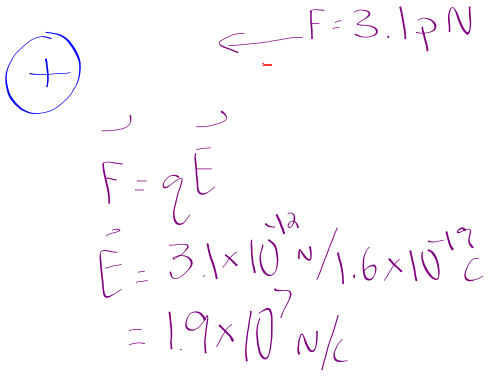
Electric Field Strength

2. What is the magnitude and direction of the electric field at a point where an electron experiences a force of 3.1 pN?

$Q, q\ [C]$

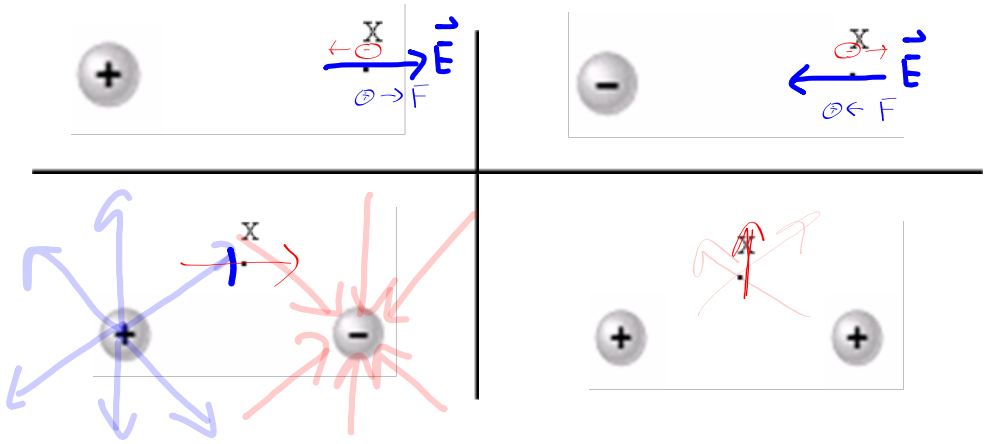
$\vec{F} = \frac{KQq}{r^2}\ [N]$

$\vec{E} = \vec{F}/q = \frac{KQ}{r^2}\ [N/C]$



Comparing Forces and Fields

1. In each case below, compare the direction of the electric field produced by the charged object at point X with the direction of the electrostatic forces exerted on a proton and on an electron placed at point X.



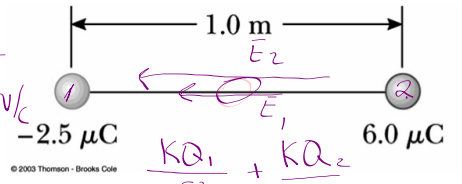
Conclusion: **F** and **E** are in same direction on a positive test charge but opposite for a negative test charge

2. a) Find the magnitude and direction of the net electric field halfway between the two charges shown below.

$E_1 = 89900\ N/C$

$E_2 = 215760\ N/C$

$\Sigma E = 3.1 \times 10^5\ N/C$



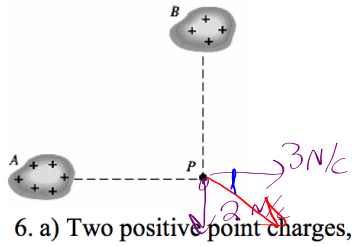
$\frac{KQ_1}{r_1^2} + \frac{KQ_2}{r_2^2}$

$(.5m)$ $(.5m)$

b) Determine the electric force on a proton placed at this spot.

$F = qE = (1.6 \times 10^{-19} C)(3.1 \times 10^5 N/C)$

3. Two charged objects, *A* and *B*, each contribute as follows to the net electric field at point *P*: $\mathbf{E_A}$ = 3.00 N/C directed to the right, and $\mathbf{E_B}$ = 2.00 N/C directed downward. What is the net electric field at *P*?

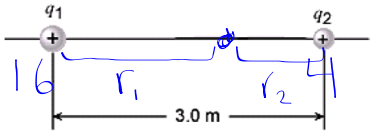


$\Sigma E = \sqrt{(2\ N/C)^2 + (3 N/C)^2}$

$= 3.6 N/C$

$\theta = \tan^{-1}(2/3) = 34°$

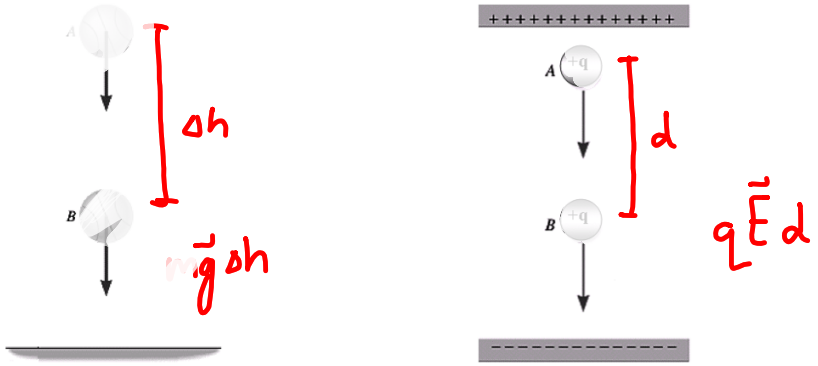
6. a) Two positive point charges, $q1$ = +16 μC and $q2$ = +4.0 μC, are separated in a vacuum by a distance of 3.0 m. Find the spot on the line between the charges where the net electric field is zero.



$E_1 = \frac{KQ_1}{r_1^2} = \frac{KQ_2}{r_2^2}$ $\quad \frac{Q_1}{Q_2} = \frac{r_1^2}{r_2^2}$

Electric Potential Energy and Electric Potential

Gravitational Potential Energy



Electric potential energy: energy due to a charge's position in an electric field

Symbol: PE_e Units: [J]

1. In the diagram above, at which spot, A or B, will the test charge have more electric potential energy?

Electric potential (voltage):

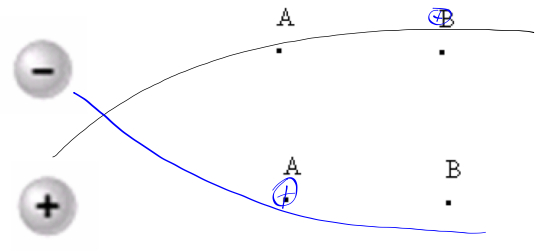
amount of electric potential energy per unit charge – property of field

Symbol: V Units: [V]

2. In the diagram above, which spot, A or B, is at a higher electric potential?

3. Which spot, A or B, is at a higher electric potential?

4. Which spot, A or B, is at a higher electric potential?



Conclusion: A spot where a positive test charge has more potential energy is at a higher potential