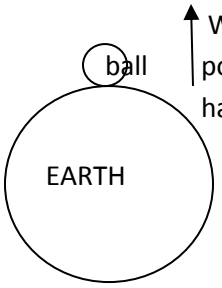
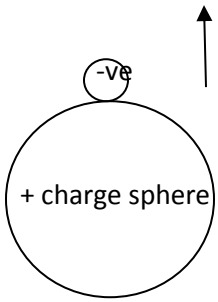
Electric Potential Difference

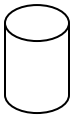
We have established that electricity is the movement of electrons through a conductor but **why** are they moving? It is convenient to use the gravity analogy and remember the work-energy theorem.



Work done against gravity to lift up. Therefore, increase in gravitational potential energy stored. When we allow the ball to drop, it loses Eg but has the ability to do work for us.



It also takes work to separate opposite charges and by doing so, there is an increase in electric potential energy. It we allow the opposite charges to come together, we lose electric potential energy, but gain the ability to do work.

Consider 2 batteries:  1.5 V  9 V ** light will be brighter with 9 V!

Both batteries allow electrons to flow but the 9 V battery can do more work – it has more energy in each electron! (…or coulomb bundle of electrons). Just like a basketball has more energy if we lift it higher!

So.. $V = E/Q$ … or energy / coulomb ….. 1 volt = 1 J/C

But remember the work-energy theorem -- doing + work, stores energy, so you can also consider

$V = W/Q$

We usually measure differences in electrical potential (change from point A to point B), so we call is **electric potential difference** (**symbol, V**). So, work done on an electric charge is equal to the gain in electrical potential. The unit of measure is the **volt** (V).

$$V = W/Q$$

There is 1 volt gain if 1 joule of work is done one 1 coloumb of electrons moving from A → B

Voltage gains occur in batteries and generators (hydro-electric generators, solar panels, wind turbines etc.)

There is 1 volt drop if 1 joule of energy was released by 1 coloumb of electrons moving from A → B

Voltage drops occur in loads (lights, computers, cell phones, hair dryer, anything that uses electricity)