INTI
International College Penang

FINAL
Examination Paper

(COVER PAGE)

Session	:	**January / March 2018**
Programme	:	Diploma in Electrical & Electronic Engineering (DEEI)
Course	:	**PHY1131: Physics**
Date of Examination	:	5 March 2018 (Monday)
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	:	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: JANUARY / MARCH 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) 2.05×10^7 g (1 mark)

(ii) 0.00090 g (1 mark)

(iii) 107010 g (1 mark)

(b) A certain CD-ROM disk can store approximately 6.0×10^2 megabytes of information, where 10^6 bytes = 1 megabyte. If an average word requires 9.0 bytes of storage, find the number of words that can be stored on one disk? (3 marks)

(c) A car is stopped at a traffic light. It then travels along a straight road so that its distance from the light is given by $x = bt^2 + ct^3$, where $b = 1.10$ m/s^2 and $c = 0.150$ m/s^3. Calculate

(i) the average velocity of the car for the time interval $t = 0$ to $t = 10.0$ s, (5 marks)

(ii) the instantaneous velocity of the car at $t = 3.0$ s. (3 marks)

(d) An airplane undergoes the following displacements, all at the same altitude: First, it flies 59.0 km in a direction 30.0° east of north. Next, it flies 58.0 km due south. Finally, it flies 100.0 km in a direction 30.0° north of west.

(i) Sketch a vector diagram showing the graphical method in determining the total displacement vector $\boldsymbol{D}$ for the entire trip. (3 marks)

(ii) Compute the magnitude and direction of the total displacement vector $\boldsymbol{D}$? (8 marks)

Question 2

(a) In **Figure (2a)**, a singer throws a small souvenir hand bag to a crowd of audience with an initial velocity, v_o at 60° from the horizontal. One of the audiences standing 6.0 m away from the stage catches the bag after 1.46 s. The height of the singer is 1.7 m. Ignore the height of the audience, calculate

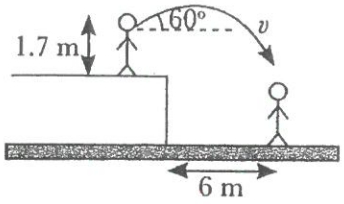

Figure (2a)

(i) the magnitude of the initial velocity of the bag, (2 marks)

(ii) the final velocity of the bag when it was caught by the audience. (5 marks)

(b) When a body is moving at constant velocity, does it need a force to maintain its state of motion? Justify your answer. (3 marks)

(c) The **Figure (2c)** shows a block A of mass, m_A = 5.0 kg on a horizontal surface with coefficient of kinetic friction, μ_k = 0.25 connected by a string through a smooth pulley to another block B of mass, m_B = 4 kg. The system is released from rest.

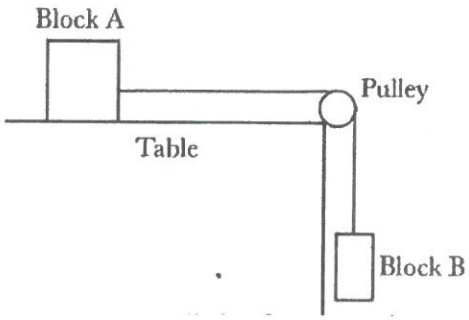

Figure 2(c)

(i) Sketch a free body diagram for the blocks when they are in motion. (3 marks)

(ii) Compute the acceleration of the blocks and the tension in the string. (6 marks)

(d) An aluminum cup of 300.0 cm^3 capacity is completely filled with glycerin at 24.0°C. Find the amount of glycerin that will spill out of the cup if the temperature of both the cup and the glycerin is increased to 30.0°C? (Given the coefficient of volume expansion of glycerin, $\beta_{glycerin} = 5.1 \times 10^{-4}$ /C° and the coefficient of linear expansion of aluminium, $\alpha_{aluminum} = 23.0 \times 10^{-6}$ /C°) (6 marks)

Question 3

(a) A block of mass, $m = 10$ kg is first compressed 20 cm against a spring having force constant, $k = 1000$ N/m, and then released on a horizontal surface as shown in **Figure (3a)**. If the horizontal and inclined surfaces are both frictionless, compute the maximum vertical height, y will the block rise on the incline? (5 marks)

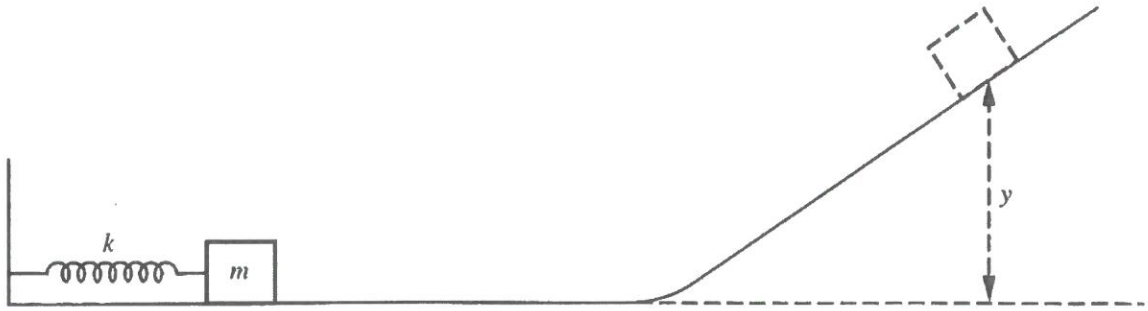

Figure (3a)

(b) A rifle bullet of mass, $m = 20$ g is fired with a muzzle velocity of 600 m/s. The length of the barrel is 80 cm.

(i) Find the total impulse imparted to the bullet. (2 marks)

(ii) If the rifle free to 'kick' backward, find its velocity when the bullet has left the muzzle, assuming the mass of the rifle, M was 3.0 kg? (3 marks)

(c) A 250.0 g of substance is heated to 350.0°C and then plunged into a 110.0 g aluminum calorimeter cup containing 180.0 g water and a 17.0 g glass thermometer at 10.5°C. The final temperature is 36.0°C. Assume no water boils away, calculate the specific heat of the substance. (Given the specific heat capacity of aluminium, $c_{aluminum} = 900.0$ J/kg·C°, specific heat capacity of water, $c_{water} = 4186.0$ J/kg·C° and specific heat capacity of glass, $c_{glass} = 840.0$ J/kg·C°) (7 marks)

(d) A gas confined in a cylinder with a tight-fitting piston is initially in the state $P_1 = 2000$ Pa, $V_1 = 2.0 \times 10^{-3}$ m^3 and $T_1 = 300$ K. Given gas constant, $R = 8.31$ J/mol.K.

(i) Find the number of moles of gas were in the cylinder? (2 marks)

(ii) If the volume is decreased to 0.50×10^{-3} 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, find the new volume? (4 marks)

Question 4

(a) In the **Figure (4a)**, a proton is projected horizontally midway between two parallel plates that are separated by 0.50 cm. The electrical field due to the plates has magnitude 610,000 N/C between the plates away from the edges. If the plates are 5.60 cm long, find the minimum speed of the proton if it just misses the lower plate as it emerges from the field. (Given charge of proton, $e = 1.60 \times 10^{-19}$ C, permittivity of free space, $\varepsilon_0 = 8.85 \times 10^{-12}$ $C^2/N \cdot m^2$ and mass of proton, $m_p = 1.67 \times 10^{-27}$ kg) (8 marks)

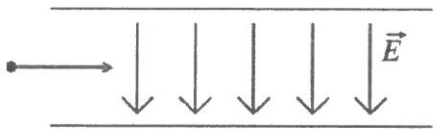

Figure 4(a)

(b) A 550.0 kg satellite orbits the Earth and has a period of 6200.0 s.
(Given Earth's mass, $M = 5.98 \times 10^{24}$ kg, Earth's radius, $R = 6.37 \times 10^6$ m and gravitational constant, G = 6.67 x 10^{-11} Nm^2kg^{-2}). Find

(i) the radius of the orbit, (3 marks)

(ii) the Earth's gravitational force on the satellite. (3 marks)

(c) **Figure (4c)** shows two charged particles ***P*** and ***Q*** entering a uniform magnetic field, B of flux density 0.85 T with the same velocity, v. The magnitude of the charges on the particles is 1.60 x 10^{-19} C. The radius of curvature of the path of ***Q*** is 15.0 cm and is twice that of ***P***.

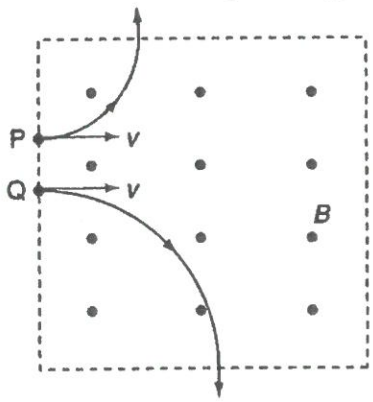

Figure 4(c)

(i) State two differences in the paths of particles ***P*** and ***Q***. (2 marks)

(ii) Identify the sign of the charges on the particles. Explain your reason. (3 marks)

(iii) Compare the masses of the particles. (2 marks)

(iv) The mass of ***Q*** is 3.32 x 10^{-27} kg. Find the speed, v and the time taken by ***P*** to move through the magnetic field. (4 marks)

Question 5

(a) A current of 7.5 A is maintained in a wire for 45 s. In this time compute the amount of charge and electrons that flow through the wire? (4 marks)

(b) A parallel-plate capacitor has plates of area 0.40 m^2 and plate separation of 0.20 mm. The capacitor is connected across a 9.0 V potential source. (Given the permittivity of free space, $\varepsilon_0 = 8.85 \times 10^{-12}$ $C^2/N \cdot m^2$)

(i) Compute the magnitude of the electric field between the plates? (2 marks)

(ii) Compute the capacitance of the capacitor? (2 marks)

(iii) Compute the magnitude of the charge on each plate of the capacitor? (2 marks)

(c) Three point charges, $Q_1 = +35\mu C$, $Q_2 = +47\ \mu C$ and $Q_3 = -53\ \mu C$, lie on a straight line in vacuum as shown in **Figure (5c)**. Calculate the resultant force acting on Q_1. (6 marks)

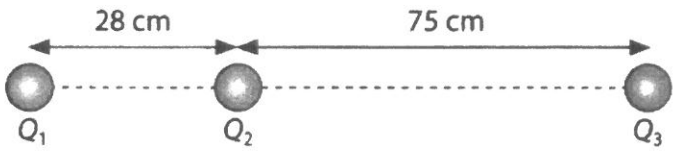

Figure (5c)

(d) From **Figure (5d)**, find:

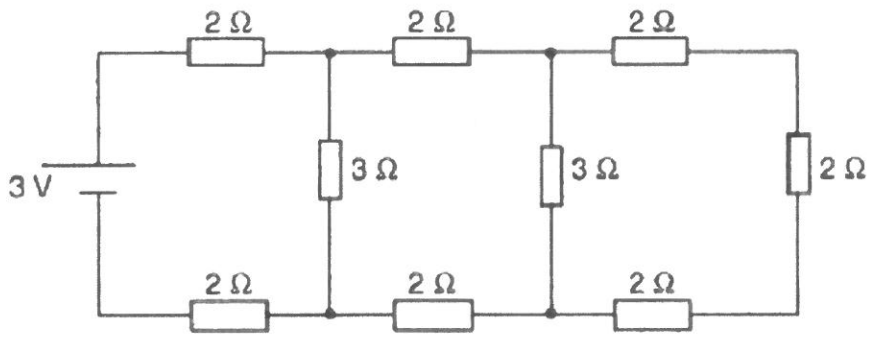

Figure (5d)

(i) the total resistance in the circuit. (7 marks)

(ii) the current *I*. (2 marks)

—THE END—