FINAL
Alternative Assessment

(COVER PAGE)

Session	:	**April 2021**
Programme	:	Foundation in Science (CFSI)
Course	:	**PHY1206: Physics 2**
Date of Examination	:	29 July 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	:	Mr. Kapilan Ramarao

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

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

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

Question 1

(a) An ideal gas confined in a container at standard temperature and pressure (STP). If half of the gas is withdrawn and the temperature is raised to 30˚C, calculate

(i) the pressure of the gas (in kPa) remaining in the container and (4 marks)

(ii) the average kinetic energy of a gas molecule that is still remaining in the container. (2 marks)

(b) Given q_1 = +6 μC and q_2 = -4 μC and the coordinates of both charges are x_1 = 4.0 cm, y_1 = 0.5 cm and x_2 = -3.0 cm, y_2 = 1.5 cm respectively. Determine

(i) the magnitude and direction of the electrostatic force on q_1 due to q_2, and (3 marks)

(ii) the x and y coordinates (in cm) of the third charged particle q_3 = -5 μC that should be placed in the plane so that the resultant electrostatic force acting on q_1 due to q_2 and q_3 is zero. (5 marks)

(c) An equilateral triangle has three charged particles as shown in **Figure Q1(c)**. Determine the magnitude and direction of resultant electric field at a coordinates of (x = 1.00 m, y = 0 m) if the charged particle of 2.00 μC is located at origin. (7 marks)

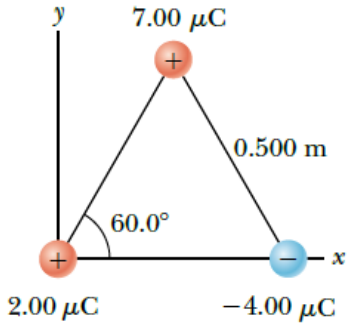

Figure Q1(c)

(d) **Figure Q1(d)** illustrated three objects that have charges of +1.0 μC, -2.0 μC and one of the object is electrically neutral. Determine

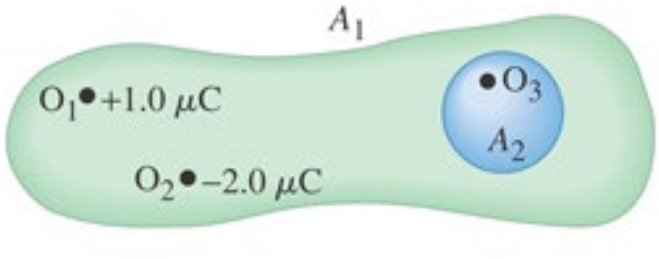

Figure Q1(d)

(i) the electric flux through surface A_1 that encloses the three objects, and (2 marks)

(ii) the electric flux through surface A_2 that encloses the third object only. (2 marks)

Question 2

(a) In a region of space, charge q_1 = +8.0 μC is 50.0 cm from another charge q_2 = -3.0 μC. Calculate

(i) the net electric potential midway between the two charges, and (3 marks)

(ii) the electric potential energy of the pair of charges. (3 marks)

(b) A circuit consist of capacitors was illustrated in **Figure Q2(b)**. Determine

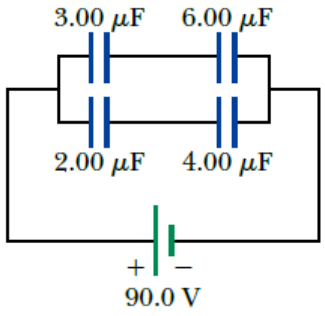

Figure Q2(b)

(i) the total capacitance in the circuit, and (3 marks)

(ii) the charge on each capacitor. (4 marks)

(c) A centipede of length 5.0 cm crawls in the direction of electron drift along a copper wire which have radius 3.0 mm and the wire carry a constant current of 10 A. The resistivity of copper wire is 1.69×10^{-8} Ω m and the number of charge carrier per unit volume in copper wire is 8.49×10^{28} m^{-3}.Determine

(i) the potential difference between the two ends of the centipede, (3 marks)

(ii) the time taken for the centipede to crawl 8.0 cm if it crawls at the drift speed of the electrons in the wire. (3 marks)

(d) A resistor of 100 Ω is connected in series with a capacitor of 100 μF and they are connected to a battery which have emf of 12.0 V. Calculate

(i) the maximum charge the capacitor could acquire, (2 marks)

(ii) the time taken for the voltage across the capacitor to reach 10.0 V . (4 marks)

Question 3

(a) A potential difference of 200 V is applied to increase the speed of a stationary electron before it moves into a uniform magnetic field of 150 mT. The direction of electron's velocity is at right angle to the direction of magnetic field. Calculate

(i) the kinetic energy of the electron (in J), (2 marks)

(ii) the speed of the electron, (2 marks)

(iii) the magnitude of the magnetic force exerted on the electron, and (2 marks)

(iv) the radius of electron's path in the magnetic field. (2 marks)

(b) Two wires are separated by a distance d = 15.0 cm was illustrated in **Figure Q3(b).** Both wires carry identical current of 9.0 A in opposite direction. Determine the magnitude and direction of the net magnetic field at

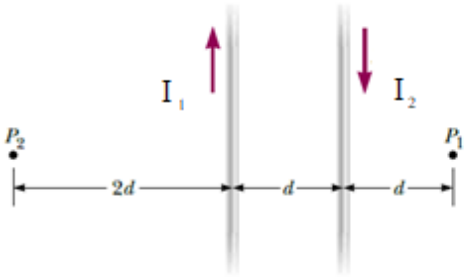

Figure Q3(b)

(i) P_1, and (2 marks)

(ii) P_2. (2 marks)

(c) **Figure Q3(c)** illustrate few wire carry identical current of 7.5 A. Calculate the magnitude and direction of the net magnetic field at point P. (4 marks)

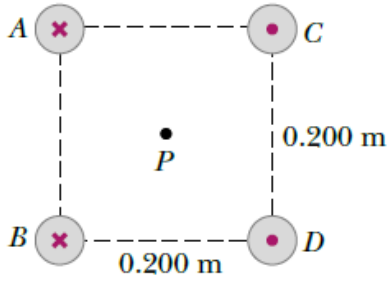

Figure Q3(c)

(d) A metal rod is moving to the left with uniform velocity as shown in **Figure Q3(d)**. A magnetic field of magnitude B = 0.550 T points out of the page. If L = 20.0 cm and v is 33.0 cm/s, determine

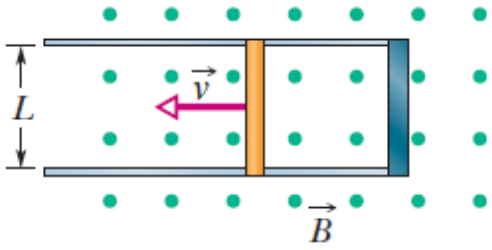

Figure Q3(d)

(i) the magnitude and direction of emf induced in the moving rod, (3 marks)

(ii) the current induced in the moving rod if the resistance of the rod is 15.0 Ω and the resistance of the parallel metal rails can be ignored, (2 marks)

(iii) the power dissipated in the moving rod, and (2 marks)

(iv) the magnetic force acted on the moving rod using the answer in **(iii)**. (2 marks)

Question 4

(a) A series RLC circuit is connected to an AC source with f = 50.0 Hz and $\mathscr{E}_m$ = 30.0 V was illustrated in **Figure Q4(a)**. Set R = 20 Ω, C = 80.0 μF, and L = 150 mH. Calculate

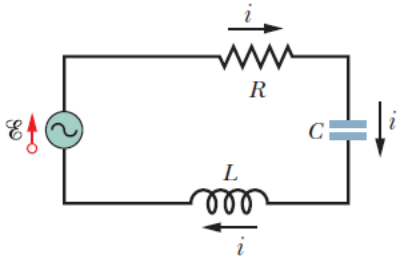

Figure Q4(a)

(i) the impedance, Z of the circuit, (4 marks)

(ii) the peak voltage across R, L and C, and (3 marks)

(iii) the phase angle. (2 marks)

(iv) Sketch a phasor diagram for the RLC circuit. (3 marks)

(b) Electric field component for an electromagnetic wave has an amplitude of 200 V/m. Calculate

(i) the amplitude of the magnetic field component, and (2 marks)

(ii) the average intensity of the wave. (2 marks)

(c) A light ray in water is incident on a flat surface of glass slab. In water, the light makes an angle of 42.0° with the glass surface. After the light ray hit the surface of the glass, some of the light refracts. The index of refraction for water and glass are 1.33 and 1.52 respectively. Determine

(i) the angle of reflection, and (1 mark)

(ii) the angle of refraction. (2 marks)

(d) A light of wavelength 600 nm is incident on a single slit and a diffraction pattern is formed on the wall. The wall is 100 cm away from the single slit and the distance between the first and third minima is 5 mm. Assuming the angle of diffraction is small, determine

(i) the slit width, and (4 marks)

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

~ The End ~