**Electric Field**

Read from Lesson 4 of the Static Electricity chapter at The Physics Classroom:

- [http://www.physicsclassroom.com/Class/estatics/u8l4a.html](http://www.physicsclassroom.com/Class/estatics/u8l4a.html)
- [http://www.physicsclassroom.com/Class/estatics/u8l4b.html](http://www.physicsclassroom.com/Class/estatics/u8l4b.html)

**MOP Connection:** Static Electricity: sublevels 10 and 11

1. The standard metric units of measurements for electric field strength are \( \text{N} / \text{C} \).
2. The direction of the electric field vector is defined as **away from positive charge** toward **negative charge**.

Use the electric field equations to answer the following questions.

3. A test charge of \(+1.0 \times 10^{-6} \text{ C}\) experiences a force of \(0.050 \text{ N}\). The electric field strength is \(5 \times 10^4 \text{ N/C}\).
4. A test charge of \(+1.0 \times 10^{-6} \text{ C}\) experiences a force of \(0.10 \text{ N}\). The electric field strength is \(1 \times 10^5 \text{ N/C}\).
5. An object with a charge of \(2.0 \times 10^{-4} \text{ C}\) creates an electric field. A test charge of \(+1.0 \times 10^{-6} \text{ C}\) experiences a force of \(0.050 \text{ N}\). The electric field strength is \(5 \times 10^4 \text{ N/C}\).
6. An object with a charge of \(2.0 \times 10^{-4} \text{ C}\) creates an electric field. A test charge of \(+2.0 \times 10^{-6} \text{ C}\) experiences a force of \(0.10 \text{ N}\). The electric field strength is \(5 \times 10^4 \text{ N/C}\).
7. An object with a charge of \(4.0 \times 10^{-4} \text{ C}\) creates an electric field. A test charge of \(+1.0 \times 10^{-6} \text{ C}\) experiences a force of \(0.10 \text{ N}\). The electric field strength is \(1 \times 10^5 \text{ N/C}\).

8. An object with a charge of \(Q\) creates an electric field. A positive test charge, \(q\), is used to test the strength of the field. Use this scenario to answer the following questions:
   a. If the charge of the test charge \(q\) is doubled, then it will experience \(2^2\) (2X, 4X, 1/2, 1/4-th, the same) force; the electric field strength at this location will be **same** (2X, 4X, 1/2, 1/4-th, the same as) the original value.
   b. If the charge of the object \(Q\) is doubled, then the test charge will experience \(2^2\) (2X, 4X, 1/2, 1/4-th, the same) force; the electric field strength at this location will be **same** (2X, 4X, 1/2, 1/4-th, the same as) the original value.
   c. If the distance between the charge and the test charge is doubled, then the test charge will experience \(\frac{1}{4}\) (2X, 4X, 1/2, 1/4-th, the same) force; the electric field strength at this location will be **same** (2X, 4X, 1/2, 1/4-th, the same as) the original value.

Use your understanding of electric force and electric field to fill in the following table.

<table>
<thead>
<tr>
<th>Charge creating the E field (C)</th>
<th>Charge used to test the E field (C)</th>
<th>Force experienced by test charge (N)</th>
<th>Electric Field Intensity (N/C)</th>
<th>Distance (fictional units)</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. (4.0 \times 10^{-4} \text{ C})</td>
<td>(1.0 \times 10^{-6} \text{ C})</td>
<td>0.20 N</td>
<td>(2.0 \times 10^5 \text{ N/C})</td>
<td>d</td>
</tr>
<tr>
<td>b. (4.0 \times 10^{-4} \text{ C})</td>
<td>(2.0 \times 10^{-6} \text{ C})</td>
<td>0.10 N</td>
<td>(2.0 \times 10^5 \text{ N/C})</td>
<td>d</td>
</tr>
<tr>
<td>c. (8.0 \times 10^{-4} \text{ C})</td>
<td>(1.0 \times 10^{-6} \text{ C})</td>
<td>0.40 N</td>
<td>(4.0 \times 10^5 \text{ N/C})</td>
<td>d</td>
</tr>
<tr>
<td>d. (8.0 \times 10^{-4} \text{ C})</td>
<td>(2.0 \times 10^{-6} \text{ C})</td>
<td>0.80 N</td>
<td>(4.0 \times 10^5 \text{ N/C})</td>
<td>d</td>
</tr>
<tr>
<td>e. (8.0 \times 10^{-4} \text{ C})</td>
<td>(1.5 \times 10^{-6} \text{ C})</td>
<td>0.60 N</td>
<td>(4.0 \times 10^5 \text{ N/C})</td>
<td>d</td>
</tr>
<tr>
<td>f. (8.0 \times 10^{-4} \text{ C})</td>
<td>(1.0 \times 10^{-5} \text{ C})</td>
<td>0.10 N</td>
<td>(1.0 \times 10^5 \text{ N/C})</td>
<td>2d</td>
</tr>
<tr>
<td>g. (8.0 \times 10^{-4} \text{ C})</td>
<td>(2.0 \times 10^{-5} \text{ C})</td>
<td>0.20 N</td>
<td>(1.0 \times 10^5 \text{ N/C})</td>
<td>2d</td>
</tr>
<tr>
<td>h. (8.0 \times 10^{-4} \text{ C})</td>
<td>(1.0 \times 10^{-6} \text{ C})</td>
<td>0.10 N</td>
<td>(1.0 \times 10^5 \text{ N/C})</td>
<td>2d</td>
</tr>
<tr>
<td>i. (4.0 \times 10^{-4} \text{ C})</td>
<td>(8.0 \times 10^{-6} \text{ C})</td>
<td>0.10 N</td>
<td>(8.0 \times 10^5 \text{ N/C})</td>
<td>0.5 d</td>
</tr>
<tr>
<td>j. (4.0 \times 10^{-4} \text{ C})</td>
<td>(4.0 \times 10^{-6} \text{ C})</td>
<td>0.20 N</td>
<td>(8.0 \times 10^5 \text{ N/C})</td>
<td>0.5 d</td>
</tr>
</tbody>
</table>
Electric Field Lines

Read from Lesson 4 of the Static Electricity chapter at The Physics Classroom:
http://www.physicsclassroom.com/Class/estatics/u814c.html
http://www.physicsclassroom.com/Class/estatics/u814d.html

MOP Connection: Static Electricity: sublevel 12

1. Electric field lines begin on (+, -) charges or at infinity and terminate on (-, +) charges or infinity. The number of lines that emanate from a charge or approach a charge depends upon the size of charge. At locations where a line meets the surface of a charge, the lines are drawn in a radial direction. The strength of the electric field is greatest (smallest, greatest) wherever the lines are closest together.

2. Use your understanding of electric field lines to identify the charges on the objects in the following configurations.

3. Observe the electric field lines below for various configurations. Rank the objects according to which has the greatest magnitude of electric charge, beginning with the smallest charge.

Ranking: B < A

Ranking: C < D

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