INTI
INTERNATIONAL COLLEGE PENANG (507232-U)
LAUREATE INTERNATIONAL UNIVERSITIES

FINAL
Examination Paper

(COVER PAGE)

Session	:	APRIL 2014
Programme	:	DIPLOMA IN ELECTRICAL & ELECTRONIC ENGINEERING
Course	:	PHY 1121: PHYSICS
Date of Examination	:	24 JULY 2014
Time	:	5.00pm – 7.00pm 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 : **Dr. Khoo Bee EE**

This paper consists of 7 printed pages, including the cover page.

INTI INTERNATIONAL COLLEGE PENANG
DIPLOMA IN ELECTRICAL AND ELECTRONIC ENGINEERING PROGRAMME

PHY 1121: PHYSICS
FINAL EXAMINATION: APRIL 2014 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) The diameter of a cylindrical copper rod was measured as 24.8 mm with a vernier caliper. Its length was measured as 35.0 cm with a measuring tape. Find:

(i) the dimension of the area and volume of the rod. (4 marks)

(iii) the cross sectional area of the rod in SI unit. (2 marks)

(iii) the volume of the rod in SI unit. (2 marks)

(b) A stone is thrown vertically upward with a speed of 23.0 ms^{-1}.

(i) How fast is it moving when it reaches a height of 12.0 m? (2 marks)

(ii) How much time is required to reach this height? (4 marks)

(iii) Why are there two answers to (b)(ii)? (2 marks)

(c) A 15.0 kg load of bricks hangs from one end of a rope that passes over a small, frictionless pulley. A 28.0 kg counterweight is suspended from the other end of the rope, as shown in the **Figure (1)**. The system is released from rest.

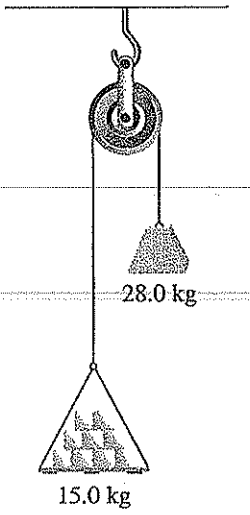

Figure (1)

(i) Draw a free body diagram for the load of bricks and the counterweight. (2 marks)

(ii) What is the magnitude of the upward acceleration of the load of bricks? (5 marks)

(iii) What is the tension in the rope while the load is moving? (2 marks)

Question 2

(a) An athlete, competing in a shot put event, throws a shot of mass 6.0 kg with an initial speed of 13.0 ms^{-1} at an angle of 40.0° to the horizontal. The shot is released at a height of 2.0 m above the ground level.

(i) Calculate the time taken for the shot to reach its maximum height of 5.5 m above the ground. (3 marks)

(ii) Find the final vertical velocity of the shot. (4 marks)

(iii) Calculate the horizontal distance that the shot travels after it leaves the athlete's hand. (3 marks)

(b) A 2.0 kg block is placed against a spring on a frictionless 30° inclined plane. The block is not attached to the spring. The spring constant is 19.6 Ncm^{-1}, is compressed 20.0 cm and then released.

(i) What is the elastic potential energy of the compressed spring? (3 marks)

(ii) What is the change in the gravitational potential energy of the block as the block moves from the release point to the highest point on the incline? (2 marks)

(iii) How far along the incline is the highest point from the released point? (4 marks)

(c) Given the Earth's radius, r_E = 6380 km, the Earth's mass, M = 5.97 x 10^{24} kg and gravitational constant, G = 6.67 x 10^{-11} Nm^2kg^{-2}.

(i) Calculate the magnitude of the acceleration due to gravity near the surface of the Earth. (3 marks)

(ii) Calculate the velocity of a satellite moving in a stable circular orbit about the Earth at a height of 5200 km. (3 marks)

Question 3

(a) In **Figure (2)**, two trolleys of mass 2.5 kg and 6.0 kg are at rest on a smooth horizontal table with a spring loaded piston between them. When the spring is released the two trolleys move apart, with the heavier trolley moving to the right with a speed of 4.0 ms^{-1}.

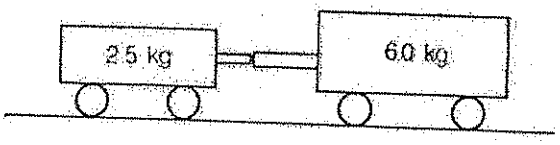

Figure (2)

(i) What is the total momentum of the system after separation? Explain your answer. (2 marks)

(ii) Determine the momentum of each trolley after separation. (3 marks)

(iii) Determine the velocity of the lighter trolley after separation. (2 marks)

(iv) If it takes 0.40 s for the trolleys to separate, determine the average force pushing them apart. (3 marks)

(b) Initially 48.0 g of ice at 0 °C is in an aluminium calorimeter can of mass 2.0 g, also at 0 °C. Then 75.0 g of water at 80 °C is poured into the can. What is the final temperature? (Given that the specific heat capacity of water, c_w = 1.00 cal/g.C°, specific heat capacity of aluminium, c_{Al} = 0.22 cal/g.C° and latent heat of the melting of ice, L_F = 79.8 cal/g) (6 marks)

(c) Two parallel plates 20 cm long and 5 cm apart have a potential difference of 1000 V between them. In an electron gun, electrons are accelerated through a potential difference of 4000 V. On leaving the electron gun these electrons enter the field between the parallel plates at right angles to the field, as depicted in the **Figure (3)**. (Given that 1 eV = 1.6×10^{-19} J, the mass of electron, $m_e = 9.11 \times 10^{-31}$ kg and the charge of the electron, $q = 1.6 \times 10^{-19}$ C). Find:

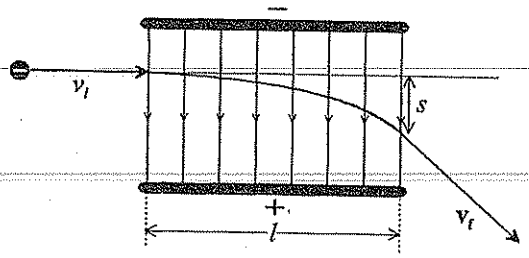

Figure (3)

(i) The time taken for the electrons to traverse this field. (5 marks)

(ii) The deflection of the electrons on leaving the field, ***S***. (4 marks)

Question 4

(a) A 20 liter gas container is filled with 350 g nitrogen at 30 °C. The molar mass of nitrogen is 28 $g.mol^{-1}$.

(i) Calculate the pressure of the nitrogen gas. (4 marks)

(ii) If the pressure drops to 1200 kPa, find the amount of the remaining gas in the container. (4 marks)

(b) In a mass spectrometer, singly positively charged ions of different isotopes of an element enter a region of cross electric field $\boldsymbol{E} = 1.5 \times 10^5$ Vm^{-1}, and magnetic field $\boldsymbol{B} = 0.83$ T that are mutually perpendicular. The ions that emerge from the slit ***S*** enter a uniform magnetic field of flux density 0.83 T and move separately along two different semicircles before striking the points ***X*** and ***Y*** of a photographic plate.

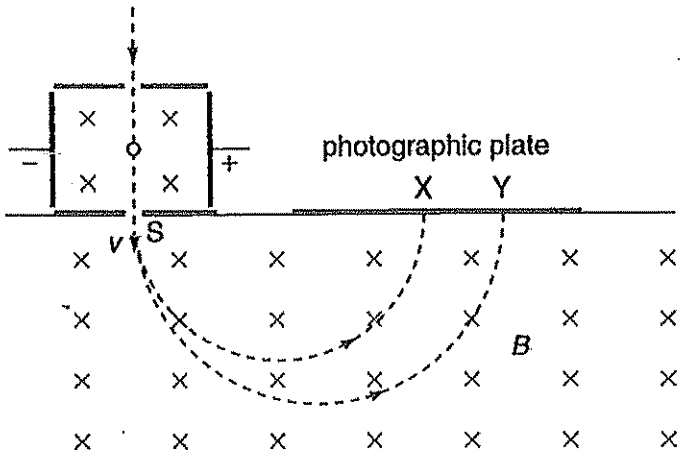

Figure (4)

(i) What is the velocity *v* of the ions that emerge from the slit ***S***? (2 marks)

(ii) Discuss what happens to the ions that have speeds less than *v*. (4 marks)

(iii) The distance of the point ***X*** from the slit ***S*** is 6.75 cm. Calculate the mass of the ions that strike the photographic plate at ***X***. (3 marks)

(iv) The mass of the ions that strike the photographic plate at ***Y*** is 2.66×10^{-26} kg. Calculate the distance of ***Y*** from the slit ***S***. (2 marks)

(c) Suppose that the beam of light in **Figure (5)** travels in air before it is incident on the glass plate ($n_g = 1.5$) at 60^o.

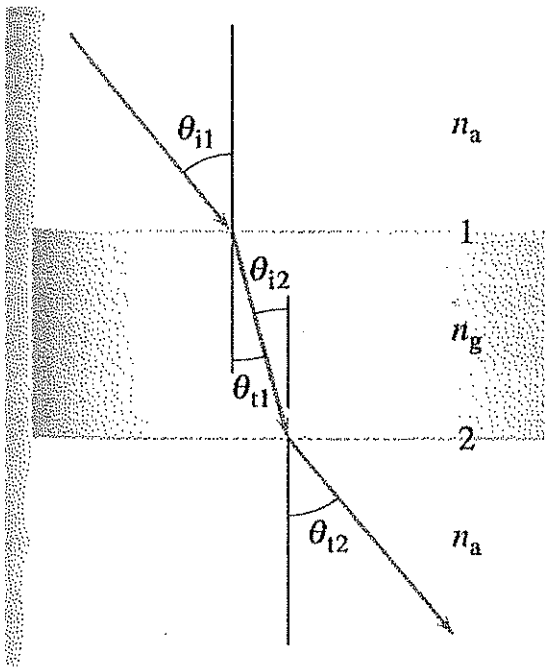

Figure (5)

(i) At what angle will it be transmitted into the block? (3 marks)

(ii) Show that the beam emerges from the far side parallel to the original incoming light. (3 marks)

Question 5

(a) The capacitance of a variable capacitor maybe adjusted between 1×10^{-10} F and 5×10^{-10} F. When the capacitance is 5×10^{-10} F, the capacitor is charged by a battery of e.m.f. 200 V. The capacitor is then disconnected from the battery and its capacitance changed to 1×10^{-10} F.

(i) What is the charge on the capacitor now? (4 marks)

(ii) What is the final potential difference across the capacitor? (2 marks)

(iii) What is the work done against the electric field when the capacitance is changed? (3 marks)

(b) From **Figure (6)**, find:

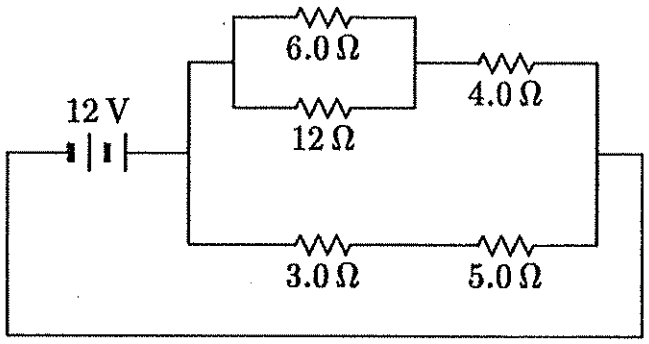

Figure (6)

(i) The equivalent resistance in the circuit. (5 marks)

(ii) The total current in the circuit. (2 marks)

(c) An object is placed 30 cm from a converging lens with 10 cm focal length.

(i) Find the position of the image. (2 marks)

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

(iii) If the lens is diverging, what will be the characteristic of the image formed? (4 marks)

--THE END--

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