أسئلة مراجعة نهاية الفصل وفق الهيكل الوزاري الخطة 102A-M

إعداد: عبد الرحمن عصام

اينشتاين

EOT 12ADV — M.102-A

مع خالص الدعاء بالتوفيق والنجاح

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Academic Year	2024/2025
Term	1
Subject	Physics M 102 A
Grade	12
Stream	Advanced
Number of Electronic Questions (Swift Assess)	15
Mark per Question	4
Number of Free Respones Questions (Paper Part)	4
Mark per Question	10
Type of All Questions	Electronic Questions & Free Response Questions
Maximum Overall Grade	100
Exam Duration	150 minutes
Mode of Implementation	Swift Assess & Paper Part
Calculator	Allowed

Question*		Learning Outcome Or KPI's**	Reference(s) in the Student Book (Arabic / English Version) المرجع في كتاب الطالب (النسخة العربية / الإنجليزية) Example/Exercise	Page
1		Apply Coulomb's law to relate the magnitude of the electrostatic force, the charge magnitudes of the pair if interacting particles, and the separation between themors	EXAMPLE 1.2 EXAMPLE 1.3 SOLVED PROBLEM 1.1 EXERCISES 1.83 & 1.84 p: 25	10, 11, 12,13,& 14
2 3		Solve problems involving general charge disribution and the electric field Develop a tool, sketches, descriptive text or presentation to show the morphology of electric field lines of a single or multiple charge system with positive and/or negative charges Define the electric field vector at a point in space as the quotient of the electrostatic force vector acting on a positive test charge at this point divided by the test charge	As mentioned in the book SOLVED PROBLEM 2.2	28, 29 & 30 34, 35 & 36
4 5		Find for a uniform distribution of charge, the linear charge density X for chargealong a line, the surface charge density o for charge on a surface, and the volume Define the electric field vector at a point in space as the quotient of the electrostatic force vector acting on a positive test charge at this point divided by the test charge	As mentioned in the book SOLVED PROBLEM 2.2	28, 29 & 30 34, 35 & 36 53
6 7		Apply the relationship between the electric field E and the electric force F and the charge q	As mentioned in the book MULTIPLE-CHOICE QUESTIONS 2.5	28, 29 & 30 34, 35 & 36 53
8		Apply the relationship between the electric field E and the electric force F and the charge q	As mentioned in the book SOLVED PROBLEM 2.2	37, 38 & 39
9 10		Solve problems on electric flux Define the electric flux through a surface as the dot product between the electric field vector and the area vector at each point of that surface and expresses that in an equation Prove that the electric flux through a closed surface is given by the net charge inside the surface divided by the permittivity of the medium, and write the Gauss's law inits integral form	FIGURE 2.22 FIGURE 2.23	42, 43 &44
11		Apply the relationship between the charge density and the electric field magnitude E and also specify the direction of the field for points near a flat thin, infinite or large, nonconducting/conducting surface with a uniform charge density	As mentioned in the book	47, 48 & 49
12		Solve problems involving electric potential energy	As mentioned in the book FIGURE 3.2	60 & 61
13		Develop a method such as schematic representations to compare the equipotential surfaces due to a point charge, two identical charges, and two different charges	FIGURE 3.17 FIGURE 3.18 FIGURE 3.19	67, 68 & 69
14		Relate the component of the electric field along a certain direction Es to the change in the electric potential along that direction (Es =-dV/ds) and use this relation to solve problems	Concept Check 3.7	77
15		Calculate the potential energy of a system of pair of charged particles	FIGURE 3.30	79 & 80

Important note: Please pay attention to specifying the units of measurement when solving problems, as grades will be calculated based on the units. Drawing relationships between variables, identifying and drawing the best fit line connecting the points, and finding values from the graph.

Q1	A B	Develop a tool, equation or sketch, to obtain the resultant electric force exerted on a point charge by a nearby system of charges using the superposition principle	EXERCISES 1.82 p: 25	10, 11, & 12
Q2	A B	Develop a tool, equation or sketch, to obtain the resultant electric field strength at a point generated by a nearby system of point charges using the superposition principle Solve problems related to the electric field due to several point charges	As mentioned in the book	30 & 31
Q3	A	Define the electric flux through a surface as the dot product between the electric field vector and the area vector at each point of that surface and expresses that in an equation (Solve problems on electric flux)	EXAMPLE 2.5	43
	B	Prove that the electric flux through a closed surface is given by the net charge inside the surface divided by the permittivity of the medium, and write the Gauss's law in its integral form (Apply Gauss' law to relate the net flux through a closed surface (real or imaginary) to the net charge enclosed by the surface)	As mentioned in the book	44, 45 & 46
Q4	A B	Develop a mathematical equation to describe the electric potential of a point charge or many point charges or distributions of different charges	As mentioned in the book FIGURE 3.21	70 & 71 79 & 80

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1 Apply Coulomb's law to relate the magnitude of the electrostatic force, the charge magnitudes of the pair if interacting particles, and the separation between themors

1. **Electrostatic Force inside the Atom**

What is the magnitude of the electrostatic force that the two protons inside the nucleus of a helium atom exert on each other?

Where $r = 2 \times 10^{-15}\ m$ separates the two protons.

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What is the magnitude of the electrostatic force between a gold nucleus and an electron of the gold atom in an orbit with radius $4.88 \times 10^{-12}\ m$?

Where

the charge of the electron is $qe = -e$

the charge of the gold nucleus is qNucleus $= +79e$

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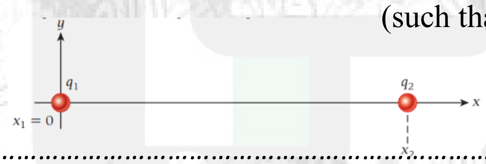
2. **Equilibrium Position**

Two charged particles are placed as shown in Figure $q1 = 0.15\ \mu C$ is located at the origin, and $q2 = 0.35\ \mu C$ is located on the positive x-axis at $x2 = 0.40\ m$.

Where should a third charged particle, $q3$, be placed to be at an equilibrium point?

(such that the forces on it sum to zero)



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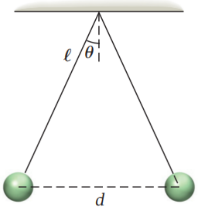
3. **Charged Balls**

Two identical charged balls hang from the ceiling by insulated ropes of equal length, $\ell = 1.50$m. A charge $q = 25.0$ μC is applied to each ball. Then the two balls hang at rest, and each supporting rope has an angle of 25.0° with respect to the vertical.
What is the mass of each ball?



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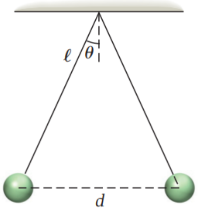
Two balls have the same mass, 0.9680 kg, and the same charge, 29.59 μC.
They hang from the ceiling on strings of identical length, ℓ, as shown in the figure.
If the angle of the strings with respect to the vertical is 29.79°,
What is the length of the strings?



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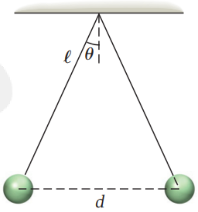
Two balls have the same mass and the same charge, 15.71 μC.
They hang from the ceiling on strings of identical length, ℓ = 1.223 m,
As shown in the figure. The angle of the strings with respect to the vertical is 21.07°.
What is the mass of each ball?



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Evaluate the magnitude of the electrostatic force exchanged between the two charges q1 = +30 μC and q2 = -40 μC separated by a distance of 9.0 cm

ⓐ 1.3×10^3 N ⓑ 3×10^3 N ⓒ 3×10^4 N ⓓ 1.8×10^3 N

The force between a charge of 25 μC and a charge of -10 μC is 8.0 N.
What is the separation between the two charges?

ⓐ 0.28 m ⓑ 0.53 m ⓒ 0.45 m ⓓ 0.15 m

Two-point charges (q1=+ q) and (q2=- 3q) the distance between them is (25 cm), if the electrostatic force between the two charges is (0.65 N) What is the value of second charge?

ⓐ 1.2 $\mathbf{nC}$ ⓑ 1.2 $\mathbf{\mu C}$ ⓒ 3.6 $\mathbf{\mu C}$ ⓓ 3.6$\mathbf{nC}$

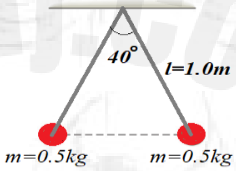
Two-point charges (+ **q**) and (- **q**) have the same magnitude and the distance between them is (12 cm), if the electrostatic force between the two charges is (6.0 N) What is the value of each charge?

ⓐ 8.9 nC ⓑ 3.1 μC ⓒ 8.9 μC ⓓ 3.1 nC

Two-point charges (+ **q**) and (- **q**) have the same magnitude and the distance between them is (9.0 cm), if the electrostatic force between the two charges is (5.0 N) What is the value of each charge?

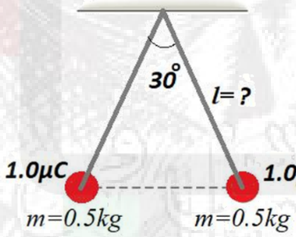
ⓐ 2.1 nC ⓑ 2.1 μC ⓒ 7.1 nC ⓓ 7.1 μC

The figure shows two identical positively charged balls hanging from the ceiling by insulated massless ropes of equal length l. What is the charge on each ball?
(g=9.81 m/s^2)



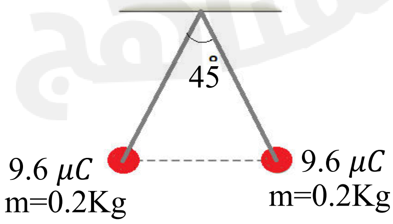
ⓐ 9.1 μC
ⓑ 9.6 μC
ⓒ $9.3\times10^{-11}\mu C$
ⓓ 9.3 μC

The figure shows two identical positively charged balls hanging from the ceiling by insulated massless ropes of equal length l. What is the length l?
(g=9.81 m/s^{-2})



ⓐ 8.28cm
ⓑ 4.28cm
ⓒ 15.98cm
ⓓ 0.68m

Two identical positively charged balls hanging at rest from the ceiling by insulated massless ropes of equal length as shown in the figure. What is the distance between the two charges?



ⓐ 3.0m
ⓑ 1.5m
ⓒ 0.5m
ⓓ 1.0m

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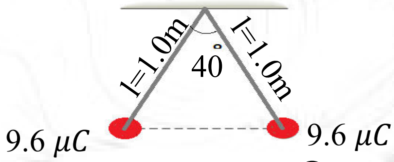
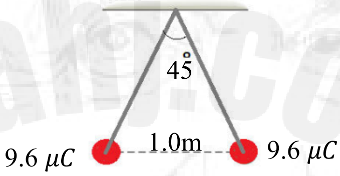
Two identical positively charged balls hanging at rest from the ceiling by insulated massless ropes of equal length as shown in the figure. What is the mass for each ball?
($g=9.81\ m/s^{-2}$)



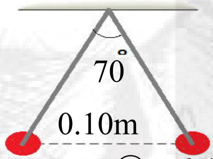
ⓐ 0.2kg
ⓑ 0.5kg
ⓒ 0.6kg
ⓓ 1.0kg

Two identical positively charged balls hanging at rest from the ceiling by insulated massless ropes of equal length as shown in the figure. What is the mass for each ball?
($g=9.81\ m/s^{-2}$)



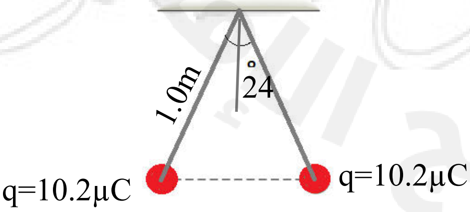
ⓐ 0.2kg
ⓑ 0.5kg
ⓒ 0.6kg
ⓓ 1.0kg

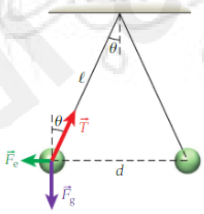
In the figure, the balls were given the same amount of charge, they repel and become to equilibrium as shown, the weight of each ball is 1.20 *N*, if r = 0.10 m. What is the magnitude of the charge on each of them



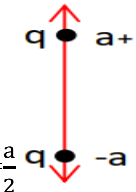
ⓐ 1.0 μ C
ⓑ 1.2×10^{-6} C
ⓒ 6.4×10^{-7} C
ⓓ 0.72 μ C

Two identical charged balls hang from the ceiling by insulated ropes of equal length, ℓ=0.8m.
A charge q=10.2μC is applied to each ball. Then the two balls hang at rest, and each supporting rope has an angle of 24.0° with respect to the vertical What is the mass of each ball?





ⓐ 0.51 kg
ⓑ 0.57 kg
ⓒ 0.67 kg
ⓓ 0.77 kg



Two positive charges each of magnitude q are positioned on (y=+a and y=-a) as shown where should we put a third charge Q on the y-axis such that the net force on the charge Q is zero.

ⓐ y=0 ⓑ y=-2a ⓒ y=+2a ⓓ $y=\frac{a}{2}$

The figure shows two points charges, where can the electrostatic force be absent?

ⓐ 1 ⓑ 2 ⓒ 3 ⓓ 4

The figure shows two points charges, where can the electrostatic force be absent?

ⓐ 1 ⓑ 2 ⓒ 3 ⓓ 4

A charge Q1 is positioned on the x-axis at $x = a$. Where should a charge Q2 = -4Q1 be placed to produce a net electrostatic force of zero on a third charge, Q3 = Q1, located at the origin?

ⓐ at x = -a ⓑ at x = -2a ⓒ at x = 2a ⓓ at the origin

A charge Q1 = Q is positioned on the x axis at x = a. Where should a charge Q2 = 9Q be placed to produce a net electric force of zero on charge placed at the origin

ⓐ at x = -3a ⓑ at x = -2a ⓒ at x = 2a ⓓ at x = 3a

A point charge +3q is located at the origin, and a point charge -q is located on the x-axis at D= 0.500 m. At what location on the x-axis will a third charge, q., experience no net force from the other two charges?

ⓐ 0.68m ⓑ 1.28m ⓒ 1.18m ⓓ 0.500m

Two-point charges are fixed on the x-axis: q1 = 6.0 μC is located at the origin, O, with x1 = 0.0 cm, and q2 = -3.0 μC is located at point A, with x2 = 8.0 cm. Where should a third charge, q3, be placed on the x-axis so that the total electrostatic force acting on it is zero?

ⓐ 19 cm ⓑ 8.0 cm ⓒ 0.0 cm ⓓ 27 cm

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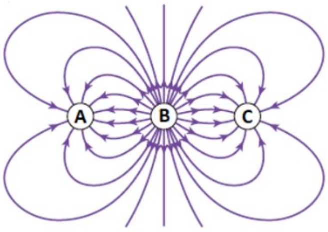
2 Develop a tool, sketches, descriptive text or presentation to show the morphology of electric field lines of a single or multiple charge system with positive or negative charges

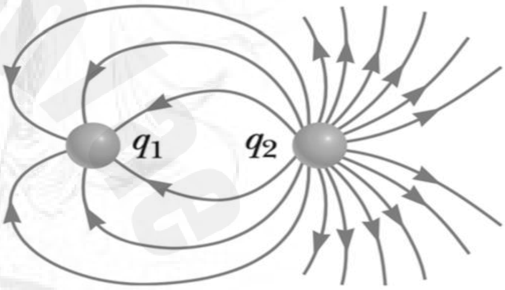
The spatial distribution of the electric field due to charges (1,2,3) is shown in the figure below Which of the parameters regarding the charges are correct?

	Positive Charge	Negative Charge	Magnitude of charges
ⓐ	A, C	B	A >B > C
ⓑ	B	A, C	B > A= C
ⓒ	B	A, C	B > A > C
ⓓ	A, B, C	None	B> A = C



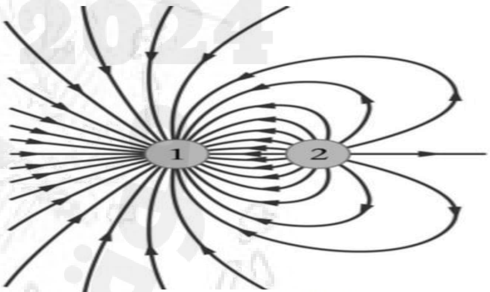
The spatial distribution of the electric field due to charges q_1 and q_2 is shown in the figure below.

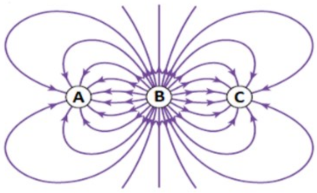
	Charge $q1$	Charge $q2$	Magnitude
ⓐ	positive	negative	$q1 > q2$
ⓑ	positive	negative	$q2 > q1$
ⓒ	negative	positive	$q1 > q2$
ⓓ	negative	positive	$q2 > q1$



The electric field lines for a system of two charges is shown below.
Which of the following could be the correct charges 1 and 2?

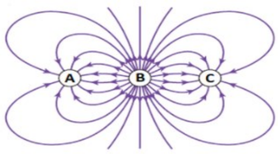
	Charge $q1$	Charge $q2$
ⓐ	$+32\ \mu C$	$-16\ \mu C$
ⓑ	$-32\ \mu C$	$+16\ \mu C$
ⓒ	$-16\ \mu C$	$+32\ \mu C$
ⓓ	$-32\ \mu C$	$-32\ \mu C$





The figure shows three charges placed at three points A, B and C
Which of the following statements is correct about the charge (q) of A , B and C ?

ⓐ $qA = qB$ ⓑ $qA = qc$ ⓒ $qA = qB = qc$ ⓓ $qA = -qc$



The figure shows three charges placed at three points A, B and C.
Which of the following statements is incorrect about the charge?

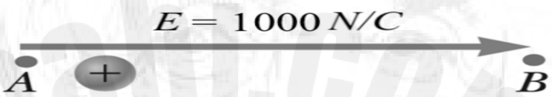
ⓐ $qA = qC$ ⓑ $qB > -qc$ ⓒ $qB > -qA$ ⓓ $qA = -qc$

3 Define the electric field vector at a point in space as the quotient of the electrostatic force vector acting on a positive test charge at this point divided by the test charge

Negative charge-2 ×10 $^{-7}$ C is located in an electric field of 20 N/C directed toward the East. What is the electric force acting on the charge?

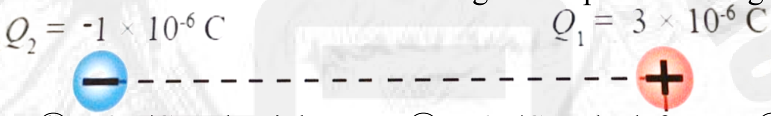
ⓐ 4.0×10^{-6} N East ⓑ 1.0×10^{-8} N East ⓒ 4.0×10^{-6} N West ⓓ 1.0×10^{-8} N West

A uniform electric field of magnitude 1000 N/C is directed to the right from A to B. What would be the magnitude and direction of the electric force on a positive charge +20 nC located close to point A?



ⓐ 2.0×10^{-5} N A to B ⓑ 2.0×10^{-5} N B to A ⓒ 2.0×10^{-11} N A to B ⓓ 2.0×10^{-11} N B to A

The figure shows two-point charges. if the electrostatic force attraction between them is 6μN. What is the magnitude and direction of the electric field acting on the positive charge?



ⓐ 2N/C to the left ⓑ 2N/C to the right ⓒ 6N/C to the left ⓓ 6N/C to the right

Which of the following represents force?

ⓐ Eq ⓑ $\frac{E}{q}$ ⓒ $\frac{q}{E}$ ⓓ q^2E

4 Solve problems involving general charge distribution and the electric field Find for a uniform distribution of charge, the linear charge density X for charge along a line, the surface charge density o for charge on a surface, and the volume

What is the unit of measuring the Linear charge density(λ) on a thin metallic sheet?

ⓐ c/s ⓑ c/m ⓒ c/m^2 ⓓ c/m^3

What is the unit of measuring the surface charge density (σ) on a thin metallic sheet

ⓐ c/s ⓑ c/m ⓒ c/m^2 ⓓ c/m^3

What is the unit of measuring the Volume charge density (ρ) on a thin metallic sheet?

ⓐ c/s ⓑ c/m ⓒ c/m^2 ⓓ c/m^3

What does x represent in the equation $dq = X\, d\, V$ for a charge distribution over all the parts of an insulating sphere? And what is the unit of x?

ⓐ $surface\ charge\ density\ C/m^2$ ⓒ $linear\ charge\ density\ C/m$
ⓑ $volume\ charge\ density\ C/m^3$ ⓓ $infinity\ charge\ density\ C/m^4$

If the charge is distributed over a One- dimensional object. What is the unit of charge density of this object?

ⓐ c/s ⓑ c/m ⓒ c/m^2 ⓓ c/m^3

If the charge is distributed over a two- dimensional object. What is the unit of charge density of this object?

ⓐ c/s ⓑ c/m ⓒ c/m^2 ⓓ c/m^3

If the charge is distributed over a three- dimensional object. What is the unit of charge density of this object?

ⓐ c/s ⓑ c/m ⓒ c/m^2 ⓓ c/m^3

A long wire carries a charge 12.0 $\mu C/m$, what is the charge of 0.333 m of it?

ⓐ 1.2 μC ⓑ 36 μC ⓒ 1.8 μC ⓓ 4.0 μC

A conducting sphere has a charge 23.5 nC, if its radius is 25 cm, what its charge surface density?

Hint: Area of sphere ($A = 4\pi r^2$)

ⓐ 3×10^{-8} C/m^2 ⓑ 6.0×10^{-6} C/m^2 ⓒ 1.2×10^{-6} C/m^2 ⓓ 4500 C/m^2

A large, flat, horizontal sheet of charge has a charge per unit area of $\sigma = 25.0\ \mu C/m^2$.
What is the total charge of the 0.02 cm^2 sheet?

ⓐ 0.5 μC ⓑ 2.6 μC ⓒ 25 pC ⓓ 50pC

A 2D disk with a radius of 12 cm has a uniform charge density of 14 C/m^2 .
What is the amount of charge distributed over the surface of this disk?
(Hint: Area of $disk\ A = \pi r^2$)

ⓐ 0.63 C ⓑ 0.49 C ⓒ 0.12 C ⓓ 0.35 C

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A plastic disk with a diameter of 20 cm is charged uniformly with 10^{14} electrons.
What is its surface charge density
(Hint: Area of $disk\ A = \pi r^2$)

ⓐ $5.1 \times 10^{-6} C/m^2$ ⓑ $1.3\times 10^{-4} C/m^2$ ⓒ $2.5\times 10^{-4} C/m^2$ ⓓ $5.1\times 10^{-4} C/m^2$

Two long, uniformly charged rods are placed parallel to each other. Rod A has a total charge of 10 μC and a length of 5.0 m. Rod B has a total charge of 15 μC and a length of 3.0 m.
What is the ratio of the linear charge densityλ A of rod A to the linear charge density λ B of rod B?

ⓐ 3/4 ⓑ 1/4 ⓒ 4/5 ⓓ 2/5

A large plastic disc with a radius r is charged uniformly with 4.5×10^{18} electrons. If the surface charge density of this disc is 0.11 C/ m^2, what is the radius of this disc?

ⓐ 1.4 m ⓑ 4.1 m ⓒ 0.14 m ⓓ 0.41 m

Given a linear charge density ($\lambda = 5.0x^2$) from (x=0.0m) to (x=4.0m).
Find the electric charge between (x=0.0m, x=4.0m)

ⓐ 106.6 C ⓑ 40 C ⓒ 0 C ⓓ 853.3C

What does x represent in the formula $Ey = \frac{2kX}{y}$ of an **infinitely long** wire and what is its unit?

ⓐ $surface\ charge\ density\ C/m^2$
ⓑ $volume\ charge\ density\ C/m^3$
ⓒ $linear\ charge\ density\ C/m$
ⓓ $infinity\ charge\ density\ C/m^4$

5 Apply the relationship between the electric field E and the electric force F and the charge q

Force due to an Electric Field
An electron with a kinetic energy of 2.00 keV is fired horizontally across a horizontally oriented charged conducting plate with a surface charge density of $+4.00x10^{-6}\ C/m^2$.
Taking the positive direction to be upward (away from the plate),
What is the vertical deflection of the electron after it has traveled a horizontal distance of 4.00 cm?
Where ($1\ eV = 1.602x10^{-19}\ J$)

$$y_f - y_0 = -\frac{e\sigma x_f^2}{2m\varepsilon_0 v_0^2} = -\frac{e\sigma x_f^2}{4\varepsilon_0 K}$$ ....
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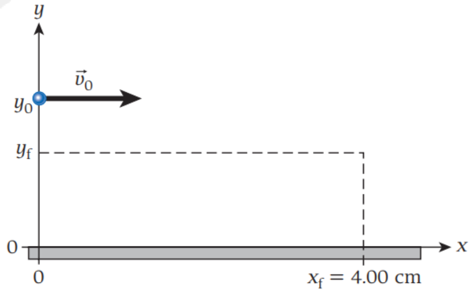
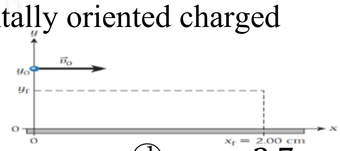


A proton is placed in the uniform electric field of magnitude $E = 0.25\ N/C$. Find the acceleration of the proton (in m/s^2). Hint: Proton mass is $1.67 \times 10^{-27} kg$ and proton charge is $1.6 \times 10^{-19}\ C$.

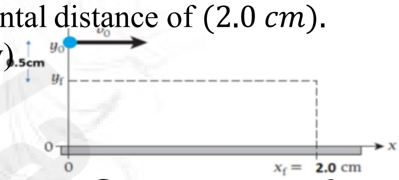
ⓐ 2.5×10^{7} ⓑ 5.0×10^{8} ⓒ 6.0×10^{7} ⓓ 9.0×10^{-7}

An electron with velocity $1.55 \times 10^3 m/s$ is fired horizontally across a horizontally oriented charged conducting plate with a surface charge density of $+3.0 \times 10^{-15}\ C/m^2$.
What is the magnitude of vertical deflection of the electron?



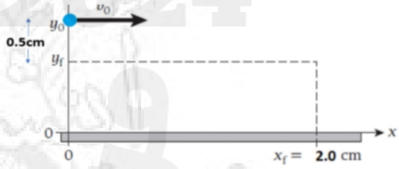
ⓐ $4.9 \times 10^{-3} m$ ⓑ $0.5cm$ ⓒ $2.7 \times 10^{-6} m$ ⓓ $2.7cm$

As shown in the figure an electron is fired horizontally towards the positive x direction over a horizontally oriented charged conducting plate with a surface charge density of $(+3.0 \times 10^{-15}\ C/m^2)$.
If the vertical deflection of the electron is $(0.5cm)$ after it has traveled a horizontal distance of $(2.0\ cm)$.
What is the kinetic energy of the electron when is fired? (Neglect Earth gravity)



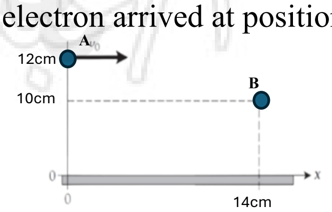
ⓐ $1.08 \times 10^{-24} J$ ⓑ $5.42 \times 10^{-24} J$ ⓒ $2.38 \times 10^{6} J$ ⓓ $1.54 \times 10^{3} J$

As shown in the figure an electron is fired horizontally towards the positive x direction over a horizontally oriented charged conducting plate with a surface charge density of $(+3.0 \times 10^{-15}\ C/m^2)$. If the vertical deflection of the electron is (0.5cm) after it has traveled a horizontal distance of (2.0 cm).
What is the velocity of the electron when is fired?



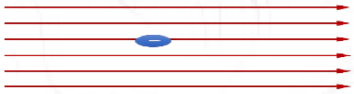
ⓐ $2.4 \times 10^{6} m/s$ ⓑ $1.6 \times 10^{3} m/s$ ⓒ $1.3 \times 10^{5} m/s$ ⓓ $1.2 \times 10^{3} m/s$

According to the figure showing an electron fired with an initial velocity Vo from point A above a horizontally charged plate with a surface charge density of $3.2\ \mu C/m^2$, the electron arrived at position (B).
What is the magnitude of Vo at point A



ⓐ $3.1 \times 10^{16} m/s$ ⓑ $3.5 \times 10^{7} m/s$ ⓒ $3.0 \times 10^{8} m/s$ ⓓ $1.8 \times 10^{8} m/s$

In the figure, a small negatively charged object is placed at rest in a uniform electric field. Which of the following statements describes the motion of the object when it is released? Neglect the mass



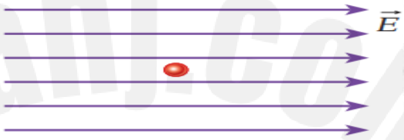
ⓐ *begin to move with a constant acceleration towards the right*

ⓑ *begin to move with a constant speed towards the left*

ⓒ *begin to move with an increasing acceleration towards the left.*

ⓓ *begin to move with a constant acceleration towards the left*

In the figure, a small positively charged object is placed at rest in a uniform electric field. Which of the following statements describes the motion of the object when it is released? Neglect the mass



ⓐ *begin to move with a constant acceleration towards the right*

ⓑ *begin to move with a constant speed towards the left*

ⓒ *begin to move with an increasing acceleration towards the left.*

ⓓ *begin to move with a constant acceleration towards the left*

6 Apply the relationship between the electric field E and the electric force F and the charge q

The diagram shows a particle with positive charge Q and a particle with negative charge –Q. The electric field at point P on the perpendicular bisector of the line joining them is ....

ⓐ ↑ ⓑ ↓ ⓒ ← ⓓ →

The diagram shows two particles with positive charge +Q. The electric field at point P on the perpendicular bisector of the line joining them is …………

ⓐ ↑ ⓑ ↓ ⓒ ← ⓓ →

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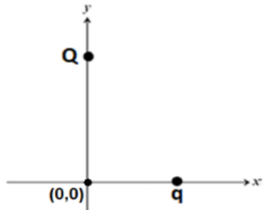
Consider two-point charges $q1 = +4.0\mu C$ and $q2 = -8.0\mu C$, separated by a distance of 4.0 m.
Find the magnitude of the electric field (in N/C) midway between the two-point charges

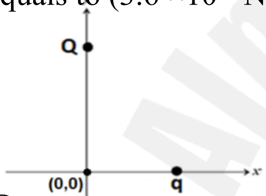
ⓐ 2.7×10^4 ⓑ 72×10^4 ⓒ 9.0×10^3 ⓓ 1.8×10^4

According to the figure, two charges (Q= -3.0μC) and (q = +2.0μC), the electric force between them equals to 7.3×10^{-4} N and the distance between them is (8.6m), if q is placed at (5m,0m).
What is the electric field at the point (0,0)?



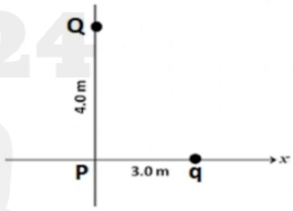
ⓐ 1271.0N/C ⓑ 905.0N/C ⓒ -551.0N/C ⓓ 720.0.2N/C

According to the figure, two charges ($Q = +8.0\ \mu C$) and ($q\ - 5.0\mu C$), the electric force between them equals to (3.6×10^{-1} N), if Q is placed at ($0\ m, 0.8m$). What is the electric field at the point (0,0)?

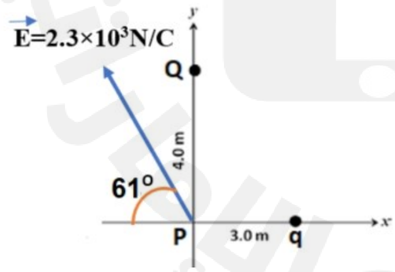


ⓐ 1.68×10^5 N/C ⓑ 1.12×10^5 N/C ⓒ 1.25×10^5 N/C ⓓ 2.82×10^{10} N/C

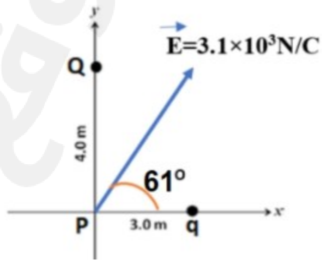
1. According to the figure, if ($Q = -2\ 0\ \mu C$) and ($q = +2\ 0\ \mu C$),
what is the electric field at the point $P(0,0)$



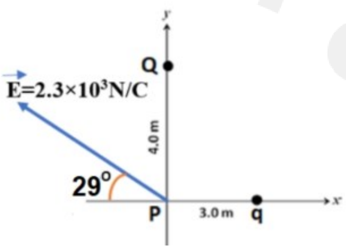
ⓐ



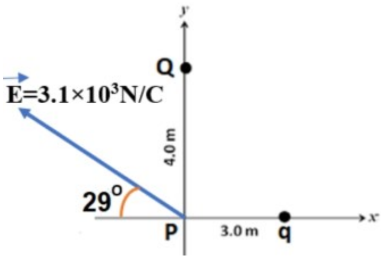
ⓑ



ⓒ



ⓓ



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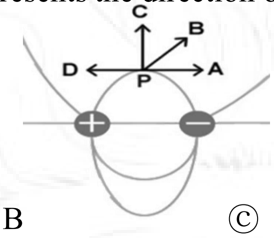
The figure shows the electric field pattern around two charges of equal magnitudes and opposite signs.
Which of the labeled arrows correctly represents the direction of the electric field vector at point P?

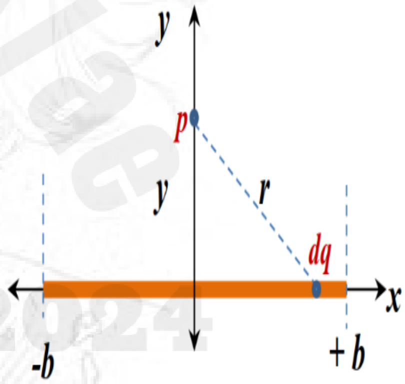


ⓐ A ⓑ B ⓒ C ⓓ D

7 Apply the relationship between the electric field E and the electric force F and the charge q

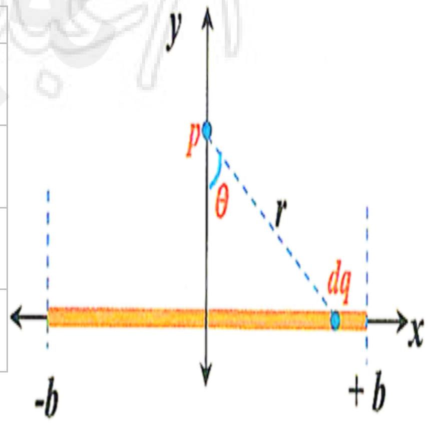
In the figure, a straight wire is located along the x-axis between points (-b and + b) and carries a charge with linear charge density (**λ**), assume that the wire is positioned with its midpoint at **x = 0**.
Which of the following is correct for the magnitude of the electric field, at point ***p*** located on the y-axis?

	Ey	Ex
ⓐ	$k\lambda y\int_0^b \frac{dx}{(x^2+y^2)^{\frac{3}{2}}}$	0
ⓑ	0	$2k\lambda y\int_0^b \frac{dx}{(x^2+y^2)^{\frac{3}{2}}}$
ⓒ	$k\lambda y\int_0^b \frac{dx}{(x^2+y^2)^{\frac{3}{2}}}$	$k\lambda y\int_0^b \frac{dx}{(x^2+y^2)^{\frac{3}{2}}}$
ⓓ	$2k\lambda y\int_0^b \frac{dx}{(x^2+y^2)^{\frac{3}{2}}}$	0



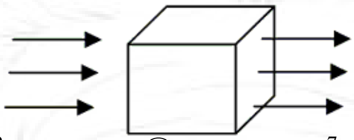
In the figure, a straight wire is located along the x-axis between points (-b and + b) and carries a charge with linear charge density (**λ**), assume that the wire is positioned with its midpoint at **x = 0**.
Which of the following is correct for the magnitude of the electric field, at point ***p*** located on the y-axis?

	Ey	Ex
ⓐ	$k\lambda y\int_0^b \frac{dq}{r^2}\cos\theta$	0
ⓑ	0	$2k\lambda y\int_0^b \frac{dq}{r^2}\cos\theta$
ⓒ	$k\lambda y\int_0^b \frac{dq}{r^2}\sin\theta$	$k\lambda y\int_0^b \frac{dq}{r^2}\cos\theta$
ⓓ	$2k\lambda y\int_0^b \frac{dq}{r^2}\sin\theta$	0



9 Solve problems on electric flux Define the electric flux through a surface as the dot product between the electric field vector and the area vector at each point of that surface and expresses that in an equation

A cubical Gaussian surface is placed in a uniform electric field as shown in the figure. The length of each edge of the cube is 1.0 m. The uniform electric field has a magnitude of $5.0 \times 10^8\ N/C$ and passes through the left and right sides of the cube perpendicular to the surface. What is the total electric flux that passes through the cubical Gaussian surface?



ⓐ zero ⓑ $3.0 \times 10^9\ Nm^2/C$ ⓒ $1.5 \times 10^7\ Nm^2/C$ ⓓ $2.5 \times 10^6\ Nm^2/C$

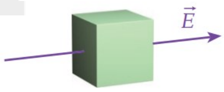
A flat surface of area $3.20\ m^2$ is rotated in a uniform electric field of magnitude $E = 6.20 \times 10^2\ N/C$. Determine the electric flux through this area when the electric field is perpendicular to the surface

ⓐ $0\ Nm^2/C$ ⓑ $1.98 \times 10^6\ Nm^2/C$ ⓒ $1.40 \times 10^6\ Nm^2/C$ ⓓ $6.19 \times 10^5\ Nm^2/C$

A flat surface of area $3.20\ m^2$ is rotated in a uniform electric field of magnitude $E = 6.20 \times 10^2\ N/C$. Determine the electric flux through this area when the electric field is parallel to the surface

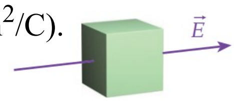
ⓐ $0\ Nm^2/C$ ⓑ $1.98 \times 10^6\ Nm^2/C$ ⓒ $1.40 \times 10^6\ Nm^2/C$ ⓓ $6.19 \times 10^5\ Nm^2/C$

According to the figure, a cube that has ($5.0cm$) side length in a uniform electric field ($E = 200N/C$), that is perpendicular to the plane of one face of the cube.
What Is the magnitude of electric flux passing through the black face?



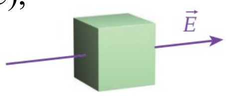
ⓐ $0\ Nm^2/C$ ⓑ $1.0Nm^2/C$ ⓒ $1.5\ Nm^2/C$ ⓓ $0.5\ Nm^2/C$

According to the figure, a uniform electric field ($E = 360N/C$), that is perpendicular to the plane of one face of the cube. if the electric flux passing through the left shaded face is equal to ($-1.2Nm^2/C$).
What is the cube side length?



ⓐ 0.058m ⓑ 3.3×10^{-3} m ⓒ 17.3m ⓓ 300m

According to the figure, a uniform electric field ($E = 28N/C$), that is perpendicular to the plane of one face of the cube. If the electric flux passing through the left shaded face is equal to ($-7.0\ Nm^2/C$),
what is the volume the cube?



ⓐ $0.125m^3$ ⓑ $8.000m^3$ ⓒ $0.250m^3$ ⓓ $0.500m^3$

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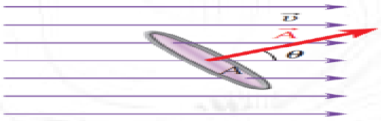
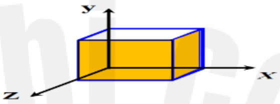
What is the flux through a circular area with radius of 0.30 m placed in an external electric field has a strength of 1200 N/C and makes an angle of 60° with the plane of the circle?



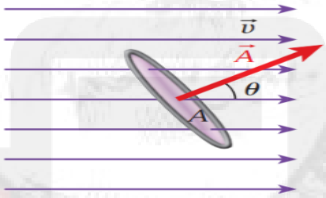
ⓐ $293\ Nm^2/C$ ⓑ $169 Nm^2/C$ ⓒ $565 Nm^2/C$ ⓓ $979 Nm^2/C$

In the figure a cube with sides of length 5.0 cm, an electric field is passes through the cube if the electric field is given by this equation: $E = 2.0\hat{x} + 4.0\hat{y} + 6.0\hat{z}$. What is the electric flux through the shaded faces?



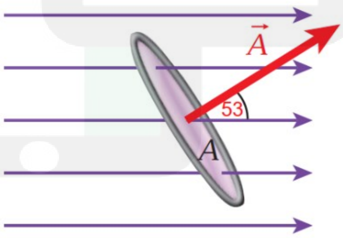
ⓐ $0.015 Nm^2/C$ ⓑ $0.020 Nm^2/C$ ⓒ $0.030 Nm^2/C$ ⓓ $0.0050 Nm^2/C$

According to the figure, at which (θ) the magnetic flux equal approximately to ($0.5EA$)?



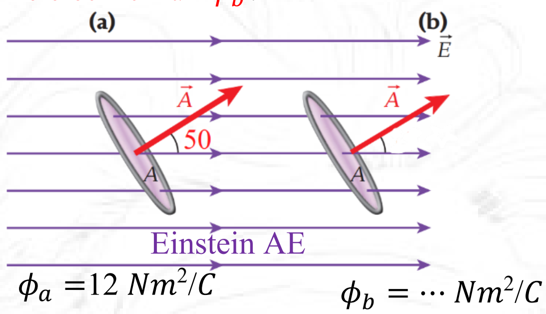
ⓐ 60 ⓑ 30 ⓒ 90 ⓓ 0

According to the figure, which of the following is corresponding about the electric flux from surface A?



ⓐ $\frac{\phi_E}{\phi_{max}} = \frac{3}{5}$ ⓑ $\frac{\phi_E}{\phi_{max}} = \frac{4}{5}$ ⓒ $\frac{\phi_E}{\phi_{max}} = \frac{5}{3}$ ⓓ $\frac{\phi_E}{\phi_{max}} = \frac{5}{4}$

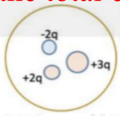
The diagram shows a ring in a uniform electric field passing through its surface. The ring rotates so that the angle it makes with the field changes as shown in the diagram, the angle made by the ring from position (a) to position (b) is17, what is the electric flux ϕ_b?



ⓐ $9.60Nm^2/C$ ⓑ $16.8Nm^2/C$ ⓒ $15.7Nm^2/C$ ⓓ $12.2Nm^2/C$

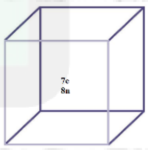
10 **Prove that the electric flux through a closed surface is given by the net charge inside the surface divided by the permittivity of the medium, and write the Gauss's law in its integral form** $\oiint \vec{E}\bullet d\vec{A} = \frac{q}{\varepsilon_0}$

Three isolated charges of+2q, -2q, and +3q are placed in a 3D vacuum space, where they are surrounded by a Gaussian surface, as shown in the figure. What is the total electrical flux through that surface?



ⓐ $\phi = \frac{+7q}{\varepsilon_0}$ ⓑ $\phi = \frac{+3q}{\varepsilon_0}$ ⓒ $\phi = +3q$ ⓓ $\phi = \frac{+5q}{4\pi\varepsilon_0}$

Assume that the cube shown in the figure contains seven electrons, eight neutrons, and a number of protons, if the electric flux through the cube is (3.62 x$10^{-8}$$Nm^2$/ C). How many protons in the cube?

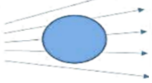


ⓐ 7 ⓑ 8 ⓒ 9 ⓓ 2

what is the magnitude of the electric flux through the sphere shown in the figure that contains an electron and two protons?

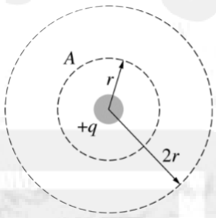
ⓐ $1.6x10^{-8}$ Nm^2/C ⓑ 1.8×10^{-8} Nm^2/C ⓒ $3.6x10^{-8}$ Nm^2/C ⓓ $5.4x10^{-8}$ Nm^2/C

A neutral sphere, made of insulating material, is placed in an external electric field as shown in the figure. The net electrical flux passing through the surface of the sphere is:



ⓐ Zero ⓑ Negative ⓒ positive ⓓ cannot be determined

A small sphere has a charge +q. Spherical Gaussian Surfaces A and B are concentric with the sphere, as shown in the figure below. The radii of surfaces A and B are r and $2r$, respectively.
The magnitude of the electric flux through A is ϕA. The magnitude of the electric flux through surface B is ϕB.
The ratio $\frac{\phi A}{\phi B}$ is



Hint: Area of sphere ($A = 4\pi r^2$)

ⓐ $\frac{4}{1}$ ⓑ $\frac{2}{1}$ ⓒ $\frac{1}{1}$ ⓓ $\frac{1}{2}$

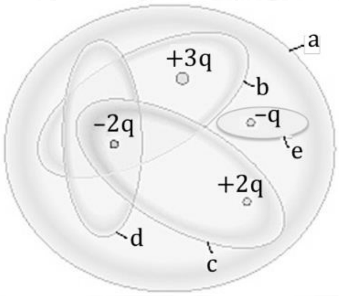
A point charge sits in the center of a 1 m cube. The electric flux through one side of the cube is 7.2×10^{10} Nm^2/C. What is the charge at the center of the cube?

ⓐ 3.8 C ⓑ 4.6 C ⓒ 6.0 C ⓓ 8.9 C

A hollow spherical conductor with an inner radius 5.0 cm and an outer radius 6.5 cm and its outer surface carries an electric charge, an electric charge q is placed at its center, resulting in an electric field at the inner surface of the conductor 50 N/C towards the center of the conductor and another electric field at the outer surface of the conductor 50 N/C away from the center of the conductor,
what is the magnitude and type of charge q?

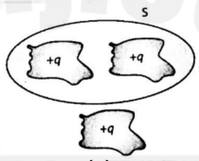
ⓐ $+ 2.5 \times 10^{-12}$ C ⓑ $- 2.5 \times 10^{-12}$ C ⓒ $- 1.4 \times 10^{-11}$ C ⓓ $+ 1.4 \times 10^{-11}$ C

The figure below shows five Gaussian surfaces (a to e) surrounding a distribution of charges
Which of the Gaussian surfaces have a largest electric flux



ⓐ a ⓑ b ⓒ c ⓓ d

The figure below shows a distribution of charges. The flux of the electric field due to these charges through the surface S is



ⓐ $\phi = \frac{+3q}{\varepsilon_0}$ ⓑ $\phi = \frac{+2q}{\varepsilon_0}$ ⓒ $\phi = +3q$ ⓓ $\phi = \frac{+5q}{4\pi\varepsilon_0}$

Inside a spherical surface is a 5.3×10^{-6} C and a -2.2×10^{-6} C charge. What is the total electric flux through the surface of the sphere in units of Nm^2/C?

ⓐ 3.4×10^{-16} ⓑ 3.1×10^{6} ⓒ 3.5×10^{5} ⓓ 2.8×10^{4}

A 3.5 C point charge sits in the center of a 1 m cube. What is the electric flux through one side of the cube?

ⓐ $6.6 \times 10^{10} Nm^2/C$ ⓑ $4.5 \times 10^{10} Nm^2/C$ ⓒ $3.3 \times 10^{10} Nm^2/C$ ⓓ $5.0 \times 10^{10} Nm^2/C$

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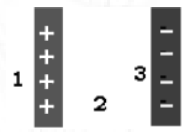
11 Prove that the electric flux through a closed surface is given by the net charge inside the surface divided by the permittivity of the medium, and write the Gauss's law in its integral form

The magnitude of the electric field due to an infinite, flat, thin and nonconducting plane of charge is ($1.55x10^4$N/C). Assuming that the charge is uniformly distributed,
What is the charge density on the surface of the plane?

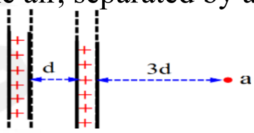
ⓐ 3.10×10^{-8} C/m² ⓑ 1.55×10^{-8} C/m² ⓒ 1.37×10^{-7} C/m² ⓓ 2.74×10^{-7} C/m²

The diagram below shows two charged plates placed close to each other.
Rank points 1, 2 and 3 from greatest to the least electric field.



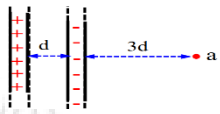
ⓐ 1 > 2 > 3 ⓑ 1= 2 = 3 ⓒ 3 = 2 > 1 ⓓ 3 > 1 > 2

In the diagram below, two infinitely thin, parallel, nonconducting plates are placed in the air, separated by a distance of d. They each carry a uniform positive charge with density distribution of
What is the magnitude of the electric field at point aa



ⓐ $\frac{\sigma}{2\varepsilon}$ ⓑ $\frac{\sigma}{\varepsilon}$ ⓒ $\frac{2\sigma}{\varepsilon}$ ⓓ 0

In the diagram below, two infinitely thin, parallel, nonconducting plates are placed in the air, separated by a distance of d. They each carry a uniform positive and negative charge with density distribution of
What is the magnitude of the electric field at point aa



ⓐ $\frac{\sigma}{2\varepsilon}$ ⓑ $\frac{\sigma}{\varepsilon}$ ⓒ $\frac{2\sigma}{\varepsilon}$ ⓓ 0

12 Solve problems involving electric potential energy

Which of the following statements is correct?

ⓐ The change in electric potential energy due to some spatial rearrangement of a system is equal to the negative of the work done by the conservative force during this spatial rearrangement

ⓑ The change in electric potential energy due to some spatial rearrangement of a system is equal to the positive of the work done by the conservative force during this spatial rearrangement

ⓒ The change in electric potential energy due to some spatial rearrangement of a system is equal to the positive of the work done by the unconservative force during this spatial rearrangement

ⓓ The change in electric potential energy due to some spatial rearrangement of a system is equal to the negative of the work done by the unconservative force during this spatial rearrangement.

For a proton moving in the direction of the electric field

ⓐ its potential energy increases and its electric potential decreases.

ⓑ its potential energy decreases and its electric potential decreases.

ⓒ its potential energy increases and its electric potential increases.

ⓓ its potential energy decreases and its electric potential increases.

For an electron moving in a direction opposite to the electric field

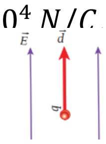
ⓐ its potential energy increases and its electric potential decreases.

ⓑ its potential energy decreases and its electric potential decreases.

ⓒ its potential energy increases and its electric potential increases.

ⓓ its potential energy decreases and its electric potential increases.

A positive charge of $3.0 \times 10^{-8}\ C$ is placed in an upward directed uniform electric field of $4.0 \times 10^{4}\ N/C$. When the charge is moved 0.5 m upward, the work done by the electric force on the charge is:



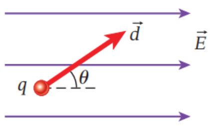
ⓐ $6 \times 10^{-4}\ J$

ⓑ $12 \times 10^{-4}\ J$

ⓒ $8 \times 10^{4}\ J$

ⓓ $2 \times 10^{4}\ J$

A proton is released from rest in 300.0 N/C electric field pointing to positive x-direction. Calculate the change in electric potential energy if it moved 10.0 cm making an angle 60.0° with the electric field.



ⓐ $-2.40 \times 10^{-18}\ J$

ⓑ $2.40 \times 10^{-18}\ J$

ⓒ $2.40 \times 10^{-16}\ J$

ⓓ $2.40 \times 10^{-16}\ J$

A proton is accelerated from rest close to the positive plate to deliver to the negative plate with maximum kinetic energy $4.8 \times 10^{-17} J$
What is the absolute value of electric potential difference between these two parallel plates?

ⓐ	$0V$	ⓒ	$3\ V$
ⓑ	$30V$	ⓓ	$300\ V$

A proton, initially at rest, is accelerated through an electric potential difference of 500 V.
What is the kinetic energy of the proton?

ⓐ 500 J ⓑ $+1.6\times10^{-19}$ J. ⓒ $+8.0\times10^{-17}$ J. ⓓ zero

An electron is accelerated from rest close to the negative plate of a capacitor. It reaches the positive plate in (0.02s). If the electric potential difference between these two plates is (100V)?
What is the acceleration of the electron?

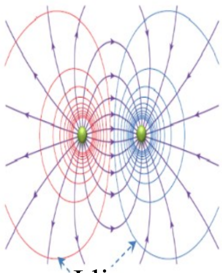
ⓐ $2.96\ x\ 10^{8} m/s^2$ ⓑ $6.92\ x10^{6} m/s^2$ ⓒ $1.92x10^{10} m/s^2$ ⓓ $3.80x10^{10} m/s^2$

An electron is accelerated from rest close to the negative plate to deliver to the positive plate, if the electric potential difference between the two parallel plates is (120V).
What is the maximum kinetic energy of the electron?

ⓐ 1.9×10^{-17} J ⓑ 1.6×10^{-19} J ⓒ 9.6×10^{-18} J ⓓ 3.8×10^{-18} J

13 Develop a method such as schematic representations to compare the equipotential surfaces due to a point charge, two identical charges, and two different charges

The figure shows the electric field lines and equipotential surfaces of two-point charges.
Which of the following is correct?



	point charges	J lines
ⓐ	same magnitude and opposite sin	electric field lines
ⓑ	same magnitude and opposite sin	Equipotential surfaces
ⓒ	identical and positive	electric field lines
ⓓ	Equipotential surfaces	identical and negative

Which one of the following statements is not true?

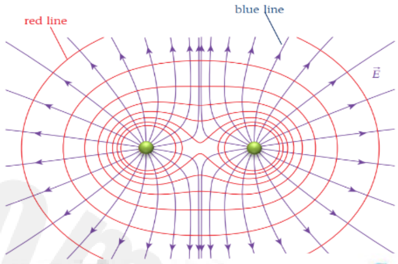
ⓐ Equipotential lines are parallel to the electric field lines.

ⓑ When a charge moves on an equipotential surface, the work done on the charge is zero.

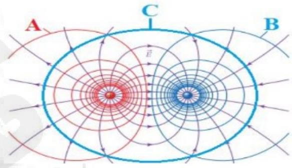
ⓒ Equipotential surfaces exist for any charge distribution.

ⓓ Equipotential lines for a point charge are circular.

The figure shows the electric field lines and equipotential surfaces of two-point charges.
Which of the following is correct?

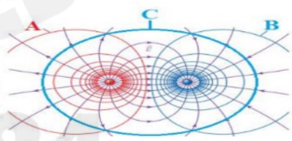


	point charges	red lines
ⓐ	identical and positive	electric field lines
ⓑ	identical and positive	equipotential surfaces
ⓒ	identical and negative	electric field lines
ⓓ	identical and negative	equipotential surfaces



Which of the following is/are equipotential surface/s?

ⓐ A ⓑ B ⓒ C ⓓ A&B



Which of the following is not equipotential surface/s?

ⓐ A ⓑ B ⓒ C ⓓ A&B

Determine the wrong statement in the following.

ⓐ we need to do work on a charge to move it on an equipotential surface,

ⓑ Electric field lines are perpendicular to equipotential surfaces at any point.

ⓒ The surface of any conductor is an equipotential surface.

ⓓ In a uniform electric field, the electric field lines are always parallel.

14 **Relate the component of the electric field along a certain direction Es to the change in the electric potential along that direction ($E_s = -\frac{dV}{ds}$) and use this relation to solve problems**

Suppose that the voltage at a point is given by the equation ($V_{(x,y,z)} = 8x^2 - 9y^2 + 5z^2$) in volts.
Which of the dimensions (x, y, z) determines the magnitude of the electric field at this point?

ⓐ x ⓑ y ⓒ z ⓓ x&y&z

Suppose that the voltage at a point is given by the equation ($V_{(x,y,z)} = 8x - 9y + 5z^2$) in volts.
Which of the dimensions (x, y, z) determines the magnitude of the electric field at this point?

ⓐ x ⓑ y ⓒ z ⓓ x&y&z

Suppose an electric potential has the equation $V_{(x,y,z)} = 3x - 6y + 2z$ in volts.
What is the magnitude of associated electric field, in units of volts per meter at P (0,0,0)?

ⓐ 0 ⓑ 7 ⓒ 1 ⓓ 6

The electric potential in some region is given by $V_{(x,y)} = 2x^2 - 3y$.
Find the x component of the electric field associated with this potential at point (1,2)

ⓐ 5 V/m ⓑ -6 V/m ⓒ -4 V/m ⓓ 8 V/m

The electric potential in some region is given by $V_{(x,y)} = 3x - 2y^2$.
Find the Y component of the electric field associated with this potential at point (1,2)

ⓐ 5 V/m ⓑ -6 V/m ⓒ -4 V/m ⓓ 8 V/m

An electric potential is described in volts by $V(x, y, z) = 3x^2 + 8y - 6z$.
What is the magnitude of an electric field at the point $(+2.0\,m, -2.0\,m, -1.0\,m)$

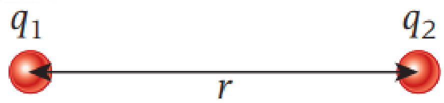
ⓐ $27.6\,V/m$ ⓑ $31.0\,V/m$ ⓒ $15.6\,V/m$ ⓓ $14.0\,V/m$

Suppose the electric potential is given by the equation $V(x, y, z) = 5x^2 - 8y^2$
what is the magnitude of electric field at the point (3,5,2)?

ⓐ $7300\,V/m$ ⓑ $10\,V/m$ ⓒ $50\,V/m$ ⓓ $85\,V/m$

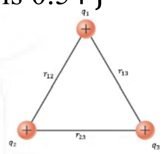
15 Calculate the potential energy of a system of pair of charged particles

Consider two identical charges of $q = 50\mu C$ each, placed 5.0 m apart.
Find the electrostatic potential energy stored in the configuration.



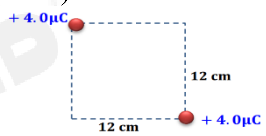
ⓐ 4.5J ⓑ 0.9J ⓒ 0.2J ⓓ 2.5J

The potential energy of a system of three equal charges arranged in an equilateral triangle is 0.54 J
If the length of one side of this triangle is 33 cm,
What is the charge of one of the three charges?



ⓐ 1.7 μC ⓑ 4.3 μC ⓒ 2.6 μC ⓓ 2.0 μC

Two $(+4.0\ \mu C)$ point charges arranged at the corners of a square with side length $(12\ cm)$
What is the potential energy of a system of two charges?



ⓐ $1.2\ J$ ⓑ $0.85\ J$ ⓒ $10\ J$ ⓓ $5.0\ J$

What happens to the magnitude of electric potential energy of a system of two-point charges when the distance between them decreases?

ⓐ increases ⓑ decreases ⓒ remains the same ⓓ increases rabidly then decreases.

When two charges are separated by a distance d, their electric potential energy is equal to U.
What would be their electric potential energy if the separation distance was $\frac{d}{2}$?

ⓐ U/4 ⓑ $U/2$ ⓒ $2U$ ⓓ $4U$

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The electric potential energy of a system of two negative point charges is equal to $1.2 \times 10^{-2} J$, if the distance between them becomes four times what it was, what is the potential energy of the system?

ⓐ $1.5 \times 10^{-2} J$ ⓑ $1.2 \times 10^{-2} J$ ⓒ $4.8 \times\times 10^{-2} J$ ⓓ $3.0 \times 10^{-3} J$

If the electric potential energy of a system of two negative point charges is (8.0J). What is the electric potential energy of the system when the distance between the two charges is halved?

ⓐ $0.0J$ ⓑ $4.0J$ ⓒ $8.0J$ ⓓ $16.0J$

If the electric potential energy of a system of two negative point charges is (24.0J). What is the electric potential energy of the system when the distance between the two charges is tripled?

ⓐ $0.0J$ ⓑ $4.0J$ ⓒ $8.0J$ ⓓ $16.0J$

الحمد لله رب العالمين تم الانتهاء من الجزء الالكتروني

استاذ عبدالرحمن عصام عيد

ومع اطيب التمنيات بالتوفيق والنجاح

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