

Phys 205

Major 1446

2nd semester.

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خاص بالمشاركين فقط

Part 1 (8 Marks): 8 multiple choice questions, 1 mark each

Indicate the answer choice that best completes the statement or answers the question.

Q1. How does the force between two point charges change if the magnitude of each charge is doubled and the distance between them is halved?

- (a) It doubles.
- (b) It quadruples.
- (c) It increases by a factor of 16.
- (d) It stays the same.

Q2. Which of the following statements is **FALSE**?

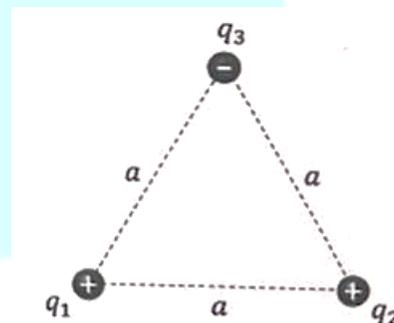
- (a) Electric field lines are always perpendicular to equipotential surfaces.
- (b) When an electron is moved along an equipotential surface, the work done by the electric field is zero.
- (c) The electric field inside a charged conductor in electrostatic equilibrium is zero.
- (d) The net electric field inside a neutral (zero net charge) insulator placed in an external electric field is always zero.

Q3. Which of the following statements is **CORRECT**?

- (a) Charging by induction requires direct contact between the charging rod and the object.
- (b) An object becomes positively charged when it loses electrons.
- (c) The electric potential increases in the direction of the electric field.
- (d) Electric field lines start at negative charges or infinity.

Q4. Three charges $q_1 = q_2 = 2\text{nC}$ and $q_3 = -3\text{nC}$ are placed on an equilateral triangle of side length $a = 3\text{ m}$, as shown. What is the total potential energy U of the charge q_3 ?

- (a) -18 nJ
- (b) -36 nJ
- (c) -9 nJ
- (d) zero



Q5. The electric field inside a parallel-plate capacitor is equal to 500 N/C and the potential difference between the plates is 1.5 V . What is the separation d between the plates?

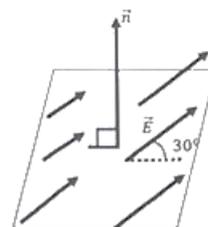
- (a) 3.0 mm
- (b) 7.5 mm
- (c) 1.5 mm
- (d) 5.0 mm

Q6. A capacitor stores $6 \mu\text{J}$ of energy when connected to a 2 V battery. To increase the energy stored in the same capacitor to $24 \mu\text{J}$, it should be connected to a:

- (a) 8 V battery
- (b) 2.8 V battery
- (c) 4 V battery
- (d) 1 V battery

Q7. A square sheet with a side length of 5 cm is placed in a uniform electric field of $E = 150 \text{ N/C}$ such that the angle between the electric field and the plane of the sheet is 30° , as shown in the figure. What is the electric flux through the sheet?

- (a) $3.8 \text{ N m}^2/\text{C}$
- (b) $0.33 \text{ N m}^2/\text{C}$
- (c) $4.5 \text{ N m}^2/\text{C}$
- (d) $0.19 \text{ N m}^2/\text{C}$



Q8. A parallel-plate capacitor is constructed using two aluminum-foil sheets, each is 0.063 m wide and 5.4 m long. The space between the sheets is filled with a 0.035 mm thick Teflon layer. Given the dielectric constant of Teflon is $k = 2.1$, what is the capacitance of this capacitor?

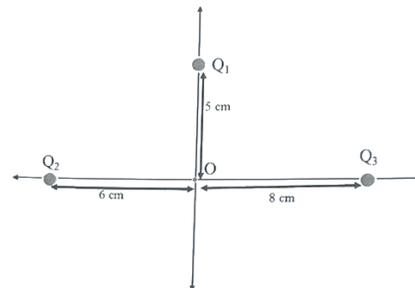
- (a) $0.18 \times 10^{-6} \text{ F}$
- (b) $0.18 \times 10^{-7} \text{ F}$
- (c) $0.18 \times 10^{-9} \text{ F}$
- (d) $0.25 \times 10^{-6} \text{ F}$

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Part 2 (12 marks)

Solve the following three problems in the provided space and show your detailed solution, including the used formulas and units.

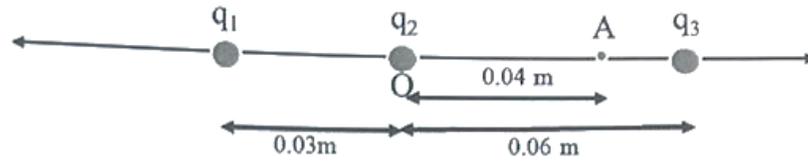
Q1. (6 marks) Three point charges $Q_1 = +10 \text{ nC}$, $Q_2 = +8 \text{ nC}$ and $Q_3 = -6 \text{ nC}$ are positioned in the xy -plane, as shown below.



- a) (5 marks) Draw the electric field vector due to each charge at the origin O . Determine the magnitude and direction of the net **electric field** \vec{E} at the origin O .
- b) (1 mark) A fourth point charge, $Q_4 = +10 \text{ nC}$, is placed at point O . Find the net force on this charge (magnitude and direction).

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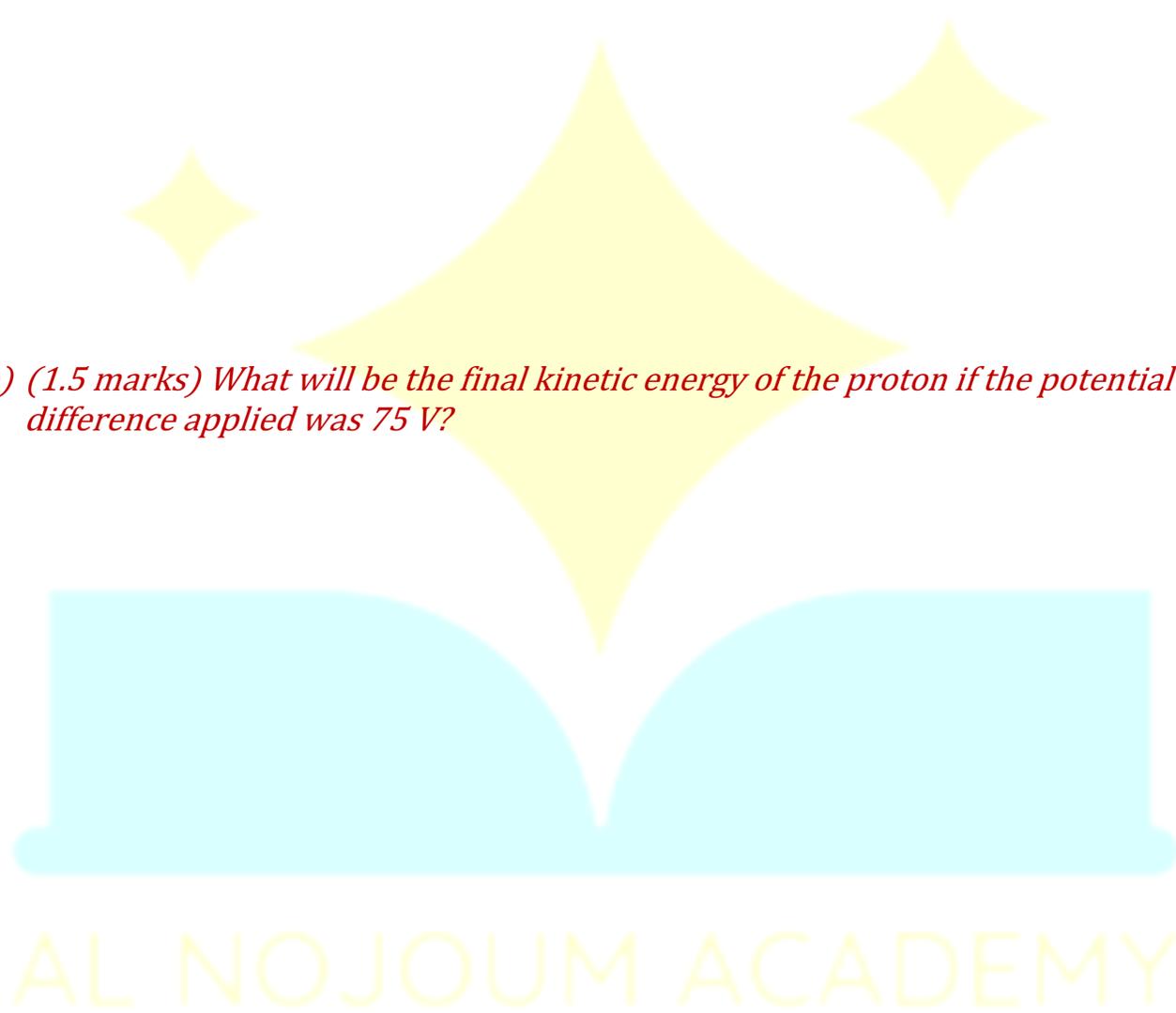
Q2. (3 marks) Three-point charges, $q_1 = 2.0 \mu\text{C}$, $q_2 = -0.5 \mu\text{C}$, and $q_3 = -1.0 \mu\text{C}$ are located along the x-axis as shown below. Find the net **electric potential** V at point A?



Q3. (3 marks) A proton enters an electric field with an initial speed of $1.50 \times 10^5 \text{ m/s}$. Assume that the only force that acts on the proton is due to the field.

a) (1.5 marks) What potential difference is required to bring the proton to a stop?

b) (1.5 marks) What will be the final kinetic energy of the proton if the potential difference applied was 75 V?

The logo for Al Nojoum Academy features a large, stylized yellow starburst shape in the center. Below it is a light blue silhouette of an open book. The text "AL NOJOUM ACADEMY" is written in a light yellow, sans-serif font across the bottom of the logo area.

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