FINAL
Alternative Assessment

(COVER PAGE)

Session	:	**April 2020**
Programme	:	Foundation in Science (CFSI)
Course	:	**PHY1206: Physics 2**
Date of Examination	:	5 August 2020 (Wednesday)
Time	:	11:00am – 1:30pm Reading Time : Nil
Duration	:	2 hours + 30 minutes (uploading time)
Special Instructions	:	

This paper consists of **FOUR (4)** questions. Answer **ALL** questions.

All questions carry equal marks.

Materials permitted :

Non-Programmable Calculator

Materials provided :

Nil

Examiner(s)	:	**Dr. Beh Boon Chun**
Chief Moderator	:	Mr. Dinash Kandasamy

*This paper consists of **5** printed pages, including the cover page.*

FOUNDATION IN SCIENCE (CFSI)
PHY1206: PHYSICS 2
FINAL ALTERNATIVE ASSESSMENT: APRIL 2020 SESSION

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

Question 1

(a) (i) Calculate the average translational kinetic energy of a nitrogen molecule at Standard Temperature and Pressure (STP). (3 marks)

(ii) Compute the total translational kinetic energy of 2.0 mol of nitrogen molecules at 30˚C. (3 marks)

(b) A square has four charge particles as shown in **Figure Q1(b).** The charges on particles are $Q_2 = -Q_1 = 70\ \mu C$ and $Q_3 = 2Q_2$ and $Q_4 = -Q_3$. The distance a is 60 mm.

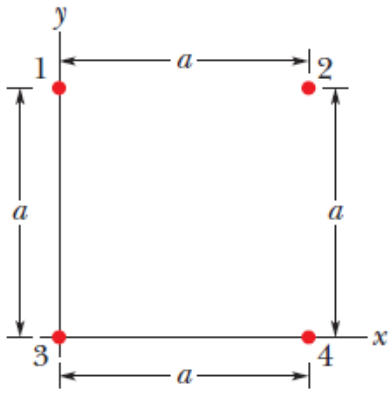

Figure Q1(b)

(i) Find the x-components of net electric force acting on charge Q_1. (3 marks)

(ii) Find the y-components of net electric force acting on charge Q_1. (3 marks)

(c) **Figure Q1(c)** illustrate four particles are fixed in place. They all have same charge which is equal to +500 nC. Determine the magnitude and direction of the resultant electric field at point P if d = 20 cm. (7 marks)

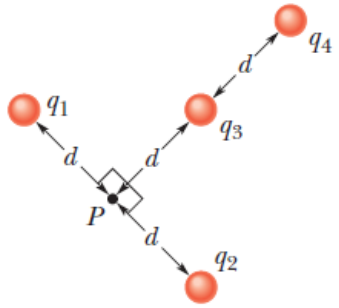

Figure Q1(c)

(d) A space vehicles traveling through Earth's radiation belts can intercept a significant number of electrons. The charge build up may damage the electronic components and disrupt the operation of space vehicle. If a spherical metal satellite have 150 cm diameter accumulates 3.0 μC of charge in one orbital revolution.

(i) Calculate the resulting surface charge density on the satellite. (3 marks)

(ii) Determine the magnitude of electric field just outside the surface of satellite due to the surface charge density in (i). (3 marks)

Question 2

(a) Charged particles are fixed in place with distance a = 25 cm as shown in **Figure Q2(a)**. Charges q_1 = 3.4 pC and q_2 = 6.0 pC. Calculate the net electric potential at the center of the rectangle. (*Hints*: Thoughtful examination of the arrangement can reduce the calculation.) (6 marks)

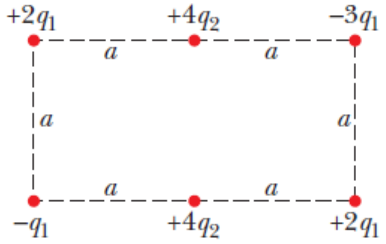

Figure Q2(a)

(b) An air-filled capacitor with plate area of 9.0 cm^2 and plate separation of 2.5 mm is charged by a 12.0 V battery. The capacitor is disconnected from the battery and the plates are then pulled apart (without discharge) to a separation of 5.0 mm. Neglecting fringing,

(i) Determine the potential difference between the plates. (3 marks)

(ii) Compute the final energy stored in capacitor. (3 marks)

(c) A copper wire has a resistance of 10 Ω. At what point along its length must the wire be cut so that the resistance of one piece is 4.0 times the resistance of the other piece. Calculate the resistances for the two pieces of copper wire. (6 marks)

(d) Calculate the total resistance for the circuit shown in **Figure Q2(d)** and determine the total current flow in the circuit if $V = 9.0$ V and $R = 10$ Ω. (7 marks)

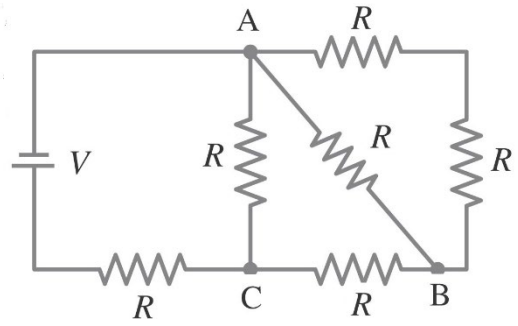

Figure Q2(d)

Question 3

(a) Determine the direction of magnetic force acting on each negative charge [(i) → (vi)] as shown in **Figure Q3(a)** where $\vec{v}$ is the velocity of the charge and $\vec{B}$ is the direction of the magnetic field. (6 marks)

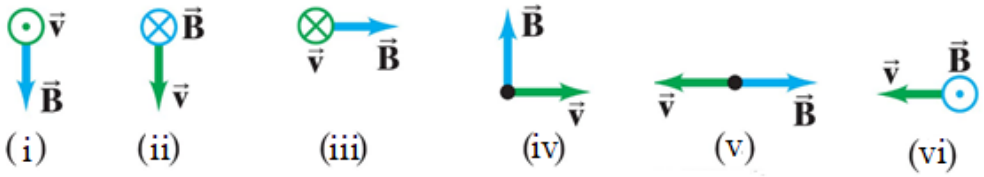

Figure Q3(a)

(b) A coil with an inductance of 2.0 H and a resistance of 10 Ω is connected to an ideal battery with $\mathscr{E} = 120$ V. At 0.5 second after the connection is made, calculate

(i) the rate of energy stored in the magnetic field. (4 marks)

(ii) the rate of thermal energy dissipated in the resistor. (3 marks)

(iii) the rate of energy delivered by the battery. (2 marks)

(c) In a series RLC circuit, R = 200 Ω, C = 70 μF, L = 230 mH. The circuit component is connected to an ac power supply which operate at frequency 60 Hz and have $\mathscr{E}_m$ = 40.0 V.

(i) Calculate the impedance in the circuit. (4 marks)

(ii) Calculate the phase angle of the circuit. (2 marks)

(iii) Calculate the peak voltage across R, C and L. (4 marks)

Question 4

(a) Two long straight wires that is 6.0 cm apart carries current of 5 A and 8 A respectively. Determine the net magnetic field midway between the two wires if both currents are

(i) in the same direction, and (3 marks)

(ii) in opposite direction. (3 marks)

(b) A high-energy pulsed laser emits a 2.0 ns long pulse of average power 3.2 x 10^{10} W. The laser beam is 4.5 mm in radius.

(i) Calculate the energy delivered in each pulse. (2 marks)

(ii) Calculate the rms value of the electric field. (3 marks)

(iii) Calculate the peak value (amplitude) of the magnetic field. (4 marks)

(c) A red laser light with wavelength of 700 nm falls on two closely spaced slits, an interference pattern formed on a screen several meters away has bright fringes spaced 9.0 mm apart from the center of the pattern. When the laser is replaced by a laser pointer, the fringes are 8.0 mm apart. Determine the wavelength of light produced by the pointer. (5 marks)

(d) When light of wavelength 550 nm is directed on a single slit, the distance between the first and fourth minima on diffraction pattern is 0.30 mm and the screen is 80 cm away from the slit.

(i) Calculate the slit width. (3 marks)

(ii) Calculate the angle θ of the second diffraction minimum. (2 marks)

~ The End ~