Phys 202

Recitation 1

Sunny Guha

http://people.physics.tamu.edu/sunnyguha/teach.html

1	Aug 27 – 31	No Recitation – No lab (first week of classes)
2	Sept 03 – 07	Recitation – No Lab
3	Sept 10 – 14	Recitation – 1. Resistors in Series and Parallel
4	Sept 17 – 21	Recitation – *Exam review*
5	Sept 24 – 28	Recitation – 2. Magnetic Fields and Forces
6	Oct. 01 –05	Recitation – 3. Induced EMF
7	Oct. 08 – 12	Recitation – *Exam review*
8	Oct. 15 – 19	Recitation – 4. Reflection and Refraction of Light
9	Oct. 22 – 26	Recitation – 5. Thin Lenses
10	Oct 29 – Nov 02	Recitation – *Exam review*
11	Nov 05 – 09	Recitation – 7. Photoelectric Effect
12	Nov 12 – 16	Recitation – Make-up lab for one missed exp only
13	Nov 19 – 23	Thanksgiving Holiday (no classes Wed/Thurs/Fri)
14	Nov 26 – 30	Recitation – *Exam review*
15	Dec 03 Monday	*No recitation, no lab* – Redefined day, Friday classes
	Dec 04 Tuesday	*No recitation, no lab* – Redefined day, Thursday classes
	Dec 05 Wednesday	*No recitation, no lab* – Last day of classes

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Sunny Guha

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Teaching

Phys 218 Resources

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Formulae

$$F = k\frac{|q_1 q_2|}{r^2}.$$

$$k \simeq 8.99 \times 10^9\ \mathrm{N \cdot m^2/C^2},$$

$$E = k\frac{|q|}{r^2}.$$

$$\Phi_E = EA\cos\phi.$$

$$\sum E_\perp\, \Delta A = 4\pi k Q_{\text{encl}}.$$

34. • A particle has a charge of -3.00 nC. (a) Find the magnitude and direction of the electric field due to this particle at a point 0.250 m directly above it. (b) At what distance from the particle does its electric field have a magnitude of 12.0 N/C?

34. • A particle has a charge of -3.00 nC. (a) Find the magnitude and direction of the electric field due to this particle at a point 0.250 m directly above it. (b) At what distance from the particle does its electric field have a magnitude of 12.0 N/C?

17.34. Set Up: For a point charge, $E = k\dfrac{|q|}{r^2}$. $\vec{E}$ is toward a negative charge and away from a positive charge.

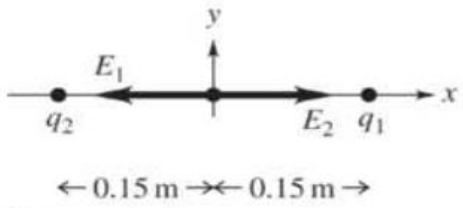
Solve: (a) The field is toward the negative charge so is downward.

$$E = (8.99\times10^{9}\ \text{N}\cdot\text{m}^2/\text{C}^2)\frac{3.00\times10^{-9}\ \text{C}}{(0.250\ \text{m})^2} = 432\ \text{N/C}.$$

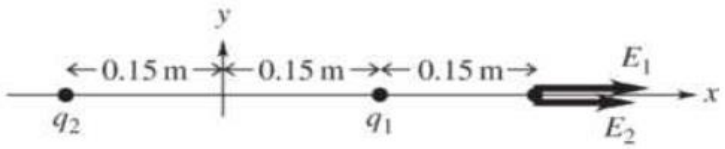
(b) $$r = \sqrt{\frac{k|q|}{E}} = \sqrt{\frac{(8.99\times10^{9}\ \text{N}\cdot\text{m}^2/\text{C}^2)(3.00\times10^{-9}\ \text{C})}{12.0\ \text{N/C}}} = 1.50\ \text{m}$$

42. ●● In a rectangular coordinate system, a positive point charge $q = 6.00$ nC is placed at the point $x = +0.150$ m, $y = 0$, and an identical point charge is placed at $x = -0.150$ m, $y = 0$. Find the x and y components and the magnitude and direction of the electric field at the following points: (a) the origin; (b) $x = 0.300$ m, $y = 0$; (c) $x = 0.150$ m, $y = -0.400$ m, (d) $x = 0$, $y = 0.200$ m.

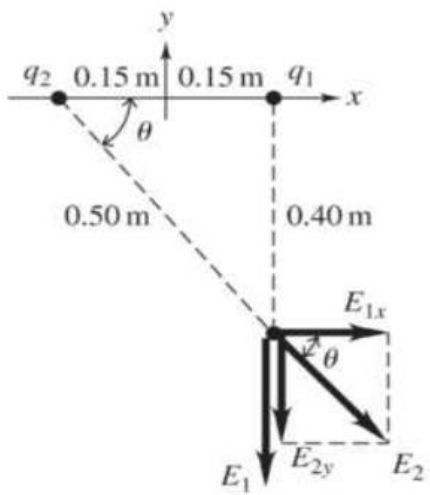
17.42. Set Up: For a point charge, $E = k\dfrac{|q|}{r^2}$. $\vec{\boldsymbol{E}}$ is toward a negative charge and away from a positive charge. The two charges and their fields at each point are shown in Figures (a)-(d) below.



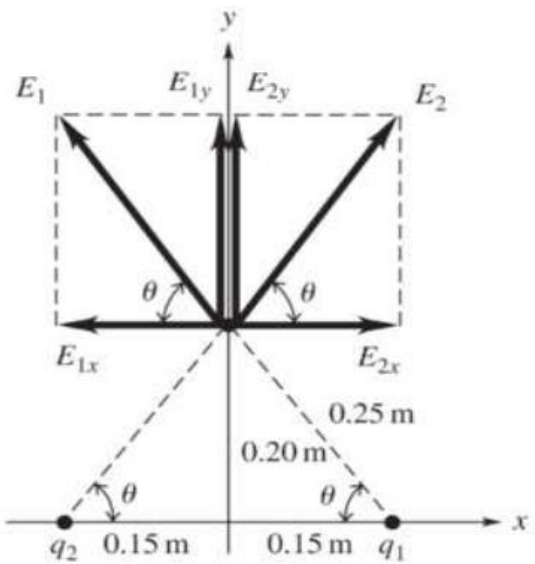
(a)



(b)



(c)



(d)

Solve: **(a)** $E_1 = E_2$ and $\vec{E}_1 = \vec{E}_2$ are in opposite directions, so the resultant electric field is zero. $E_x = E_y = E = 0$.

(b) $E_1 = (8.99\times10^9\ \text{N}\cdot\text{m}^2/\text{C}^2)\dfrac{6.00\times10^{-9}\ \text{C}}{(0.150\ \text{m})^2} = 2397\ \text{N/C}$

$E_2 = (8.99\times10^9\ \text{N}\cdot\text{m}^2/\text{C}^2)\dfrac{6.00\times10^{-9}\ \text{C}}{(0.450\ \text{m})^2} = 266\ \text{N/C}$

$E_x = E_{1x} + E_{2x} = E_1 + E_2 = 2660\ \text{N/C}$. $E_y = 0$. The resultant electric field has magnitude 2660 N/C and is in the $+x$ direction.

(c) $E_1 = (8.99\times10^9\ \text{N}\cdot\text{m}^2/\text{C}^2)\dfrac{6.00\times10^{-9}\ \text{C}}{(0.400\ \text{m})^2} = 337\ \text{N/C}$. $E_{1x} = 0$, $E_{1y} = -337\ \text{N/C}$.

$E_2 = (8.99\times10^9\ \text{N}\cdot\text{m}^2/\text{C}^2)\dfrac{6.00\times10^{-9}\ \text{C}}{(0.500\ \text{m})^2} = 216\ \text{N/C}$. $\theta = 53.1°$. $E_{2x} = E_2\cos\theta = 130\ \text{N/C}$.

$E_{2y} = -E_2\sin\theta = -173\ \text{N/C}$.

$E_x = E_{1x} + E_{2x} = 0 + 130\ \text{N/C} = +130\ \text{N/C}$. $E_y = E_{1y} + E_{2y} = -337\ \text{N/C} - 173\ \text{N/C} = -510\ \text{N/C}$.

$\tan\phi = \left|\dfrac{E_y}{E_x}\right| = 3.92$. $\phi = 75.7°$ and $\vec{E}$ makes an angle $360° - 75.7° = 284°$ counterclockwise from the $+x$ axis.

$E = \sqrt{E_x^2 + E_y^2} = 526\ \text{N/C}$.

(d) $\theta = 53.1°$. $E_1 = E_2 = (8.99\times10^9\ \text{N}\cdot\text{m}^2/\text{C}^2)\dfrac{6.00\times10^{-9}\ \text{C}}{(0.250\ \text{m})^2} = 863\ \text{N/C}$.

$E_x = E_{1x} + E_{2x} = 0$. $E_y = E_{1y} + E_{2y} = 2E_1\sin\theta = 2(863\ \text{N/C})\sin 53.1° = 1380\ \text{N/C}$. $\vec{E}$ has magnitude 1380 N/C and is in the $+y$ direction.

56. •• A point charge 8.00 nC is at the center of a cube with sides of length 0.200 m. What is the electric flux through (a) the surface of the cube, (b) one of the six faces of the cube?

17.56. Set Up: The cube is a closed surface so we can apply Gauss's law to it: $\Phi_E = \frac{Q_{\text{encl}}}{\epsilon_0}$. By symmetry the flux is the same through each of the 6 faces of the cube.

Solve: **(a)** The total flux through the cube is $\Phi_E = \frac{Q_{\text{encl}}}{\epsilon_0} = \frac{8.00 \times 10^{-9}\ \text{C}}{8.854 \times 10^{-12}\ \text{C}^2/(\text{N} \cdot \text{m}^2)} = 904\ \text{N} \cdot \text{m}^2/\text{C}$.

(b) The flux through each face is $\frac{\Phi_E}{6} = \frac{904\ \text{N} \cdot \text{m}^2/\text{C}}{6} = 151\ \text{N} \cdot \text{m}^2/\text{C}$.