

End-Semester Test (AY21/22 S1)

EP0605 – Advanced Physics

Time Allowed: 1½ hour

Instructions to Candidates

Max Marks: 100

1. All the Singapore Polytechnic examination rules must be strictly adhered to.
2. This paper consists of **6** questions. You are allowed the handwritten A4 cheat sheet.
3. Answer all the questions in this question booklet. All working must be shown.
4. This paper consists of **8** pages (inclusive of the cover page).
5. Fill in your personal particulars below.

Name :			
Admission No :		S/No	
Class :	EL/EP0605/FT/01	Date :	

Question	Marks
1	
2	
3	
4	
5	
6	
Total	

1. An electric potential difference of 1000 V is applied to a pair of parallel plates that is separated by 1.00 cm. A particle of positive charge 9.60×10^{-19} C, initially at rest, is released from the positive plate. You can ignore the weight of the particle.
 - a) What is the magnitude of the uniform electric field between the plates?
 - b) If the mass of the particle is 2.16×10^{-15} kg, what is the kinetic energy of the particle as it reaches the other plate?
 - c) What is the speed of the particle as it reaches the other plate?

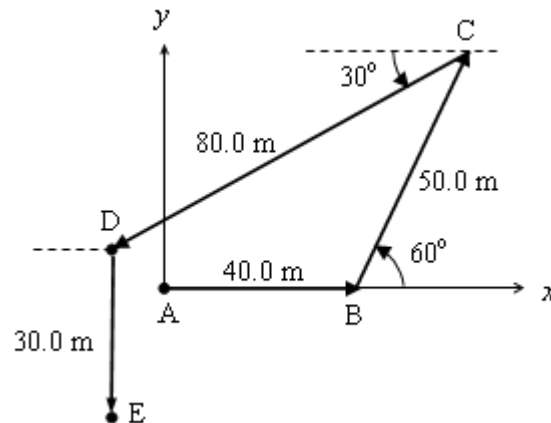
(17 marks)

2. A particle with charge $-2.00 \times 10^{-9} \text{ C}$ is moving in a uniform magnetic field $\mathbf{B} = (-1.50 \text{ T}) \mathbf{k}$. The magnetic force acting on the particle is found to be $\mathbf{F} = -(4.50 \times 10^{-7} \text{ N}) \mathbf{i} + (6.00 \times 10^{-7} \text{ N}) \mathbf{j}$.
- a) Calculate the x - and y - components of the particle's velocity.
 - b) Explain why the z - component of the particle's velocity cannot be determined.
 - c) If the x - y plane motion is circular, what is the radius of the circle? The mass of the particle is $1.00 \times 10^{-12} \text{ kg}$.

(17 marks)

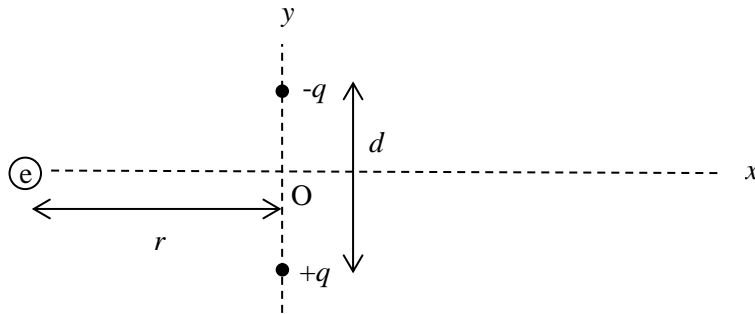
3. A person runs from point A to point E (via B, C and D) in 1.00 minute as shown in the figure.

- Write each of the 4 displacement vectors in terms of unit vectors \mathbf{i} and \mathbf{j} .
- What is the person's final displacement relative to A?
- What is the person's average speed?
- What is the magnitude and direction of the person's average velocity?



(17 marks)

4. The diagram shows a positive and a negative charge, each of magnitude $q = 1.0 \times 10^{-6}$ C. They are separated by a distance, $d = 0.20$ m along the y -axis. An electron, e , is initially at a distance $r = 1.0$ m from the origin O . The charge on an electron is -1.6×10^{-19} C while the Coulomb's constant is 8.99×10^9 N m²/C².

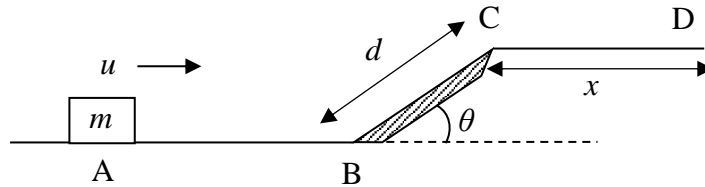


- What is the electric field due to the two charges at the location of the electron? State its magnitude and direction.
- What is the electric potential due to the two charges at the location of the electron? Explain your answer.

(17 marks)

5. A particle of mass 4.00 kg is subjected to a net force $F = (\alpha + \beta x^2)$ N that acts along the x -axis. The numerical value of α is -7.00 while that of β is 0.600 . The particle is initially at the origin, and moves at 4.00 m/s away from the origin along the negative x -axis.
- (a) What are the SI units of α and β ?
 - (b) What is the speed of the particle when it reaches $x = 8.00$ m?
 - (c) Is the force F conservative? Explain your answer with suitable calculations.
- (17 marks)

6. In the figure below, an object of mass m moves with a speed u on a flat frictionless surface AB. It then encounters an incline BC. The incline is rough where the coefficient of kinetic friction is μ_k . After the object reaches the top of the incline, it continues to move on a second flat frictionless surface CD. The length of BC is d and that of CD is x , the angle of inclination is θ and the acceleration due to gravity is g . The answers should be in terms of the variables given.



- Draw the free body diagram of the object when it is on the incline.
- What is the work done by the force of friction?
- What is the speed of the object at point D?

(15 marks)

