

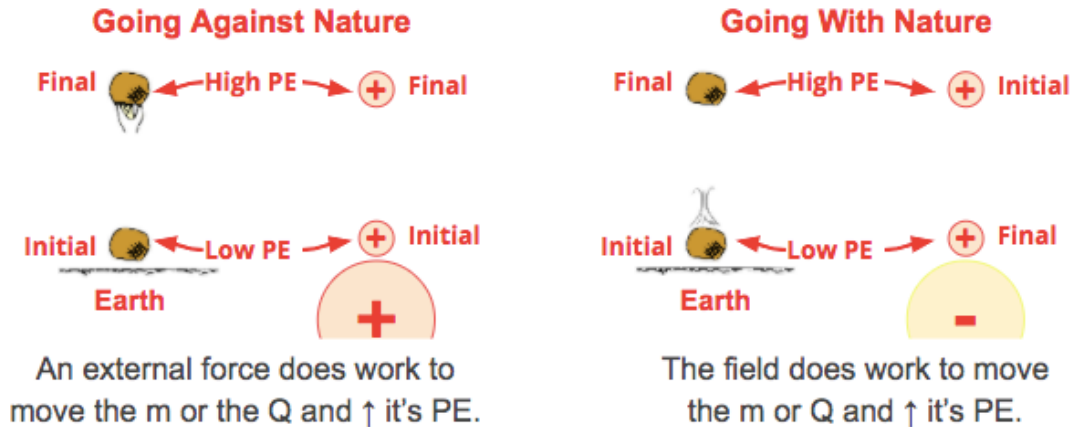
Electric Potential Lesson Notes

Learning Outcomes

- What is electric potential and how is it related to electric potential energy?

Electric Potential Energy ... Revisited

The movement of a charge (**Q**) within an electric field is accompanied by a change in potential energy (**PE**).



Factors Affecting Gravitational Potential Energy

The gravitational potential energy (PE_{grav}) depends upon the mass (**m**) and the height (**h**) of the object.

- As the **h** is doubled, the PE_{grav} is doubled.
- As the **m** is doubled, the PE_{grav} is doubled.

Gravitational potential energy is more than just a location-dependent quantity. Mass also factors into the equation.



Gravitational Potential

The gravitational potential is defined as the potential energy per mass (Joule/kilogram).



Gravitational potential is a purely location-dependent quantity that rates a location in terms of the energy stored in the gravitational field per kg of mass.

Factors Affecting Electrical Potential Energy (PE_{elect})

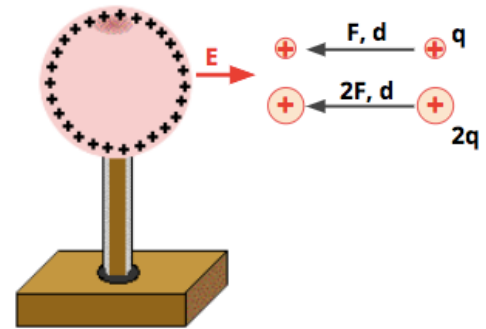
Work is done to move a + test charge against an E field.

The work done changes the PE_{elect} and is equal to the ΔPE_{elect} .

Moving twice the charge ($2q$) the same distance d would require twice the work and change the PE_{elect} by twice the amount.

So like PE_{grav} , electric PE depends on two factors:

1. location
2. the amount of test charge at that location.

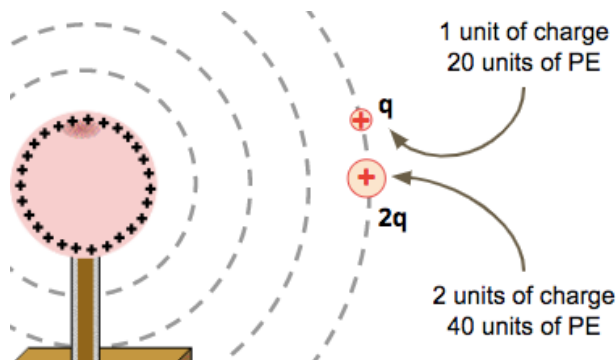


Electric Potential

The electric potential (V) describes the amount of energy (PE) stored in an electric field at a location in a way that is independent of the amount of test charge (q).

Electric Potential

$$V = PE/q$$



An object with twice the charge ($2q$) would have twice the PE ...
... but the same electric potential (PE/charge) at that same location.

Electric Potential in Circuits

- Battery-powered electric circuits have locations of high and low electric potential.
- Outside the battery, a + test charge would move from the + terminal to the - terminal (in the direction of the E field). This results in a loss of electric potential energy.
- So the negative terminal is the low PE, low electric potential terminal.
- Inside the battery, work is done to move a + test charge from - to + terminal, against the E field. This adds PE to the + test charge. So the + terminal is the high PE, high electric potential terminal.

