Fri Feb 10, 2017

Last time

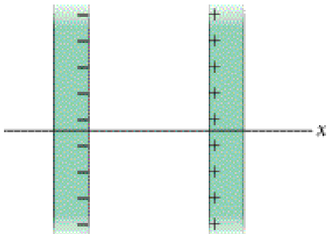
- Examples

This time

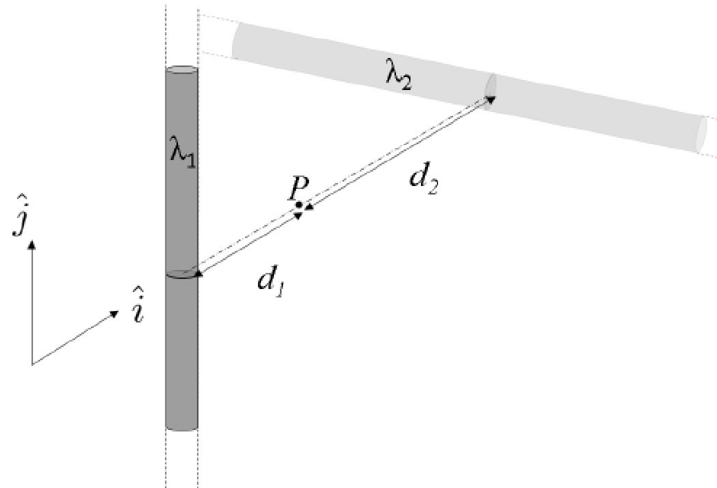
- Properties of conductors
- Group activity – superposition (two insulators)

Two conducting plates

In the figure two large, thin metal plates are parallel and close to each other. On their inner faces, the plates have excess surface charge densities of opposite signs and magnitude 7.48×10^{-22} C/m^2. What is the magnitude of the electric field at points **(a)** to the left of the plates, **(b)** to the right of them, and **(c)** between them?



(10 marks) What is the electric field, $\vec{E}$, at point P due to two charged rods of infinite length, as presented in the figure below? Rod 1 has a positive, linear charge density λ_1 and is oriented vertically, a distance d_1 from P. Rod 2 has a positive, linear charge density λ_2 and is oriented horizontally, a distance d_2 from P.



1. **(1 mark)** What Gaussian surface (i.e., what 3D shape) makes it **easiest** to apply Gauss' law for a rod? Explain why.

2. **(2 marks)** For each rod, **draw** the cylindrical Gaussian surface needed to find its electric field contribution at point P. **Label** each Gaussian surface with length l and the appropriate radius.

3. **(1 mark)** Calculate the charge enclosed in **each** of your Gaussian surfaces, in terms of l, λ_1 and λ_2.

4. **(2.5 marks)** Use Gauss' law ($\oint \vec{E} \cdot \vec{dA} = \frac{Q}{\epsilon_0}$) to calculate $\vec{E_1}$, the electric field at point P due to Rod 1, in terms of λ_1 and d_1.

5. **(1.5 marks)** Use Gauss' law ($\oint \vec{E} \cdot \vec{dA} = \frac{Q}{\epsilon_0}$) to calculate $\vec{E_2}$, the electric field at point P due to Rod 2, in terms of λ_2 and d_2.

6. **(1 mark)** Write the total electric field ($\vec{E}$) at point P **in terms of** $\vec{E_1}$ **and** $\vec{E_2}$.