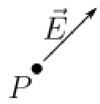
PHYS 1320 (Spring 2024) Sonnenfeld Online HW #3: Electric field and Gauss's Law

Problem 1: The electric field at point P is represented by the vector labeled $\vec{E}$.



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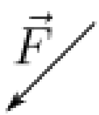
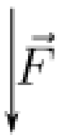
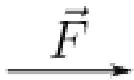
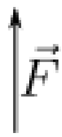
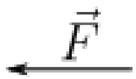
Which vector best represents the force, $\vec{F}$, on a proton placed at point P?
SchematicChoice :





$|\vec{F}| = 0$



Problem 2: Suppose you have an electric field that exerts a ***1.95*** $\times 10^{-5}$ N upward force on a -***1.75*** μC charge.
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Calculate the vertical component of the electric field, in newtons per coulomb, taking up to be the positive direction.
Numeric : A numeric value is expected and not an expression.
E = ____

Problem 3: The figure below shows the electric field lines from a charge -q.
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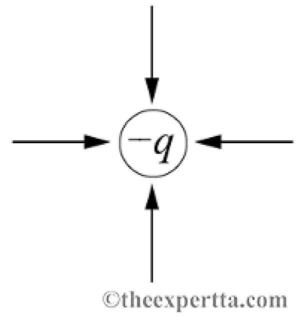
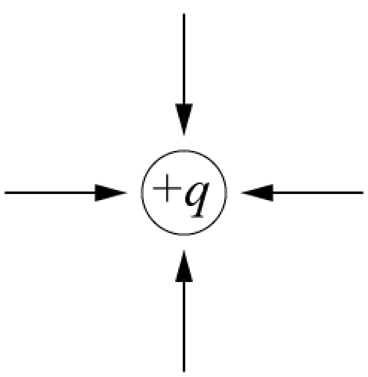
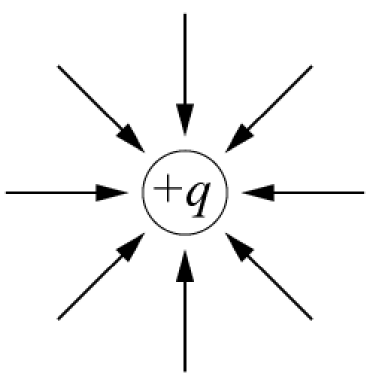
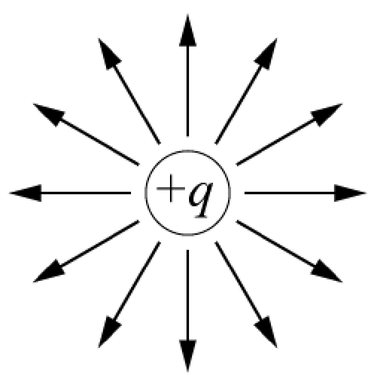
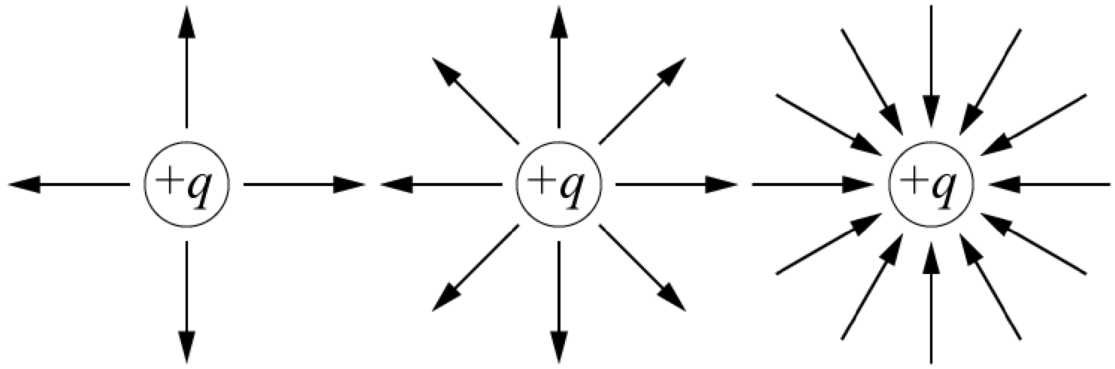


Part (a) Select the correct diagram which represents the electric field lines near a point charge +q.
SchematicChoice :

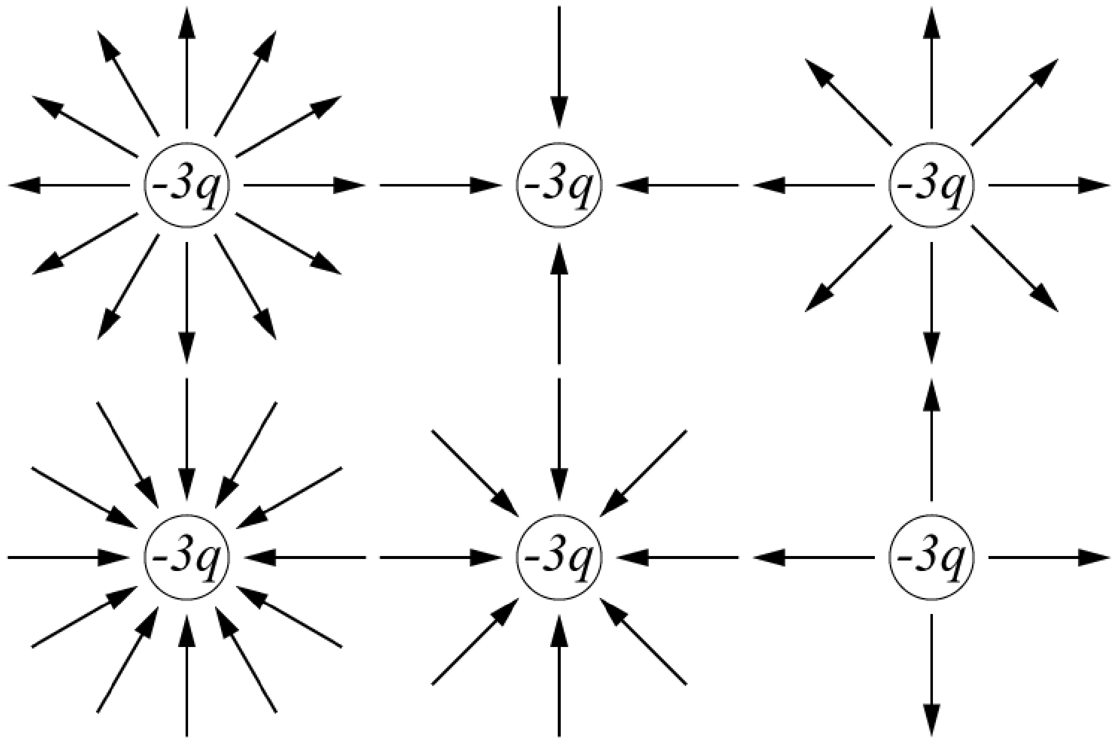








Part (b) Select the correct diagram which represents the electric field lines near a point charge -3q.
SchematicChoice :



Problem 4: A charged particle (q = ***2.5*** × 10^{-10} C) experiences a force of **F** = ***2.5*****i** - ***4.2*****j** N in an electric field.
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Part (a) Write an expression for the electric field vector **E** to which the charge is subject, in terms of the force **F**.
Expression :
E = ____

Select from the variables below to write your expression. Note that all variables may not be required.
α, β, θ, F, a, d, g, h, j, k, m, P, q, S, t

Part (b) Assume this field is generated by a point charge of $Q = 5 \times 10^{-9}$ C. How far away is this charge located? Give your answer in meters.
Numeric : A numeric value is expected and not an expression.
d = ____

Problem 5: Suppose there is a ***4.5*** $\times 10^{6}$ N/C electric field in some region.
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Calculate the magnitude of the acceleration, in meters per second squared, of a proton from rest in such an electric field.
Numeric : A numeric value is expected and not an expression.
a = ____

Problem 6: Consider the drawings of charges and electric field lines shown.
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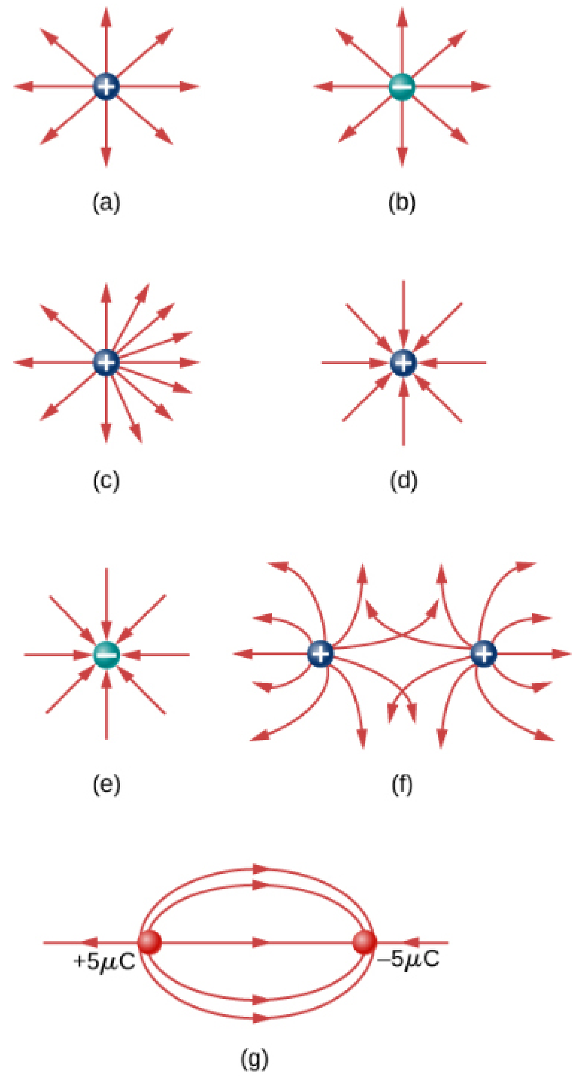

Which of the electric field line drawings are incorrect for point charges?
MultipleSelect :

1) e
2) c
3) a
4) f
5) d
6) b
7) g

Problem 7: A uniform electric field of magnitude ***1.45*** $\times 10^4$ N/C is perpendicular to a square surface with ***2.1*** m side lengths.
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What is the magnitude of the electric flux through the surface, in newton squared meters per coulomb?
Numeric : A numeric value is expected and not an expression.
$|\Phi_E|$ = ____ N·m^2/C

Problem 8: A uniform electric field of magnitude 21.1 $\mathrm{N/C}$ is parallel to the x axis. A circular loop of radius 25.7 cm is centered at the origin with the normal to the loop pointing 30.9° above the x axis.
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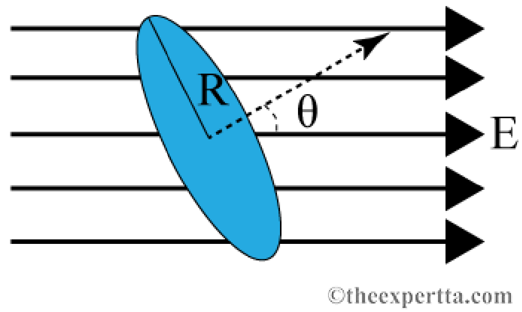

Part (a) Calculate the electric flux in, newton squared meters per coulomb, through the loop.
Numeric : A numeric value is expected and not an expression.
Φ = ____ $\mathrm{N \cdot m^2/C}$

Part (b) To what angle, in degrees from the positive x axis, should the normal of the loop be rotated so that the flux through the loop becomes 0.369 $\mathrm{N \cdot m^2/C}$?
Numeric : A numeric value is expected and not an expression.
θ' = ____ $^\circ$

Problem 9: A collection of four charges and four Gaussian surfaces are shown in the figure. The charges have values:

$q_1 = +5.96$ nC
$q_2 = -5.96$ nC
$q_3 = +11.7$ nC
$q_4 = -13.3$ nC

The dashed lines represent the intersection of the closed three-dimensional surfaces with the plane of the image. If a charge is shown within a dashed curve, then it is contained with the corresponding surface.
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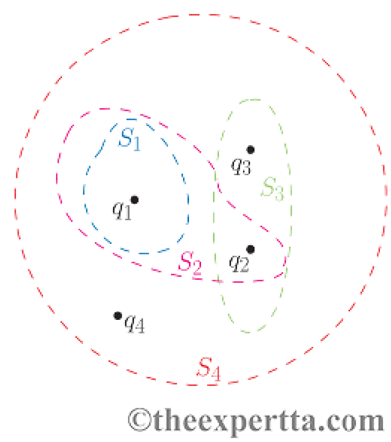

Part (a) What is the electric flux, in newton squared meters per coulomb, through the first closed surface, S_1?
Numeric : A numeric value is expected and not an expression.
Φ_1 = ____ $\mathrm{N \cdot m^2/C}$

Part (b) What is the electric flux, in newton squared meters per coulomb, through the second closed surface, S_2?
Numeric : A numeric value is expected and not an expression.

Φ_2 = ____ $\mathrm{N \cdot m^2/C}$

Part (c) What is the electric flux, in newton squared meters per coulomb, through the third closed surface, S_3?
Numeric : A numeric value is expected and not an expression.
Φ_3 = ____ $\mathrm{N \cdot m^2/C}$

Part (d) What is the electric flux, in newton squared meters per coulomb, through the fourth closed surface, S_4?
Numeric : A numeric value is expected and not an expression.
Φ_4 = ____ $\mathrm{N \cdot m^2/C}$