lake. A worker applies a constant horizontal force of 750 N to the crate. Starting from rest, the crate moves 20 m in the first 4 s. Calculate the mass of the crate. (5 marks)

Question 3

(a) Two gliders collide on a frictionless horizontal air track. The first glider has a mass of 2.0 kg. Before the collision, it is moving rightward at 5.0 m/s. The second glider has a mass of 3.0 kg. Before the collision, it is at rest. After the collision, the second glider is moving rightward at 4.0 m/s. Calculate the velocity of the first glider after the collision. (5 marks)

(b) A solid concrete wall 4.0 m by 2.4 m and 30 cm thick, with a thermal conductivity of 1.3 W/(m·K), separates a basement at 18°C from the ground outside at 6°C. Under steady state conditions, how much heat flows through the wall in one hour? (6 marks)

(c) A piece of iron of mass 0.12 kg is taken from an oven where its temperature is 336°C and quickly placed in an insulated copper can that contains 0.20 kg of water. The copper can has mass 0.50 kg, and it and the water in it are originally at a temperature of 20°C. Calculate the final temperature of the system, assuming no heat is lost to the surroundings. Use the following specific heats: water, $c = 4190$ J/kg · °C; iron, $c = 470$ J/kg · °C; and copper, $c = 390$ J/kg · °C. (6 marks)

(d) 2.0 L of an ideal nitrogen gas (N_2) are at 0.00°C and 1.0 atm. The ideal gas constant is $R = 8.314$ J/mol·K, Avogadro's number is 6.022×10^{23} molecules/mol, the molecular mass of nitrogen is 28 g/mol and $1\ L = 1 \times 10^{-3}\ m^3$.

(i) Determine the number of moles of N_2. (4 marks)

(ii) How many molecules of N_2 are present? (2 marks)

(iii) What is the mass of this gas? (2 marks)

Question 4

(a) Two positive point charges +4.00 μC and +2.00 μC are placed at the opposite corners of a rectangle as shown in the **Figure 4(a)**. (Given the Coulomb constant, $k = 8.99 \times 10^9$ N·m^2/C^2)

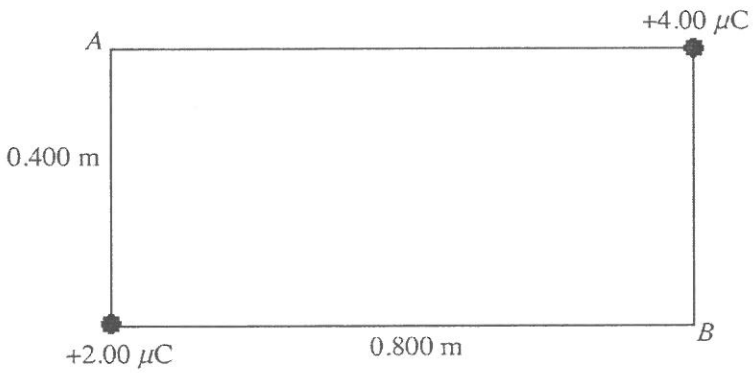

Figure 4(a)

(i) What is the potential at point *A* (relative to infinity) due to these charges? (3 marks)

(ii) What is the potential at point *B* (relative to infinity) due to these charges? (3 marks)

(b) A parallel–plate capacitor has circular plates of 8.2 cm radius and 1.3 mm separation. (Given the permittivity of vacuum, $\varepsilon_o = 8.85 \times 10^{-12}$ F.m^{-1})

(i) Calculate the capacitance. (5 marks)

(ii) What charge will appear on the plates if a potential difference of 120V is applied? Define your answer in appropriate prefixes. (3 marks)

(c) **Figure 4(c)** shows an electron is fired perpendicular into a 3.5 mT uniform magnetic field with a speed of 2.0×10^7 ms^{-1}. The magnetic field is directed into the plane of the page.

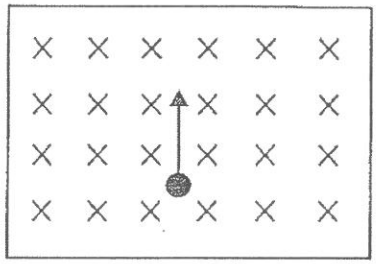

Figure 4(c)

(i) Make a copy of the diagram and mark the direction of the magnetic force on the electron. (2 marks)

(ii) Calculate the magnetic force acting on the electron. (2 marks)

(iii) Explain why the electron will move in a circle with constant speed. (2 marks)

(iv) Calculate the radius of the electron's circular path. (3 marks)

(v) How long will it take for the electron to complete one circular orbit? (2 marks)

Question 5

(a) If the electrical energy costs 25 cents per kilowatt-hour, how much does it cost to operate an electric oven for 5.0 hour if it carries a current of 20.0 A at 220 V? (4 marks)

(b) A 4.0-cm tall object is placed 50.0 cm from a diverging lens having a focal length of magnitude 25.0 cm. What are the nature and location of the image? (6 marks)

(c) A ray of light traveling in air strikes the surface of a certain plastic slab at 63.0° with respect to the normal in air. It travels in the plastic slab at a 30.6° angle with respect to the normal. Find the critical angle for the plastic in air. (5 marks)

(d) Four capacitors are connected across a 90-V voltage source as shown in the **Figure 5(d)**.

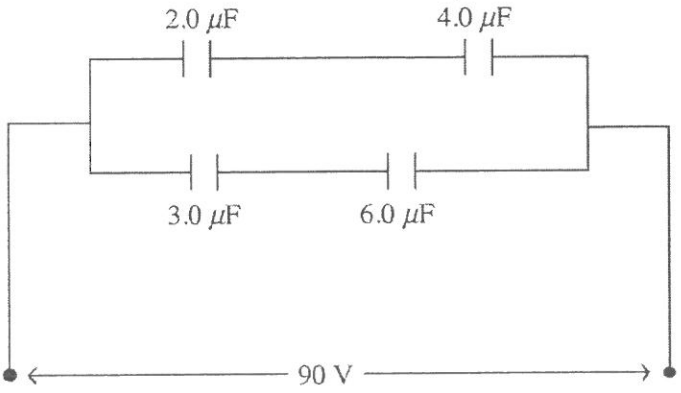

Figure 5(d)

(i) What is the equivalent capacitance for the circuit? (4 marks)

(ii) What is the charge on a 4.0-μF capacitor? (2 marks)

(iii) What is the charge on the 3.0-μF capacitor? (2 marks)

(iv) What is the potential difference across the 6.0-μF capacitor? (2 marks)

--THE END--

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