

**FINAL  
ALTERNATIVE ASSESSMENT**

(COVER PAGE)

Session : August 2020

Programme : Diploma in Electrical & Electronic Engineering (DEEI)  
Diploma in Mechanical Engineering (DMEN)

Course : PHY1121/PHY1131: Physics

Date of Examination : 14 December 2020 (Monday)

Time : 4.00pm – 6.15pm Reading Time : Nil

Duration : 2 Hours 15 Minutes

**Special Instructions :**

This paper consists of **FOUR (4)** questions. Answer **ALL** questions. All questions carry equal marks.

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Material permitted : Non-Programmable Scientific Calculator

Materials provided : Physics Formulae Booklet

Examiner(s) : Chong Mee Teng

Chief Moderator : Koh Mui Siang

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

DIPLOMA IN ELECTRICAL & ELECTRONIC ENGINEERING PROGRAMME (DEEI)  
 DIPLOMA IN MECHANICAL ENGINEERING PROGRAMME (DMEN)  
 PHY1131 / PHY1121: PHYSICS  
 FINAL ALTERNATIVE ASSESSMENT: AUGUST 2020 SESSION

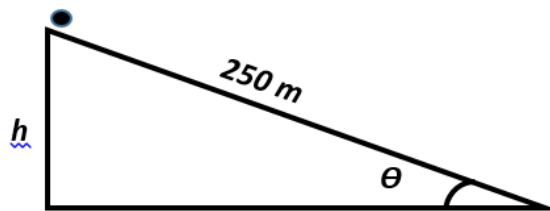
**Instructions:** This paper consists of **FOUR (4)** questions. Answer **ALL** questions. All questions carry equal marks.

**Question 1**

- (a) State the number of significant digits in the following measurements.
- (i)  $3.20 \times 10^3$  kg (1 mark)
  - (ii) 2.150 kg (1 mark)
- (b) If the density of an object is  $2.87 \times 10^{-4}$  lbs/cubic inch, convert its density in g/mL. Given that 1lb = 454 g and 1 inch = 2.54 cm. (3 marks)
- (c) A 0.40 kg block with an initial speed of 0.80 m/s slides along a horizontal tabletop against friction of 0.70 N.
- (i) How far will it slide before stops? (3 marks)
  - (ii) What is the coefficient of friction between the block and the tabletop? (4 marks)
- (d) A car moving at 30 m/s slows uniformly to a speed of 10 m/s in a time of 5.0 s.
- (i) What is the acceleration of the car? (3 marks)
  - (ii) What is the distance it moves in the third second. (4 marks)
- (e) A hockey puck slides off the edge of a table at point **A** with an initial velocity of 20.0 m/s and experiences no air resistance. The height of the tabletop above the ground is 2.00 m.
- (i) What is the speed of the puck just before it touches the ground? (3 marks)
  - (ii) What is the distance between point **A** and the point where the puck hits the ground? (3 marks)

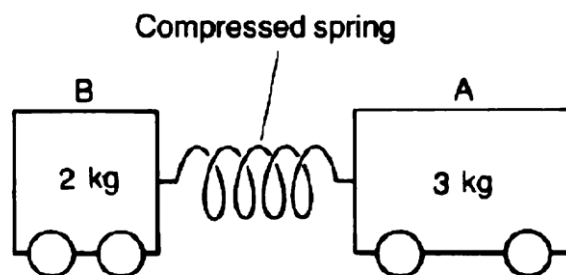
**Question 2**

- (a) A physics student takes a 5.0 kg pail of water connected on a rope, and swings it in a vertical circle of radius 90.0 cm at a constant speed of 7.0 m/s.
- (i) When the pail passes its highest point, what are the magnitude and direction of its acceleration? (2 marks)
- (ii) When the pail passes its highest point, what is the tension in the rope. (3 marks)
- (b) In **Figure Q2(b)**, a 70.0 kg skier slides down a uniform  $30.0^\circ$  slope of snow, starting from rest at the top of the hill. The distance traveled along the slope is 250 m.



**Figure Q2(b)**

- (i) Assuming no friction, how large is her kinetic energy at the bottom of the hill? (4 marks)
- (ii) Suppose instead that the skier is slowed down by a kinetic friction force,  $f_k = 60.0$  N up the slope. What would be her kinetic energy at the bottom of the hill? (3 marks)
- (c) **Figure Q2(c)** shows two trolleys **A** and **B** initially at rest, separated by a compressed spring. The spring is now released and the 3.0 kg trolleys moves with a velocity of 1.0 m/s to the right. Compute:



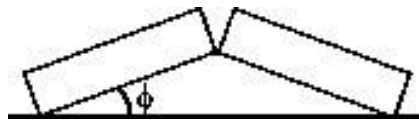
**Figure Q2(c)**

- (i) the velocity of the 2.0 kg trolley, (4 marks)
- (ii) the total kinetic energy of the trolleys. (3 marks)

- (d) A cylinder of volume  $2.00 \times 10^{-3} \text{ m}^3$  contains a gas at a pressure of  $1.50 \times 10^6$  Pascal and at a temperature of 300 K. Compute:
- (i) the number of moles of the gas, (2 marks)
  - (ii) the mass of gas if its molar mass is  $32.0 \times 10^{-3} \text{ kg/mol}$ , (2 marks)
  - (iii) the mass of one molecule of the gas. (2 marks)

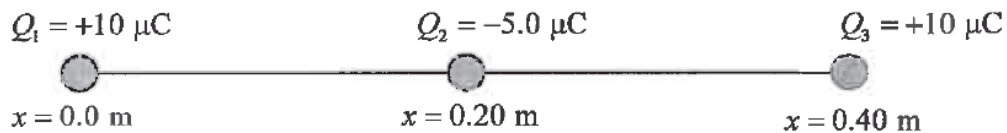
**Question 3**

- (a) A 50.0 g ice cube at  $0^\circ\text{C}$  is heated until 45.0 g has become water at  $100^\circ\text{C}$  and 5.0 g has become steam at  $100^\circ\text{C}$ . How much energy was added to accomplish the transformation? Given that the specific heat capacity of water is  $4190 \text{ J/kg} \cdot \text{K}$ , the heat of fusion of water is  $3.34 \times 10^5 \text{ J/kg}$  and the heat of vaporization of water  $2.26 \times 10^6 \text{ J/kg}$ . (5 marks)
- (b) Two identical concrete slabs lie flat and in contact with each other as shown in the **Figure Q3(b)**. If the temperature increases by 40 K, the lower edges opposite the contact edges remained fixed in position, and the lower edges of the contact side remain in contact, at what angle will the slabs be tilted? The coefficient of thermal expansion of the concrete is  $10 \times 10^{-6} / \text{K}$ . (6 marks)



**Figure Q3(b)**

- (c) Three charges  $Q_1 = +10 \mu\text{C}$ ,  $Q_2 = -5.0 \mu\text{C}$  and  $Q_3 = +10 \mu\text{C}$  are arranged along the  $x$ -axis, at  $x = 0.0 \text{ m}$ ,  $x = 0.2 \text{ m}$  and  $x = 0.4 \text{ m}$  respectively as shown in **Figure Q3(c)**.



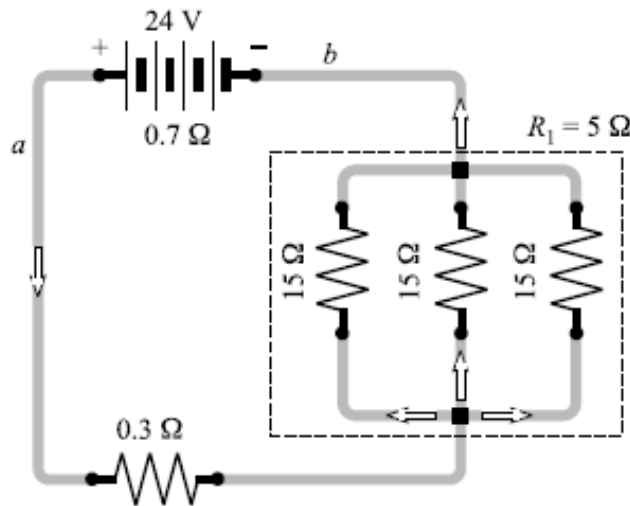
**Figure Q3(c)**

- (i) Were the electrons added or removed in charging  $Q_2$ ? (1 mark)
- (ii) Compute the magnitude and direction of the resultant electrostatics force acting on charge  $Q_3$ ? (6 marks)

- (d) A parallel-plate capacitor has circular plates of 8.2 cm radius and 1.3 mm separation. (Given the permittivity of vacuum,  $\epsilon_0 = 8.85 \times 10^{-12}$  F/m)
- Compute the capacitance. (4 marks)
  - What charge will appear on the plates if a potential difference of 120V is applied? Define your answer in appropriate prefixes. (3 marks)

**Question 4**

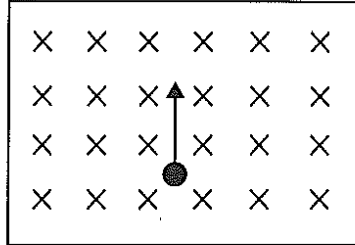
- (a) In **Figure Q4(a)** below, the battery has an internal resistance of  $0.7 \Omega$ . Compute:



**Figure Q4(a)**

- the current drawn from the battery, (4 marks)
  - the current in each  $15 \Omega$  resistor. (3 marks)
- (b) 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? (6 marks)
- (c) Explain the following terms of semiconductor:
- doping process, (2 marks)
  - depletion region in PN junction, (2 marks)
  - P-type Semiconductor. (2 marks)

- (d) **Figure Q4(d)** shows an electron is fired perpendicular into a 3.5 mT uniform magnetic field with a speed of  $2.0 \times 10^7$  m/s. The magnetic field is directed into the plane of the page.



**Figure Q4(d)**

- (i) Make a copy of the diagram and mark the direction of the magnetic force on the electron. (2 marks)
- (ii) Compute the magnetic force acting on the electron. (2 marks)
- (iii) Explain why the electron will move in a circle with constant speed. (2 marks)

**~THE END~**