FINAL
Alternative Assessment

(COVER PAGE)

Session	:	**August 2021**
Programme	:	Foundation in Science (CFSI)
Course	:	**PHY1206: Physics 2**
Date of Examination	:	9 December 2021 (Thursday)
Time	:	9:00am – 11:30am 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	:	Ms. Ng Wing Mei

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

FOUNDATION IN SCIENCE (CFSI)
PHY1206: PHYSICS 2
FINAL ALTERNATIVE ASSESSMENT: AUGUST 2021 SESSION

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

Question 1

(a) A cylinder contains 1.0 mol of an ideal gas that occupies 1.0 L of volume. The gas expands isothermally at the temperature of 120˚C. The final volume occupies by the gas becomes three times of the initial volume. The molar mass of the gas is 16 g/mol. Calculate

(i) the entropy change of the gas, (2 marks)

(ii) the final pressure of the gas, and (2 marks)

(iii) the rms speed of the gas molecules in the container. (2 marks)

(b) Three charged particles are located along a horizontal line, Q_1 carries a charge of +30 μC and at a distance of 55 cm to the left of Q_2 which carries a charge of -80 μC. Q_3 carries a charge of -50 μC is at a distance of 45 cm to the right of Q_2. Determine

(i) the magnitude and direction of the net electric force acting on Q_2, and (4 marks)

(ii) the magnitude and direction of the net electric force acting on Q_2 if there is a Q_4 which carries a charge of +60 μC at a distance of 30 cm at the top of Q_2. (4 marks)

(c) Four particles lie in the xy-plane as shown in **Figure Q1(c)**. Point P is located beneath q_3 and 10 cm from q_1. Compute the magnitude of electric field at point P due to the three charges. Given that q_1 = +3.2 μC, q_2 = -4.8 μC and q_3 = +1.6 μC. (7 marks)

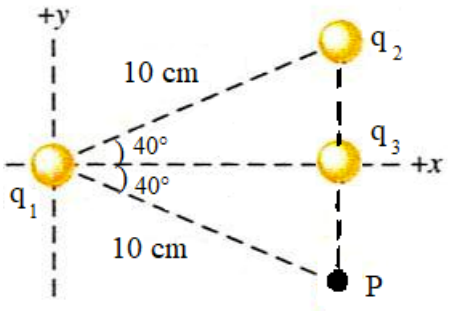

Figure Q1(c)

(d) **Figure Q1(d)** illustrates four Gaussian surfaces (S1, S2, S3 and S4). Using Gauss's Law, find the electric flux through the surfaces of S1 and S4. (4 marks)

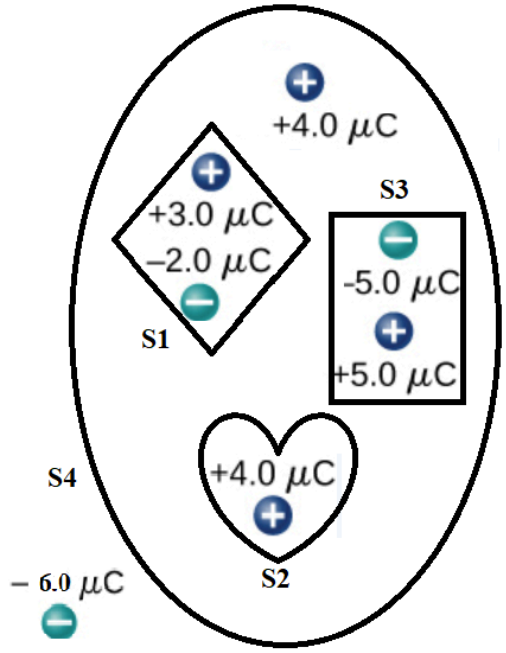

Figure Q1(d)

Question 2

(a) **Figure Q2 (a)** illustrates a triangle with charged particles fixed at its corner. Given that $q_1 = -180$ μC and $q_2 = q_3 = 160$ μC, calculate the net electric potential at the centroid of the triangle which is at a distance of *d* from each corner. (6 marks)

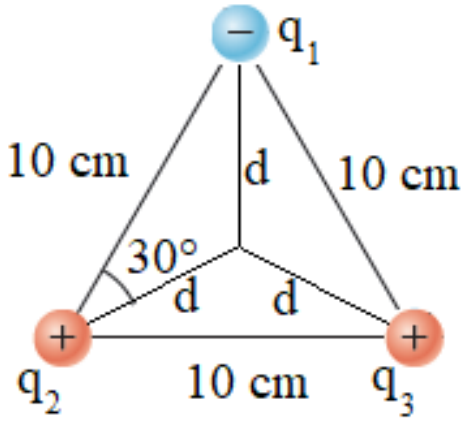

Figure Q2(a)

(b) A circuit consists of identical capacitors as illustrated in **Figure Q2(b)**. Each capacitor has a capacitance of 100.0 μF, determine the total capacitance in the circuit. (6 marks)

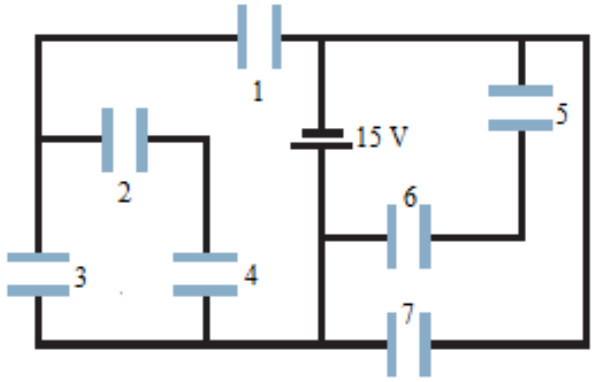

Figure Q2(b)

(c) A 250 W refrigerator is plugged into a wall outlet and operates continuously for 24 hours per day. Compute

(i) the amount of electrical energy in kWh for the usage of 30 days , and (2 marks)

(ii) the total amount that needs to be paid from 1st of March until 30th of April if the electrical energy costs RM 0.22 per kWh. (3 marks)

(d) A circuit is shown in **Figure Q2(d)**. Find the current I_1, I_2 and I_3 in the circuit using Kirchhoff's Rules. Show the working clearly, (8 marks)

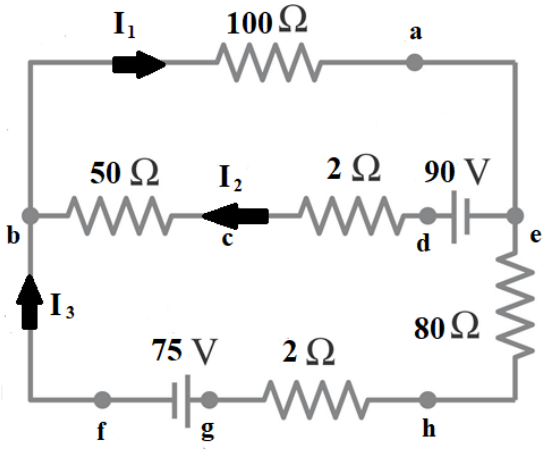

Figure Q2(d)

Question 3

(a) A charged particle with mass of 2.5 x 10^{-20} kg moves into a region of uniform magnetic field of 2.0 T. The velocity of the particle is 6 x 10^{2} m/s and the particle moves in an arc of a circle with a radius of 500 mm. Calculate

(i) the charge on the particle, (3 marks)

(ii) the potential difference applied to accelerate the particle, and (3 marks)

(iii) the magnetic force exerted on the particle. (3 marks)

(b) Four long, parallel wires with length of 10.0 m each carries a current of 8.0 A as shown in **Figure Q3(b)**. Determine the magnitude of the resultant magnetic force acting on wire 1. (8 marks)

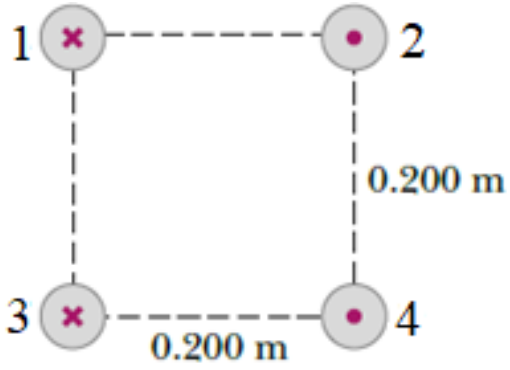

Figure Q3(b)

(c) A series RL circuit consists of a resistor of R = 100 Ω and an inductor of L = 100 mH that is connected to a battery of 9.0 V.

(i) Compute the time constant of the circuit. (2 marks)

(ii) Compute the time needed for the current in the circuit to reach 50% of the maximum value. (4 marks)

(iii) Briefly explain what is meant by the time constant τ in a RL circuit. (2 marks)

Question 4

(a) A series RLC circuit consists of resistor $R = 20\ \Omega$, charged capacitor $C = 80.0\ \mu F$, and an inductor $L = 150$ mH.

(i) Prove that the circuit will produce oscillations. (2 marks)

(ii) Calculate the frequency of the ac source when the RLC circuit is connected to an ac generator and the impedance of the circuit is 45 Ω. (4 marks)

(iii) Calculate the peak current in the circuit if the ac source has a rms voltage of 30 V. (3 marks)

(iv) Using the answer from **(a)(iii)**, calculate the average power dissipated through the resistor. (3 marks)

(b) An electromagnetic (EM) wave travels in the $+z$ direction in vacuum. The magnetic wave is moving in a direction that is at right angle to the direction of propagation and having an amplitude of 10.0 T. Determine

(i) the amplitude of the of the electric wave, (2 marks)

(ii) the total energy density of the EM wave when E and B are at their peak values, and (2 marks)

(iii) the average intensity of the EM wave. (3 marks)

(c) A white light is incident on a double slit and the interference pattern formed is observed on a large wall. The first order maxima consists of rainbow colors and the separation between the slits is 1 μm. The purple light with wavelength of 410 nm is observed to be at a distance of 5 cm from the central maximum.

(i) Compute the distance between the wall and double slit. (2 marks)

(ii) Compute the maximum order that can be seen on the wall for the red light which has a wavelength of 680 nm. (2 marks)

(iii) Explain with a reason whether it is possible to see the second order for the purple light on the wall? (2 marks)

~ The End ~