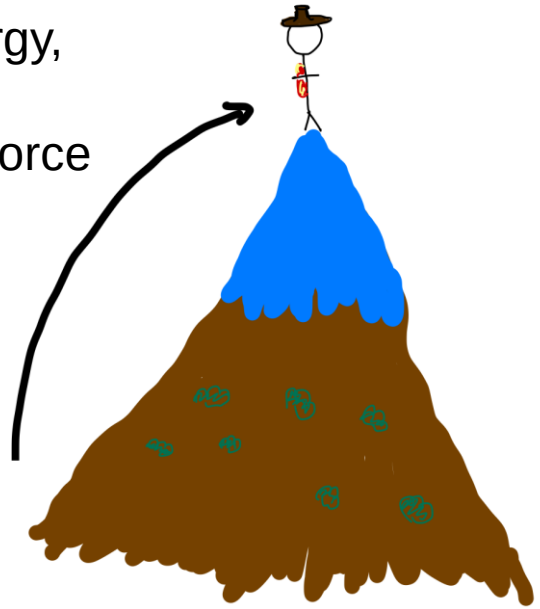
Electric potential and Voltage

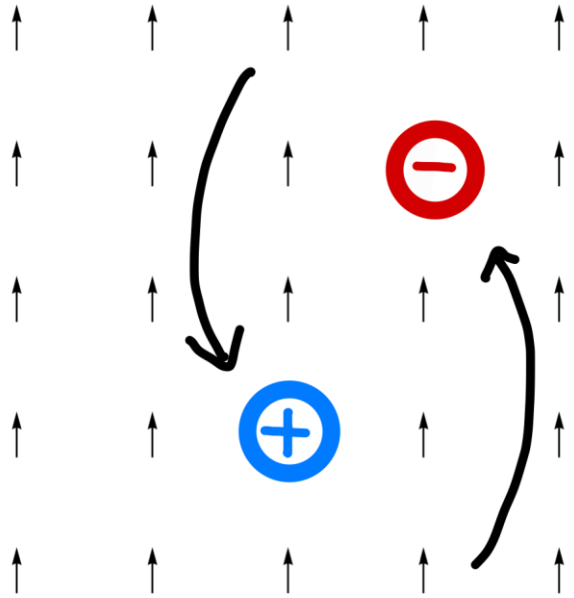
When we studied gravity, we saw that the presence of a force field implies that an object will have a potential energy that depends on its position in space. For gravity, the higher you go, the greater your potential energy becomes.

Similarly, we have found that a charge placed on an electric field will feel a force. This case will also represent a force field. Therefore, there will be some potential energy associated to the electric field and the electric charges.

Going higher increases your potential energy, since the gravitational force is pulling you downwards.



In the case of this particular electric field, bringing a positive charge down increases its potential energy (the electric force pushes it upwards).

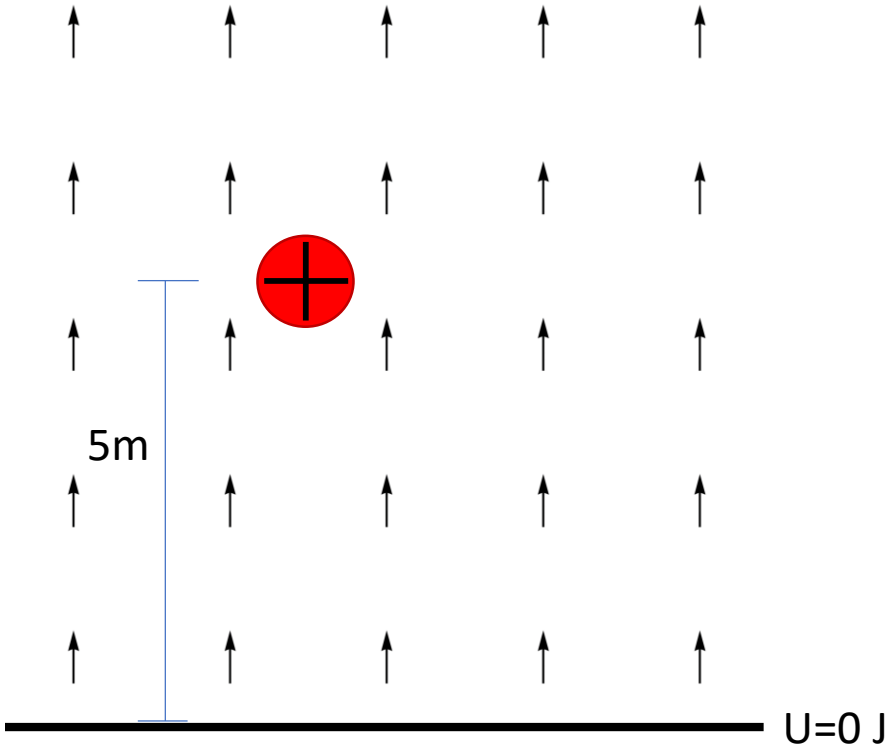


For a negative charge, the behavior changes. Moving it up increases its potential energy since the electric force pulls downwards.

Notice that in order to find the potential energy at each point we need the polarity of the charge, its magnitude and a reference value of the energy. For some applications this can be difficult and confusing

Homework

Problem 1. Suppose that we have a uniform electric field with a magnitude of E = 3N/C. We now place a positively charged particle with a charge of q_1=2C, and this charge is placed 5m above the point at which we defined the potential energy to be U=0 J (see the figure below). Find the potential energy of the charged particle at this point.



Bonus. Redo the problem above, but consider that instead of a positive particle we decided to place a negative particle.