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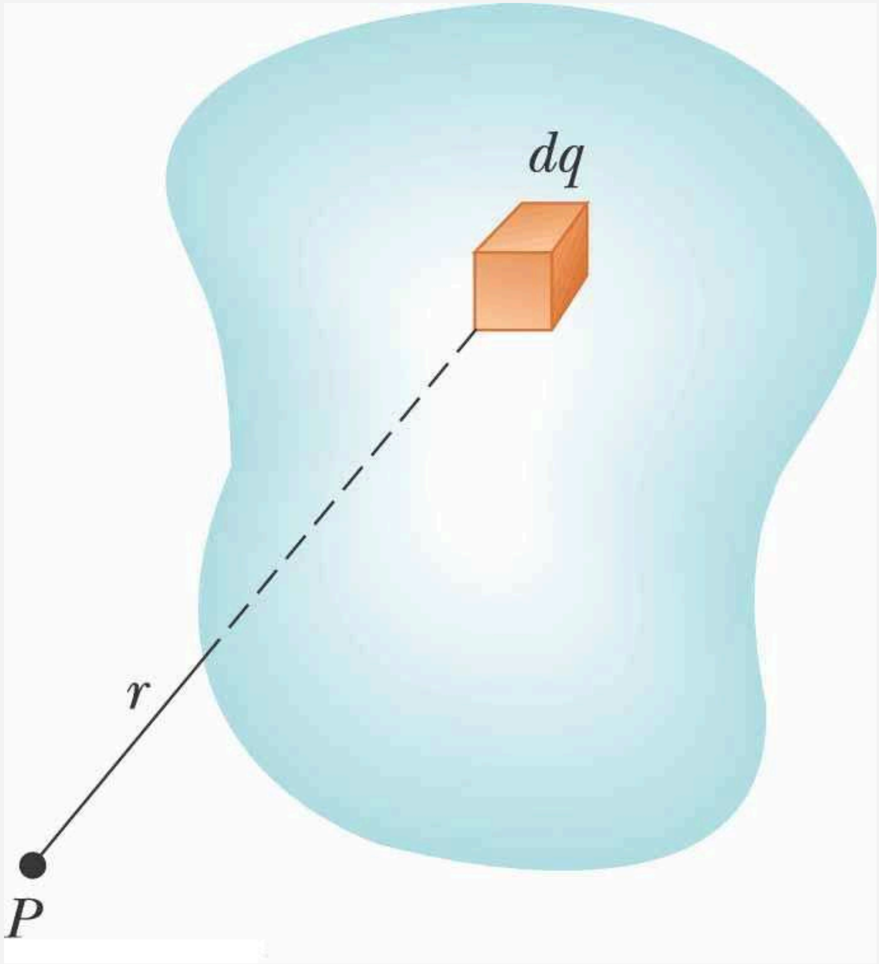

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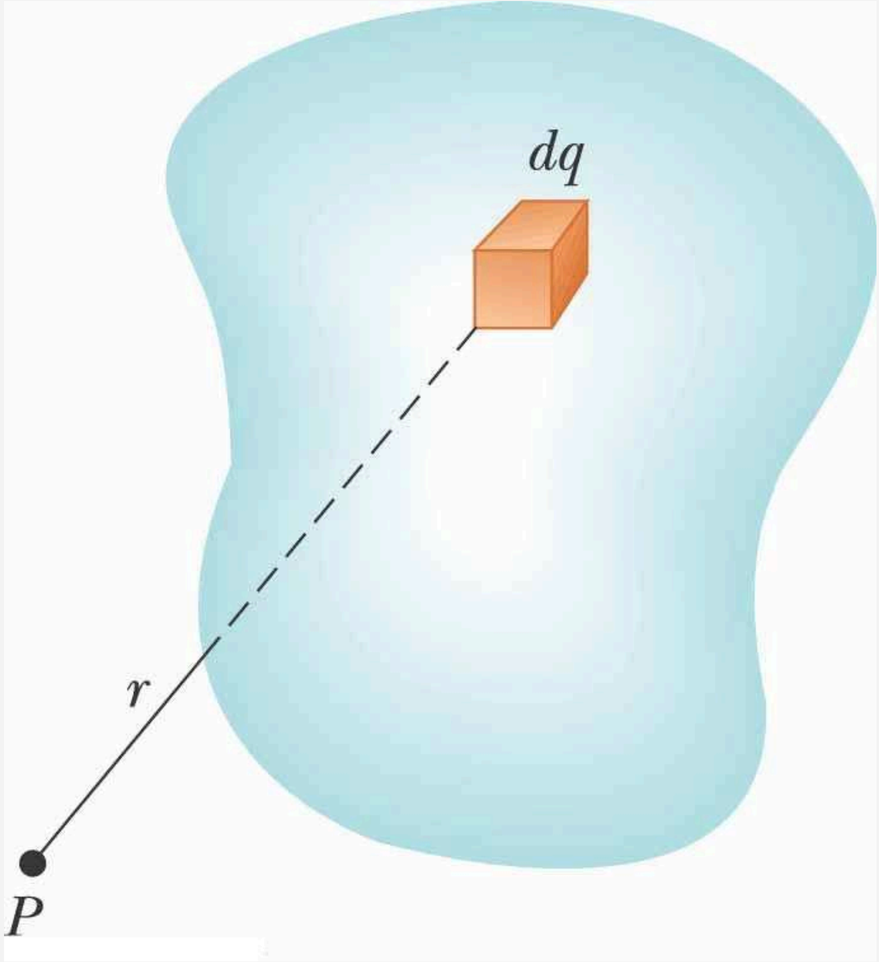

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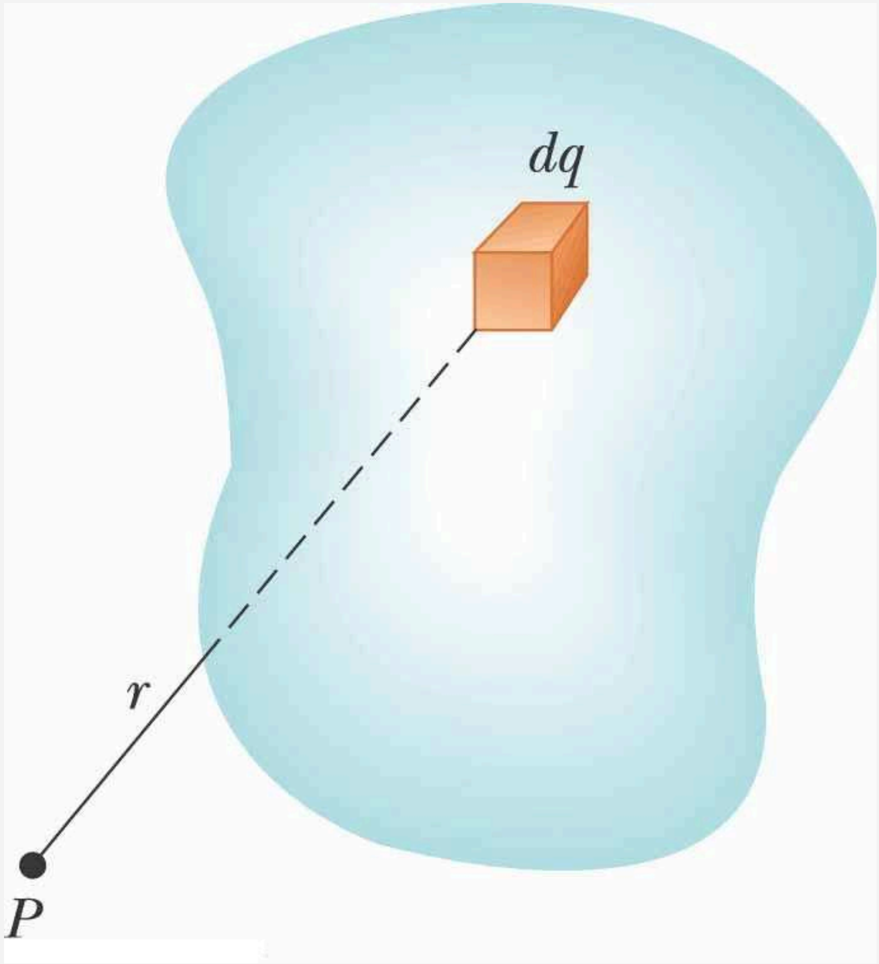

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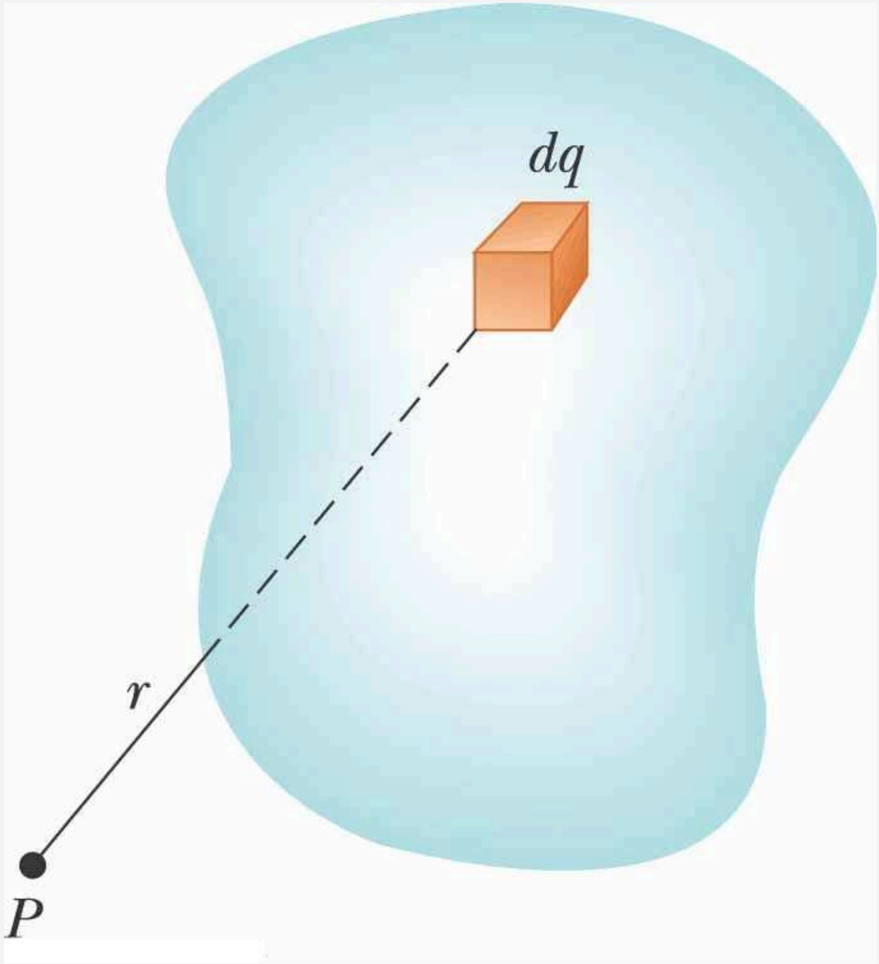

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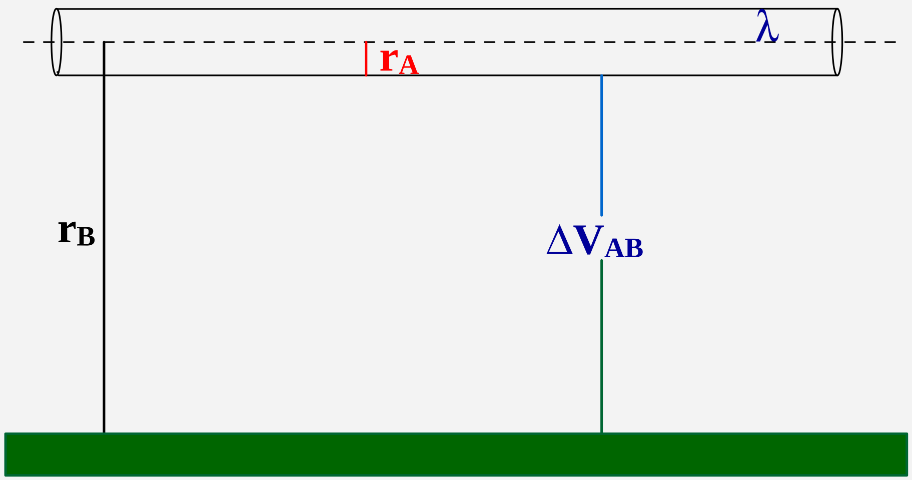
- Let's work out an example with a few different objects.

Example - Power Line

- A long, straight power line is made from wire with radius $r_A = 1.0$ cm and carries a line charge density $\lambda = 2.6\,\mu C/m$ as shown in the figure on the right. Assuming no other charges are present, what is the potential difference between the surface of the wire and the ground, a distance $r_B = 22$ m below?



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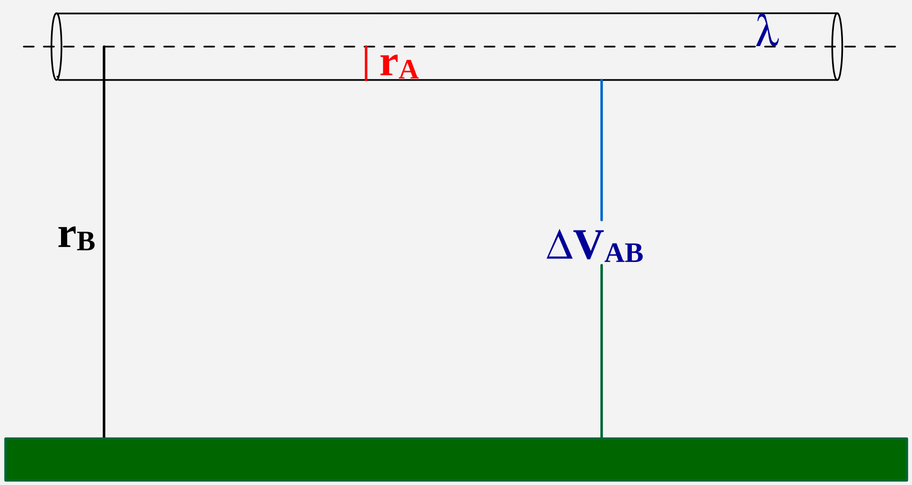

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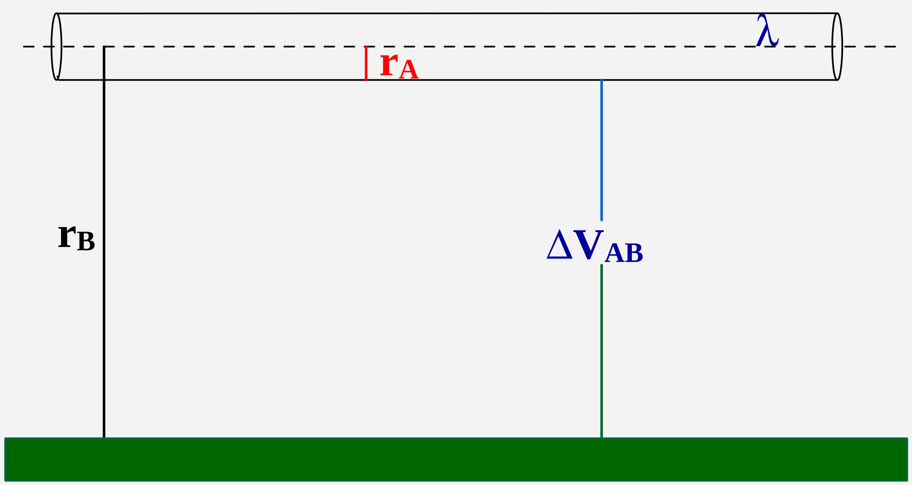
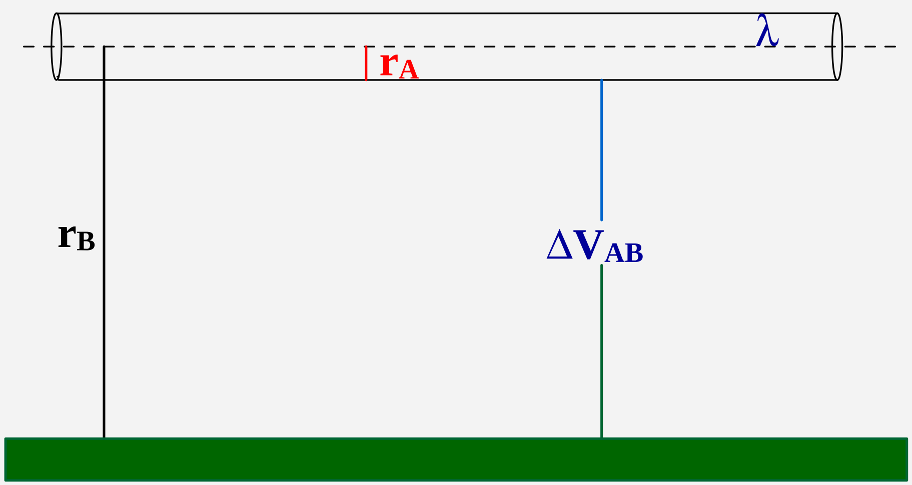
$$\mathbf{E} = \frac{\lambda}{2\,\pi\,\varepsilon_0\,r}\,\hat{\mathbf{r}} \quad (r > r_A)$$



ii. Use the definition of potential difference.



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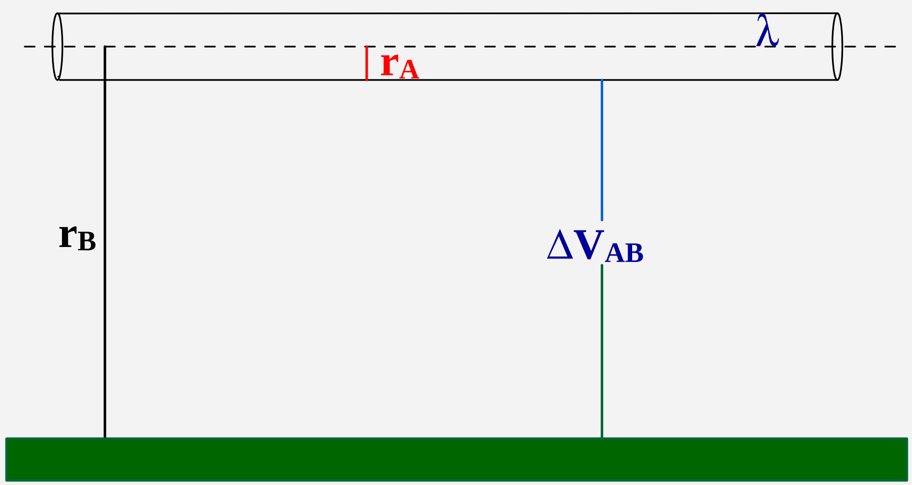

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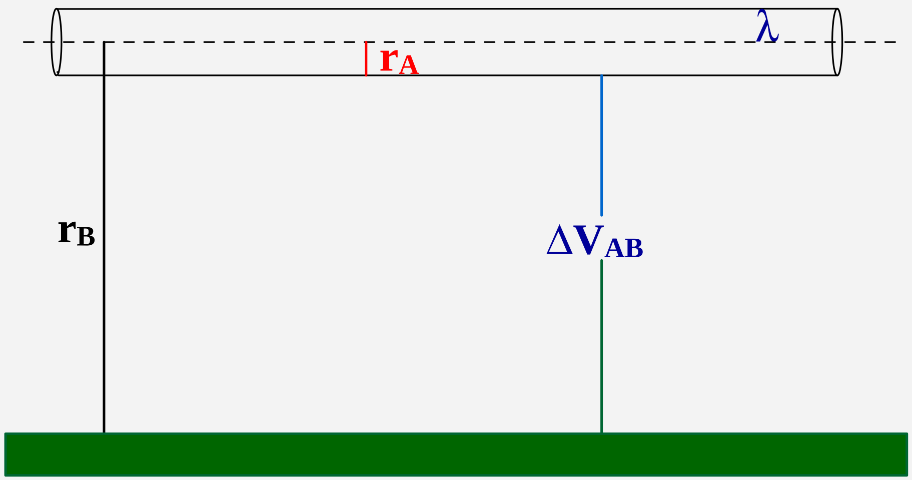

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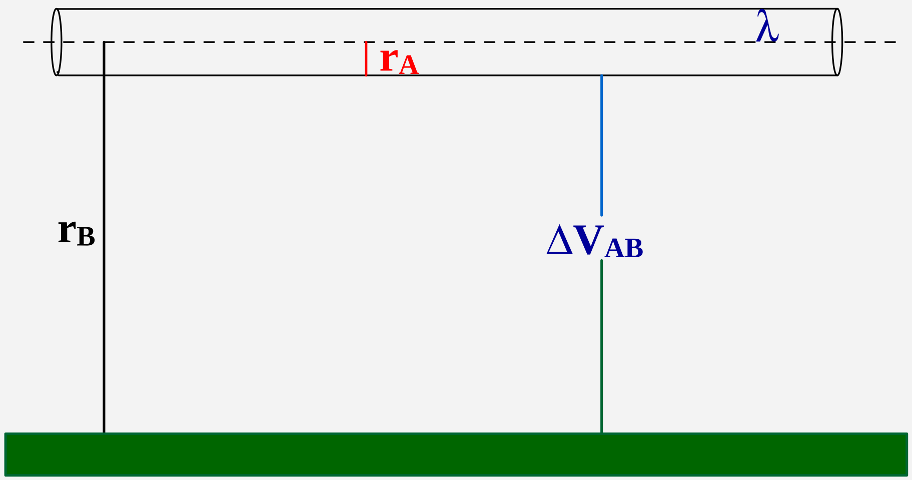

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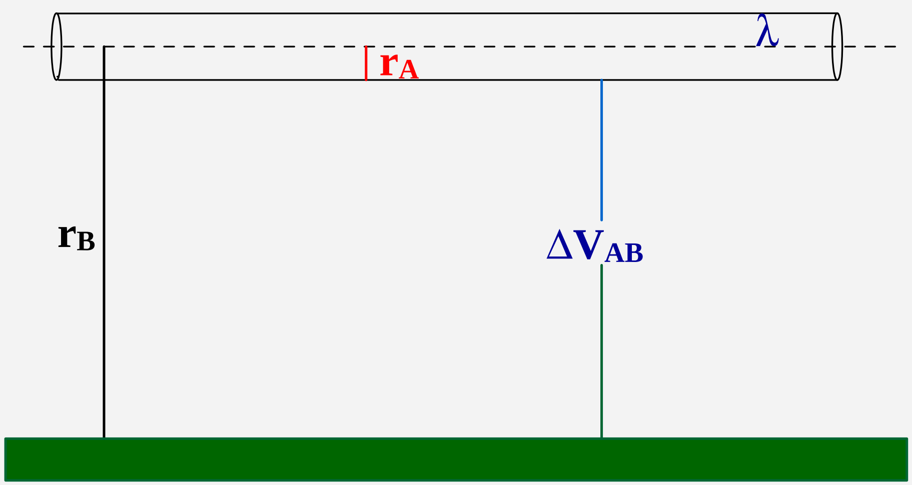

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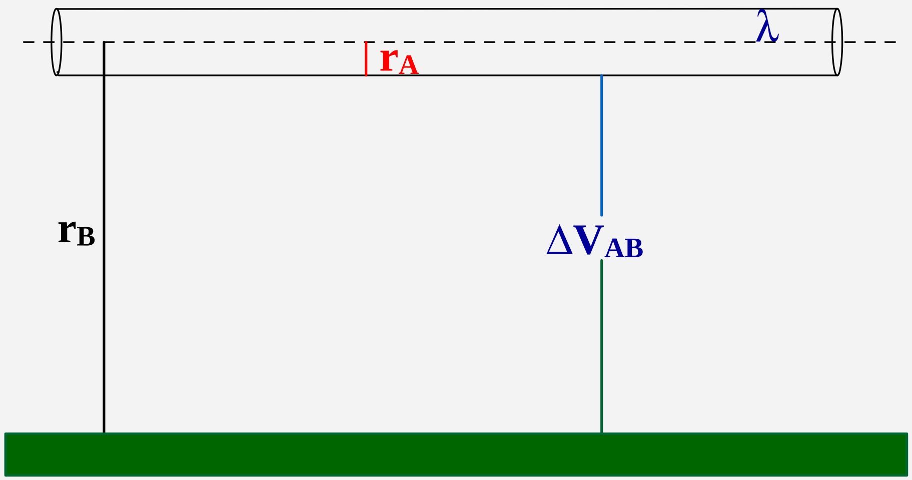

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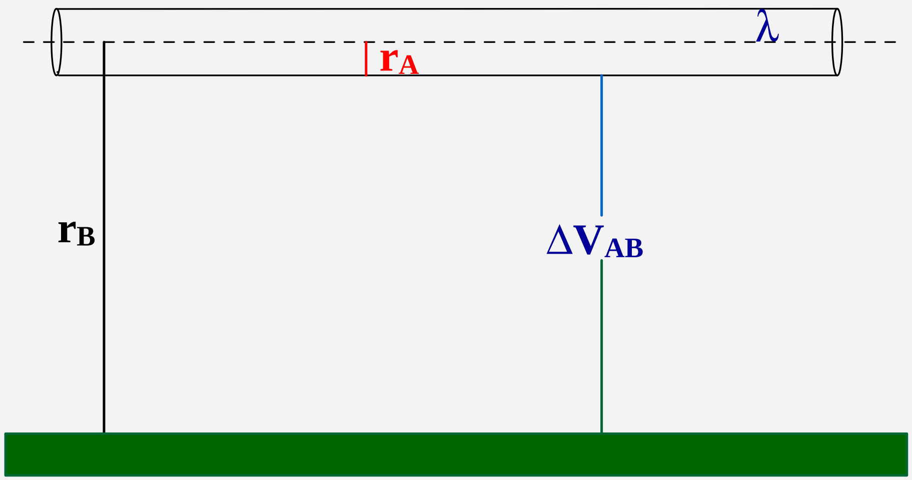

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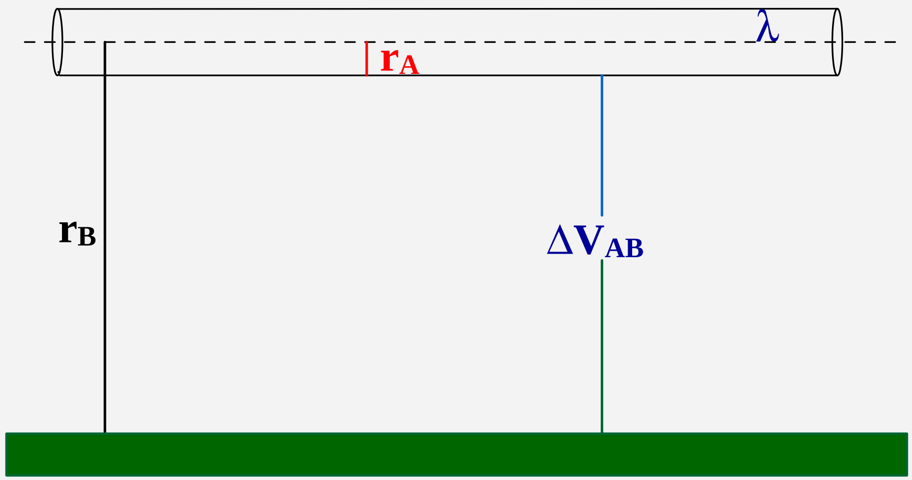

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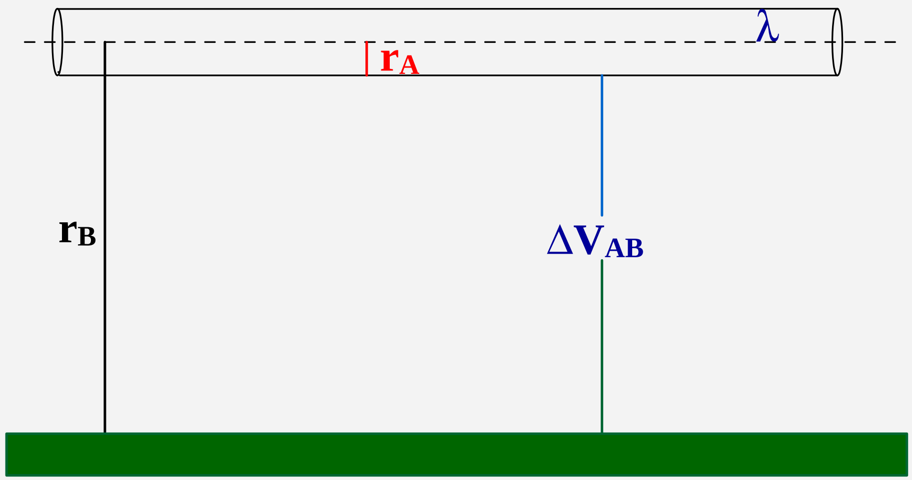

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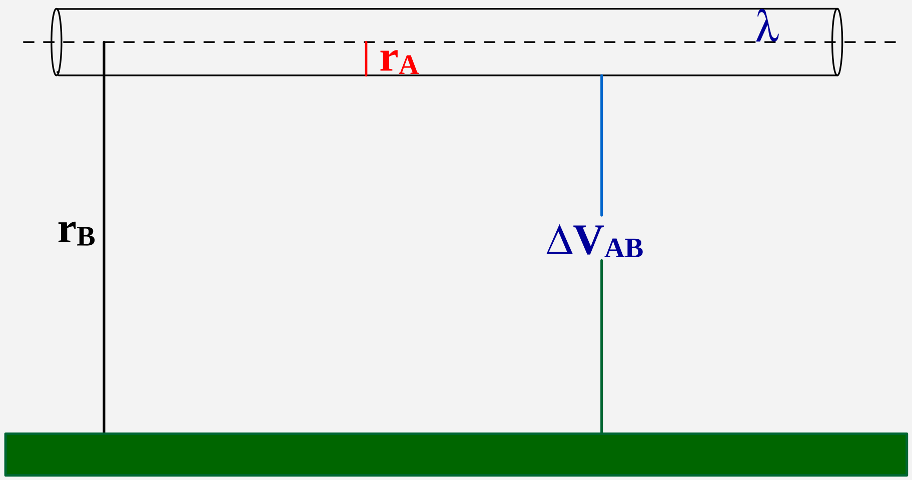

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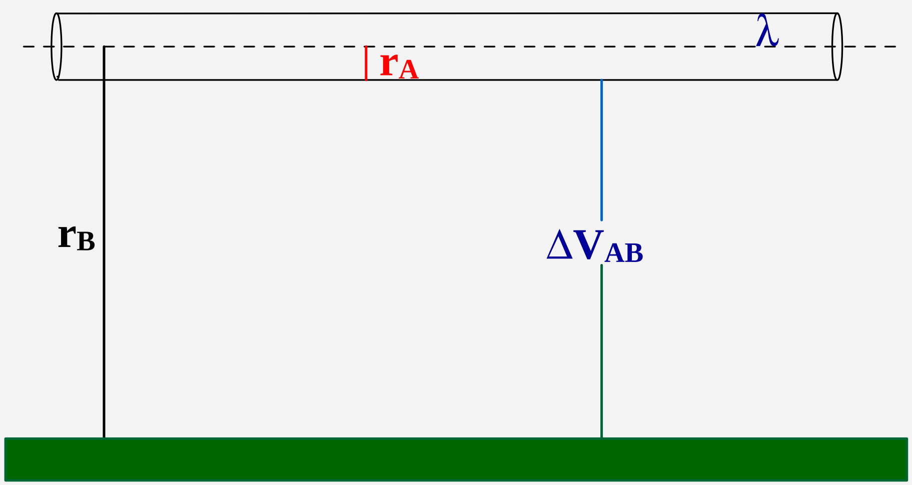

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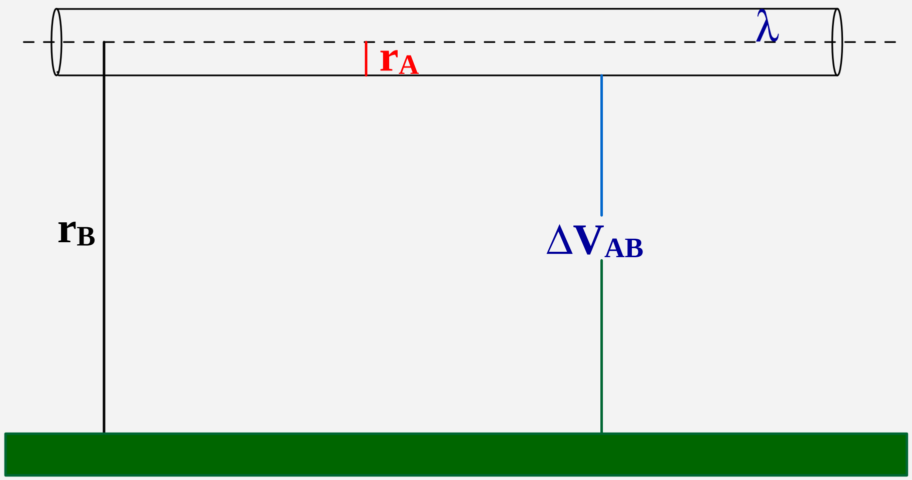

Example - Assembling Charges

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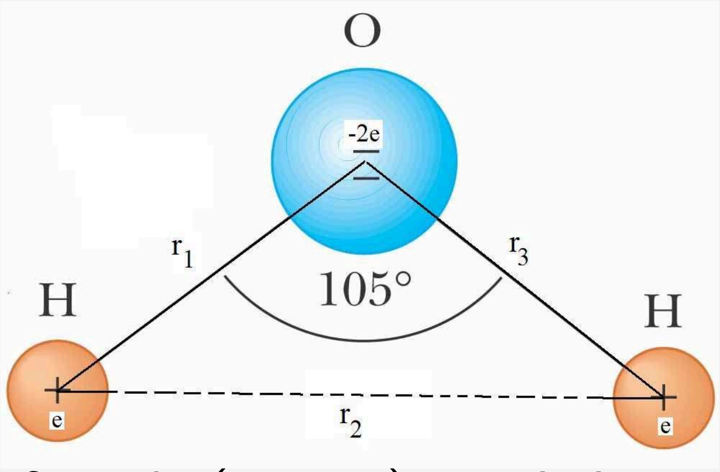

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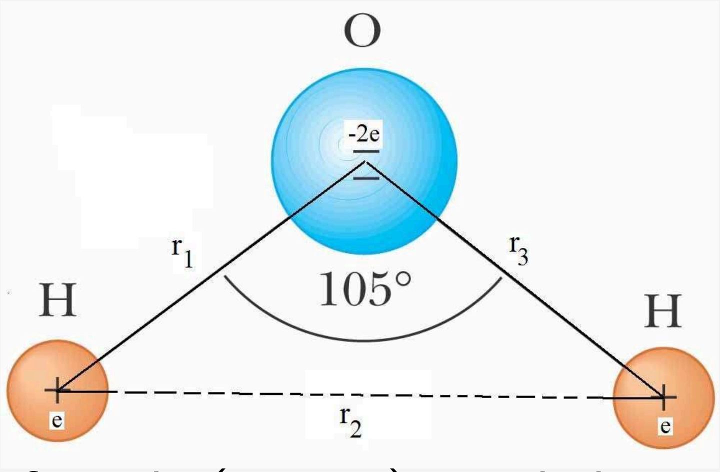

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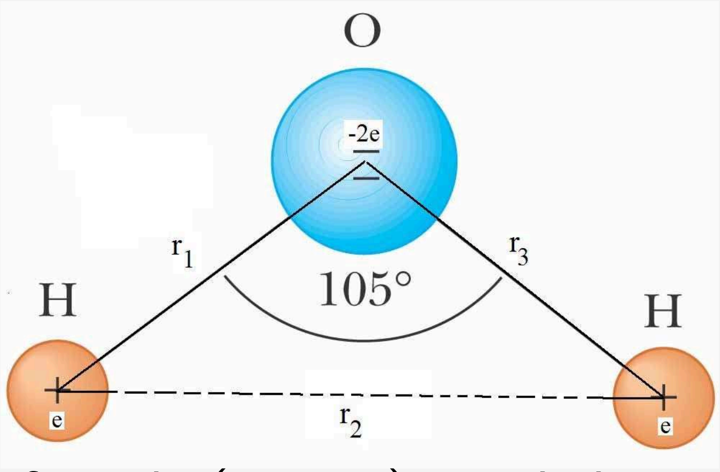

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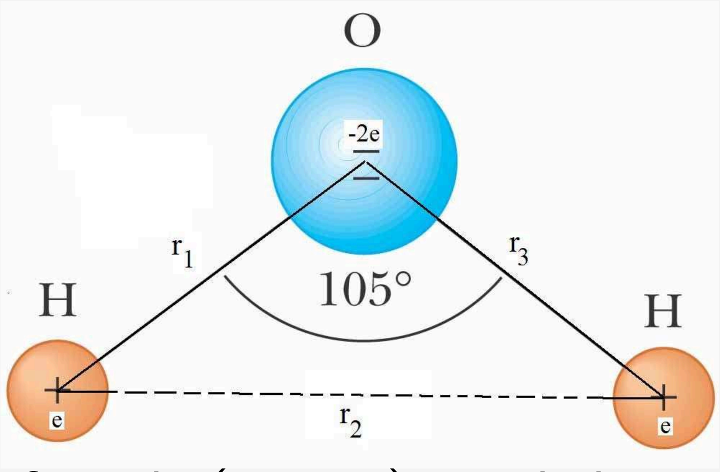

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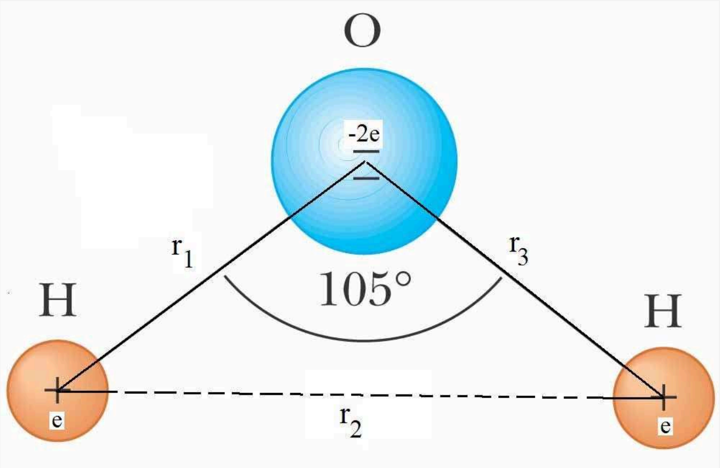

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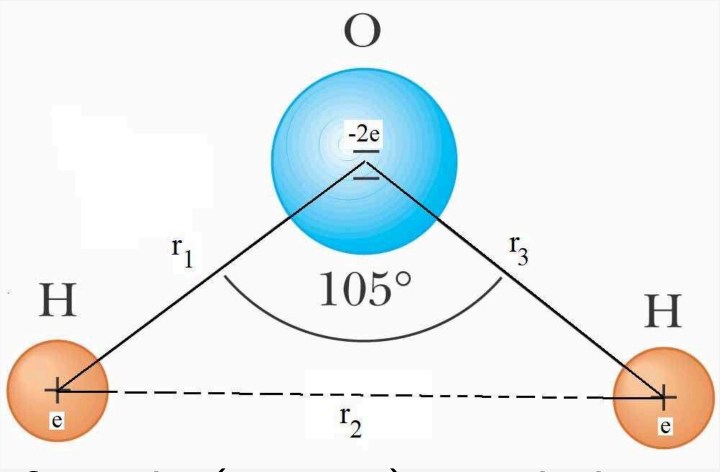

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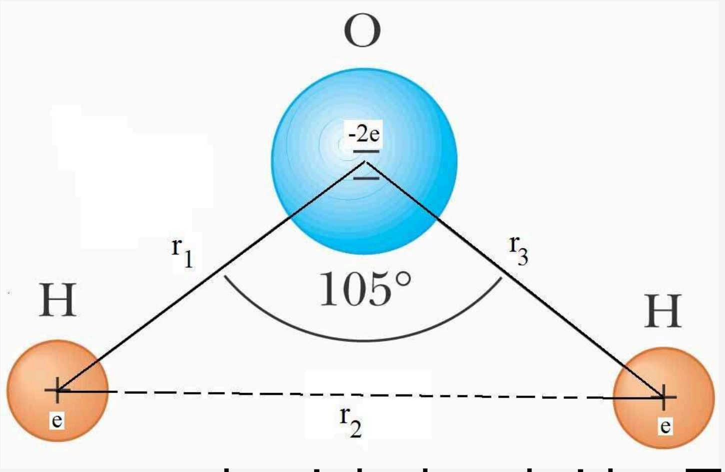

- Assemble the last charge, $+e$ on the right hand side. This charge interacts with the two potentials, V_1 and V_2, set up by the two other charges.

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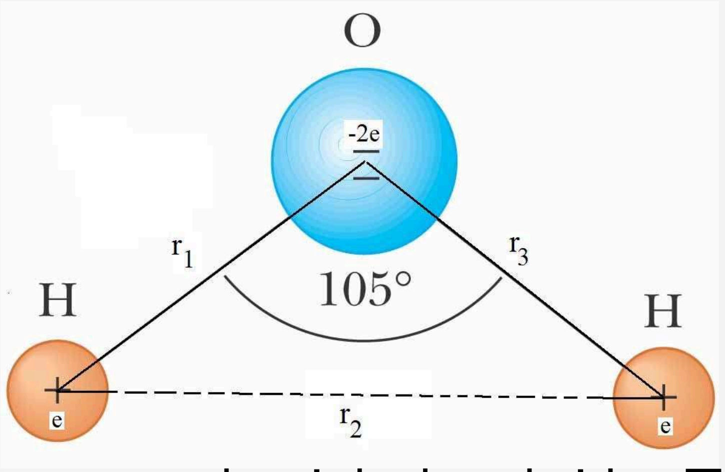

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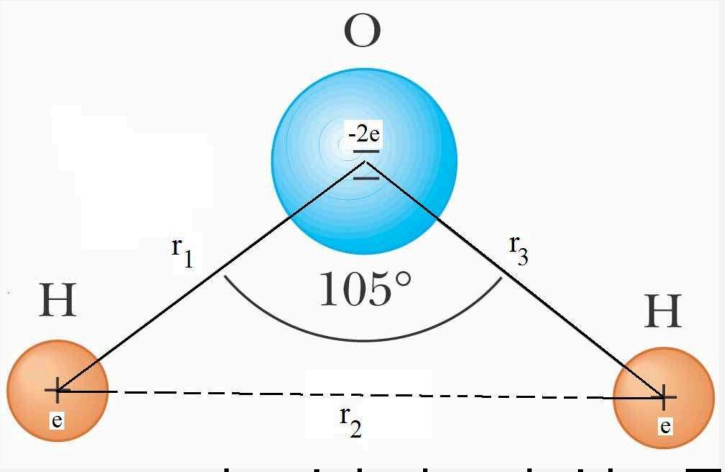

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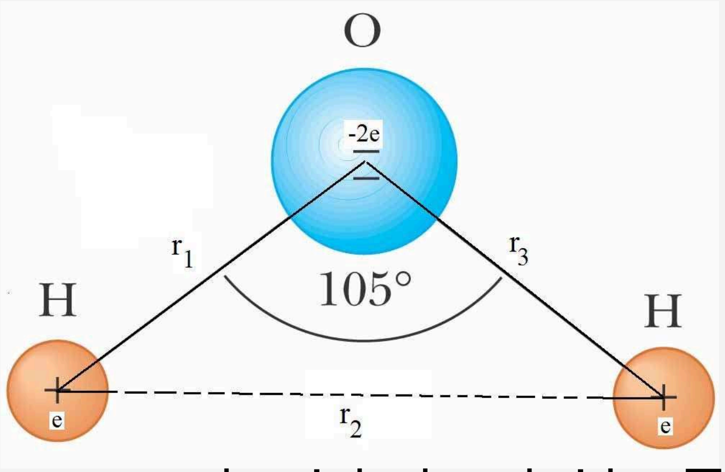

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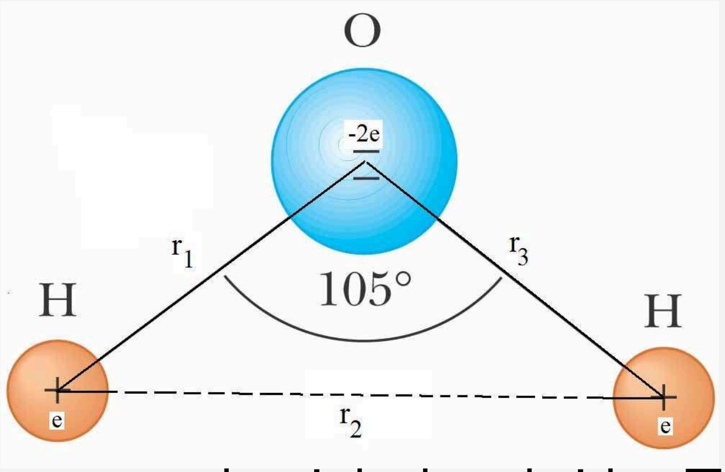

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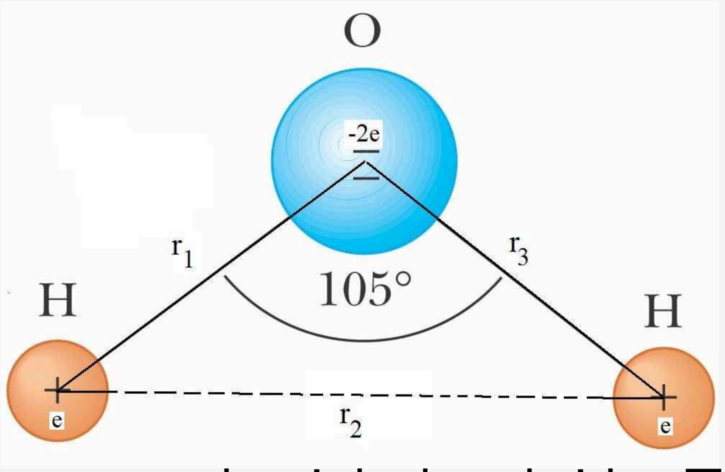

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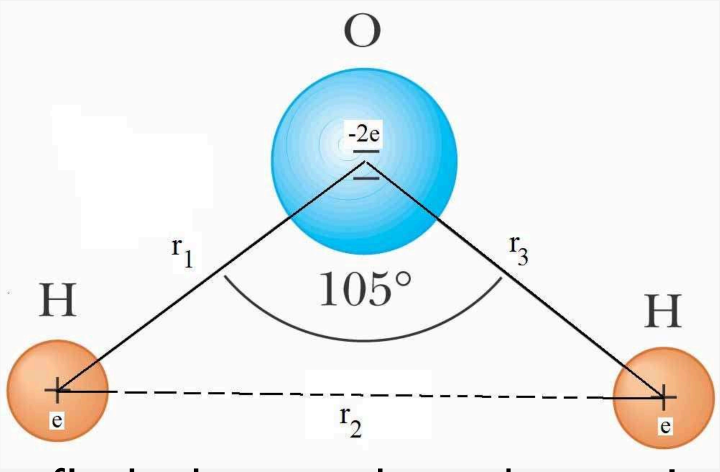
Example - Assembling Charges III



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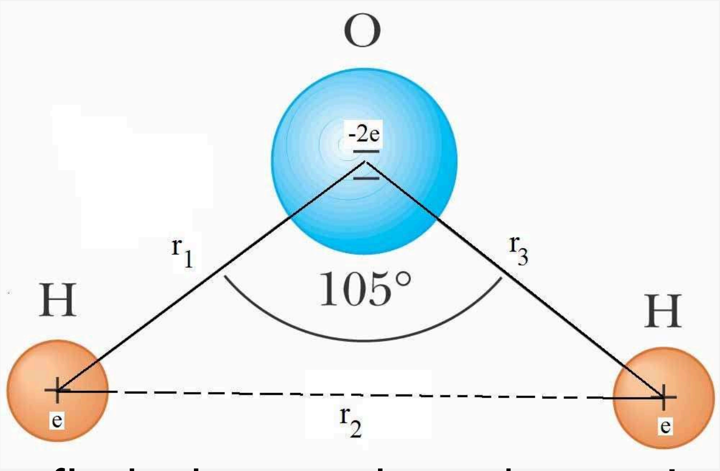

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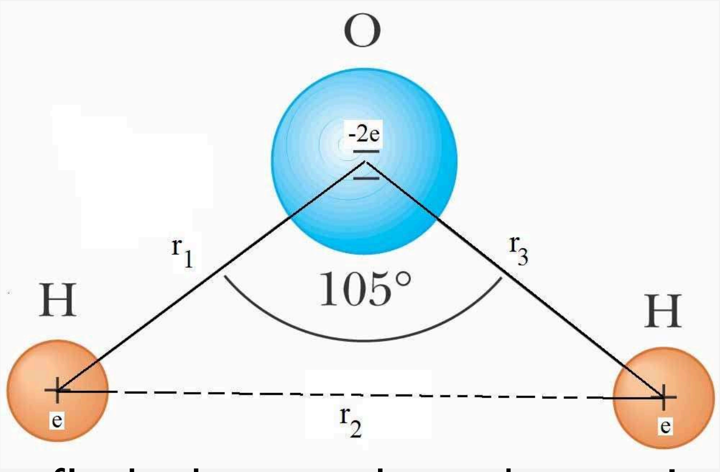

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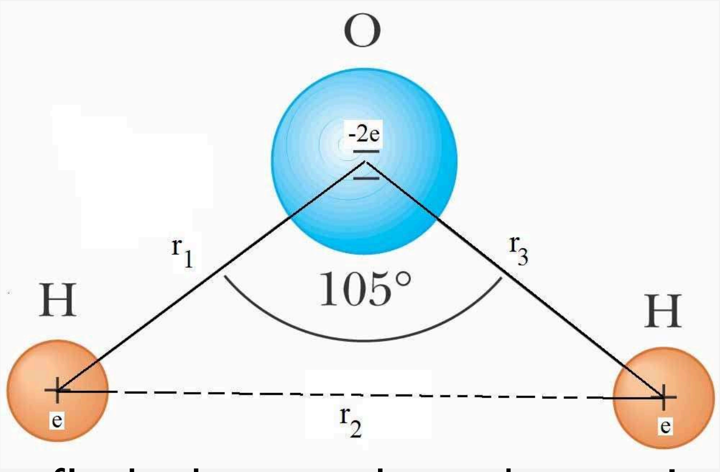

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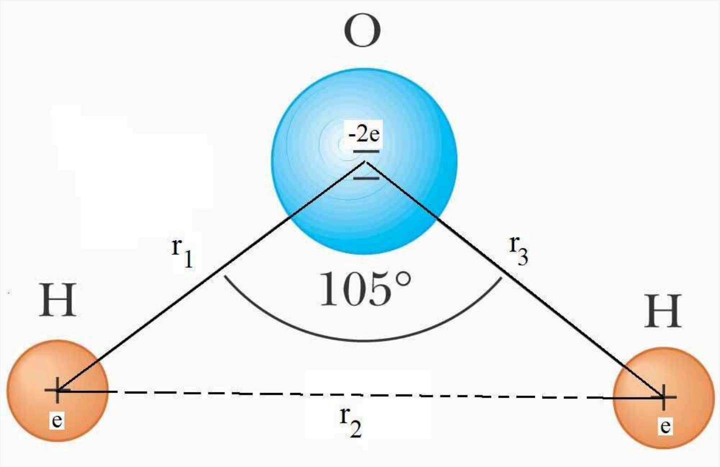

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Units

- On the last slide, we calculated a very small amount of energy in Joules. A more convenient unit of energy when dealing with atoms or molecules is the electron-Volt (eV) which is the amount of energy gained by a charge (e) passing through a potential difference of 1 V:

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$$E_l = -\frac{dV}{dl}$$

Potential Difference and $\vec{E}$-field

- Since the electric field and the potential difference are related by:

$$dV = -\vec{E} \cdot d\vec{l} = -E_l \, dl$$

$$E_l = -\frac{dV}{dl} \qquad \text{(where } E_l \text{ is the component of the electric field parallel to } l\text{)}$$