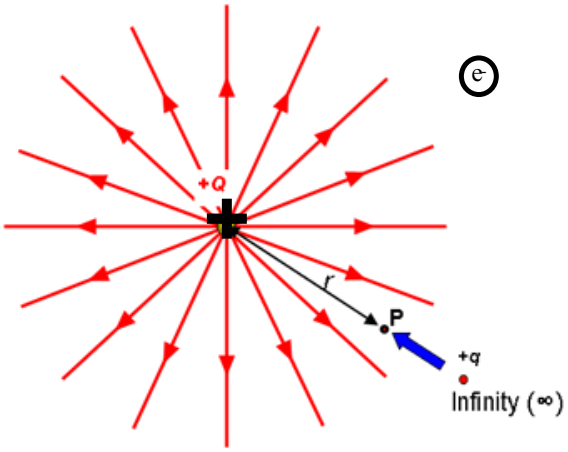
Electric Potential Energy (EPE), Electric Potential and Potential Difference (Voltage)

Remember...potential energy is stored energy, the potential to do some work
a mass gets gravitational potential energy when it is in a gravitational field

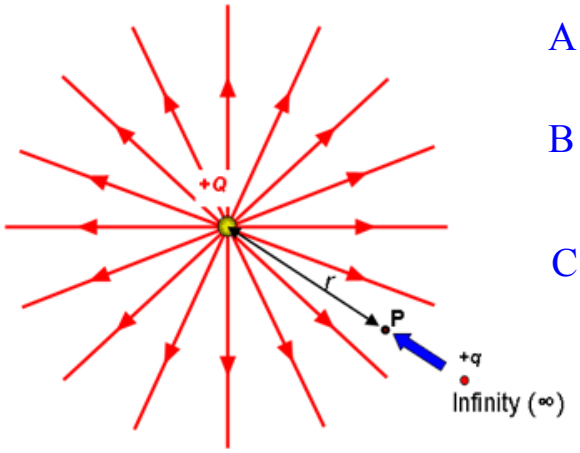
Electric Potential Energy (J) is also stored energy, the potential to do some work
a charge gets electric potential energy when it is in an electric field



An electron will gain EPE as work is done to force it away from the positive charge
Work is done against the field.
What does this work in an electrical circuit?

Electric Potential (J/C) is the amount of electric potential energy per Coulomb of charge.

$$\text{Electric Potential} = \frac{EPE}{Q}$$

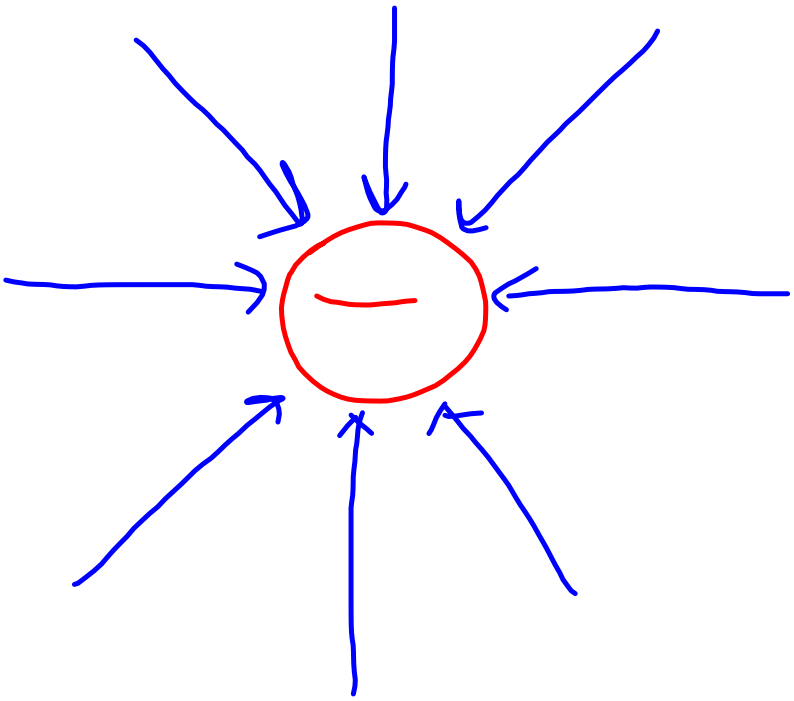


A Where is the Electric Potential zero?

B Where is there Electric Potential greater than zero?

C Where is the Electric Potential the greatest?

Its like stretching an elastic band...




e⁻

Potential Difference (J/C) is the energy required to move a charge from lower potential to higher potential. This is also called ***voltage (measured in volts - V).***

$$\text{Potential Difference} = \frac{\Delta \text{ Energy}}{Q} \qquad V = \frac{\Delta E}{Q}$$

OR

$$\text{Potential Difference} = \frac{\text{Work done}}{Q} \qquad V = \frac{W}{Q}$$

***A 12V battery gives 12J of energy to each Coulomb of charge.*
It is this energy that makes electrons flow in a circuit!

1. How much work must be done to increase the potential of a 3.0×10^{-7} C charge by 120V?

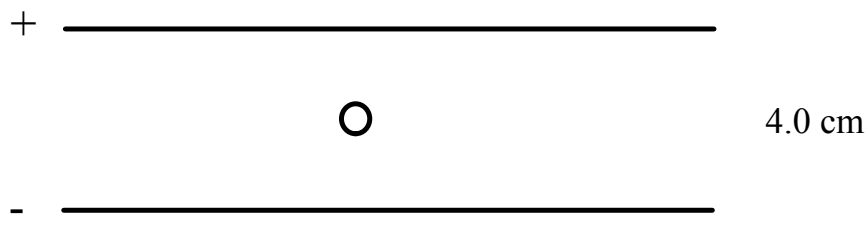
2. It takes 4.2mJ of energy to move an electron from position X to position Y in an electric field. What is the potential difference (voltage) between points X and Y?

3. A 1.5×10^{-5} C charged particle has mass of 1.0×10^{-5} kg. It is releasedform rest at position 1 which has a potential 12V higher than position 2.

(a) What will happen to this particle?

(b) What is its speed at position 2?

4. A small negatively charged sphere with a mass of 4.5×10^{-6} kg is suspended electrostatically between oppositely charged horizontal parallel plates as shown. A potential difference of 360 V is required across the plates to hold the charged sphere stationary.



Calculate the magnitude of the charge on the sphere.

$F_e = F_g$

5. A bird lands on a point on a bare transmission wire with potential of 20 000V. Why is the bird not electrocuted?

Both of the bird's feet are in contact with portions of the wire at the same voltage. There is no potential difference across the bird, so no charges move- no current.

Sources of electrical energy Read Page 598 Table 14.2