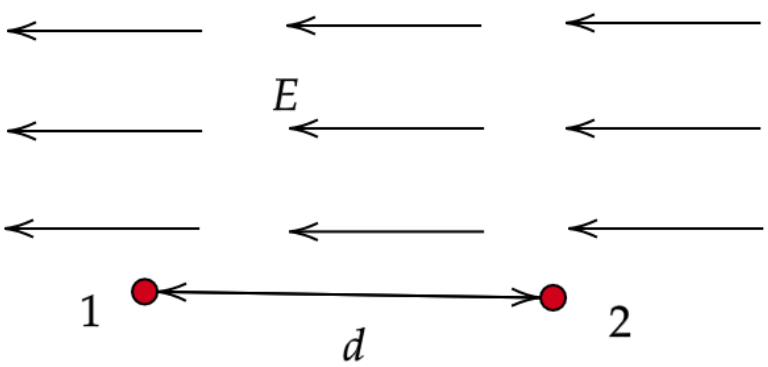
Electrostatic potential energy

- **Potential energy in electric field.**
  - Electric field produces force acting on charged particles. This force accelerates the particles changing its kinetic energy. Because energy is conserved, there must be potential energy of charged particle in electric field.
  - If electric field is uniform (constant in space) it looks very similar to the uniform gravitational field near the surface of the Earth which we discussed. We can use this analogy to establish what is the potential energy of a charged particle in electric field.



- On the figure above potential energy of a particle with charge q at point 2 is larger than at point 1 by $\Delta U_{12} = qEd$

Voltage

- **Voltage**

  - Electrostatic potential energy is always proportional to the charge of the particle:

$$\Delta U_{12} = q\Delta\phi_{12}$$

  - $\Delta\phi_{12}$ is called voltage between points 1 and 2. It is basically the difference in potential energy divided by the electric charge.

  - Voltage is convenient because it characterizes the electric field regardless of the charge someone puts in it.

  - Unit of voltage is J/C (Joule/Coulomb) which has a special name: V (Volt)

Homework

Problem 1

A particle with charge 0.003 C is moved from point 1 to point 2 against the direction of uniform electric field of 5 N/C. The distance between points 1 and 2 is 6 meters. How did the potential energy of the particle change? What is the voltage between points 2 and 1?

Problem 2

A particle with charge 0.001 C is accelerated by voltage 100 V and then it goes vertically up in the region without electric field. If the mass of the particle is 1 gram, how high will it go before starting to fall down?