INTI
International College Penang

**FINAL**
Examination Paper

(COVER PAGE)

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| Session | : | **August 2018** |
| Programme | : | Diploma in Electrical & Electronic Engineering (DEEI) |
| Course | : | **PHY1131: Physics** |
| Date of Examination | : | 13 December 2018 (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

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| 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 (DEEI)
PHY 1131: PHYSICS
FINAL EXAMINATION: AUGUST 2018 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) 0.00280 s (1 mark)

(ii) $3.40 \times 10^2$ s (1 mark)

(b) A car is traveling at a speed of 38.0 m/s on an interstate highway where the speed limit is 75.0 mi/h. Is the driver exceeding the speed limit? Justify your answer. (3 marks)

(c) The period of a simple pendulum, $T$ defined as the time necessary for one complete oscillation, is measured in time units and is given by: $T = 2\pi\sqrt{\frac{l}{g}}$, where $l$ is the length of the pendulum and $g$ is the acceleration due to gravity (in units of length divided by time squared). Show that this equation is dimensionally consistent. (3 marks)

(d) A commuter airplane starts from an airport and takes the route shown in **Figure (Q1d)**. The plane first flies to city $A$, located 175 km away in a direction 30.0° north of east. Next, it flies for 150 km 20.0° west of north, to city $B$. Finally, the plane flies 190 km due west, to city $C$. Find the location of city $C$ relative to the location of the starting point. (9 marks)

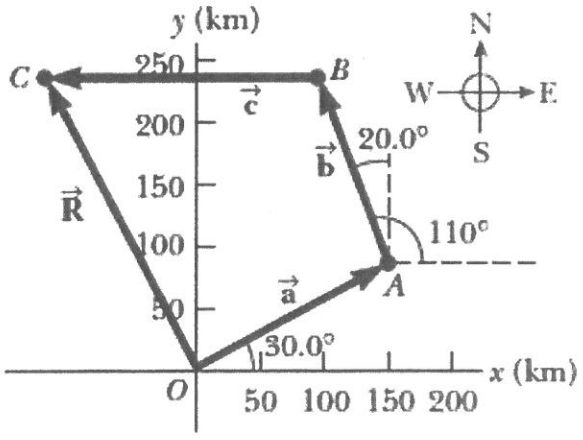


**Figure (Q1d)**

(e) The velocity of an object as a function of time is given by $v(t) = 2.00$ m/s + (3.00 m/s) $t$ - (1.0 m/s$^2$) $t^2$.

(i) Determine the instantaneous acceleration of the object at time $t = 5.00$ s. (3 marks)

(ii) Find the average acceleration over the first 5.00 s seconds. (5 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)

(b) Two objects with masses of 3.00 kg and 5.00 kg are connected by a light string that passes over a frictionless pulley, as shown in **Figure (Q2b)**. Determine:

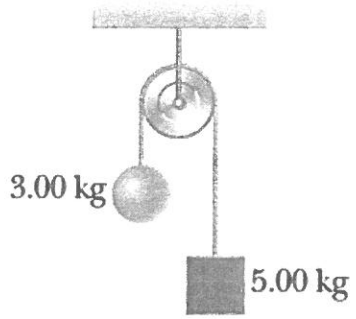


**Figure (Q2b)**

(i) the acceleration of each object, (5 marks)

(ii) the tension in the string, and (2 marks)

(c) A satellite is in a circular orbit around the Earth at an altitude of 2.80 x $10^6$ m. Find:

(i) the period of the orbit, (4 marks)

(ii) the speed of the satellite, and (2 marks)

(iii) the acceleration (magnitude & direction) of the satellite. (3 marks)

(d) A 0.200 kg block of copper at a temperature of 90 °C is dropped into 0.400 kg of water at 27 °C. The water is contained in a 0.300 kg glass container. What is the final temperature of the mixture? (Given the specific heat capacity of copper, $c_{cu} = 387\ Jkg^{-1}\,°C^{-1}$, the specific heat capacity of water, $c_w = 4186\ Jkg^{-1}°C^{-1}$ and the specific heat capacity of glass, $c_g = 837\ Jkg^{-1}°C^{-1}$ ) (5 marks)

**Question 3**

(a) 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, (3 marks)

(ii) the maximum height of the sphere. (3 marks)

(iii) State two ways to increase the potential energy of a body. (2 marks)

(b) 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? (2 marks)

(ii) Calculate the ratio of kinetic energy of the system after collision to the kinetic energy before collision. (5 marks)

(c) A hollow aluminum cylinder 20.0 cm deep has an internal capacity of 2.00 L at 20.0 °C. It is completely filled with turpentine at 20.0 °C. The turpentine and the aluminum cylinder are then slowly warmed together to 80.0 °C. (Given the coefficient of linear expansion of aluminium, $\alpha = 24 \times 10^{-6}\ °C^{-1}$ and the coefficient of volume expansion of turpentine, $\beta = 9 \times 10^{-4}\ °C^{-1}$) How much turpentine overflows? (6 marks)

(d) Gas is confined in a tank at a pressure of 11.0 atm and a temperature of 25.0°C. If two-thirds of the gas is withdrawn and the temperature is raised to 75.0°C, what is the new pressure of the gas remaining in the tank? (4 marks)

**Question 4**

(a) In **Figure (Q4a)**, two charges $q_1$ and $q_2$, of magnitudes 30 μC and 50 μC respectively, are placed 40 cm apart in a vacuum. A third charge, $q_3$ = +40 μC, is placed between $q_1$ and $q_2$, and 10 cm from $q_1$. Find the force on $q_3$ if:

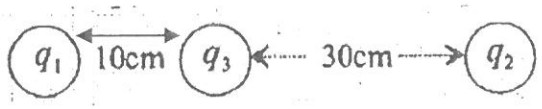


**Figure (Q4a)**

(i) $q_1$ and $q_2$ are both positive. (6 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)

(b) A parallel plate capacitor consists of two plates, each with area 200 $cm^2$, separated by a 0.40 cm air gap. (Given the permittivity of free space, $\varepsilon_o = 8.85 \times 10^{-12}$ $Fm^{-1}$)

(i) Compute its capacitance. (2 marks)

(ii) If the capacitor is connected across a 500 V source, what are the energy stored in it? (4 marks)

(iii) Find the value of electric field, $\boldsymbol{E}$ between the plates. (2 marks)

(c) An object is placed 10 cm from a converging lens with 20 cm focal length.

(i) Find the position of the image. (3 marks)

(ii) Define the magnification factor. (2 marks)

(iii) Define the characteristic of the image formed. (3 marks)

**Question 5**

(a) A potential difference of 9.0 V is causing electrons to flow through a steel wire so that 1.0 x $10^{20}$ 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)

(b) For a system of capacitors shown in **Figure (Q5b)**, find:

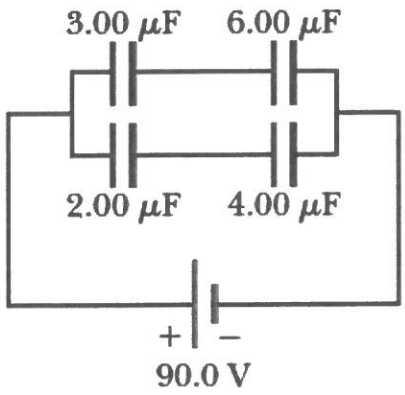


**Figure (Q5b)**

(i) the equivalent capacitance of the system, (5 marks)

(ii) the charge on each capacitor, (3 marks)

(iii) the potential difference across capacitor 3.00 μF. (2 marks)

(c) **Figure (Q5c)** shows a proton moving with a speed of $1.0 \times 10^{6}$ $ms^{-1}$ 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, $m_p = 1.67 \times 10^{-27}$ kg, charge of proton, $p = +1.60 \times 10^{-19}$ C.

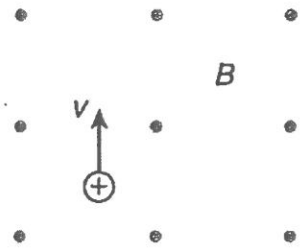


**Figure (Q5c)**

(i) Show on a diagram the direction of the magnetic force, F on the proton. (1 marks)

(ii) Show on a diagram the subsequent path of the proton. (1 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)

—THE END—