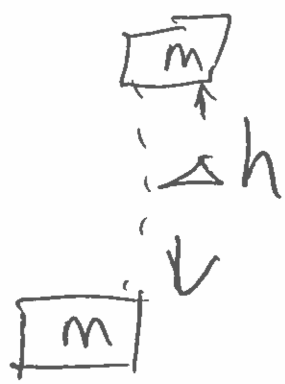
$$W_{field} = -\Delta U_{field}$$

$$W_{ext} = +\Delta U_{field}$$

work is done by a force

energy is possessed by an object.



$$W_{grav} = -mg\Delta h$$

$$W_{ext} = +mg\Delta h$$

$$\Delta U_{grav} = +mg\Delta h$$

Forces have associated potential energy when the force is conservative!

$$\Delta U_{el} = Q\Delta V = W_{ext}$$

$W_{ext} = -6.0 \times 10^{-5}\,J$ moving q $+3.0\,\mu C$ from point A to point B, what is

$$\Delta V_{A\to B} = V_B - V_A$$

$$Q(\Delta V_{A\to B}) = W_{ext}$$

$$V_B - V_A = \frac{W_{ext}}{Q} = \frac{-6.0 \times 10^{-5}\,J}{3.0 \times 10^{-6}\,C}$$

$$\boxed{V_B - V_A = -20.\ V}$$

which is greater voltage A or B?

$$V_B - V_A < 0$$

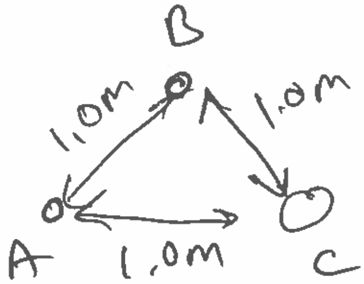
$\Rightarrow$ V_A is greater voltage

V for a point charge is

$$V_{\substack{pt \\ ch}} = \frac{kQ}{r}$$

If more than 1 charge

$$V_{TOT} = \Sigma V_i$$



$Q_A = -3\,\mu C$

$Q_B = +6\,\mu C$

$V_C = ?$

$$V_C = V_{A\,at\,C} + V_{B\,at\,C}$$

$$V_C = \frac{kQ_A}{r_{AC}} + \frac{kQ_B}{r_{BC}} = k\left(\frac{Q_A}{r_{AC}} + \frac{Q_B}{r_{BC}}\right)$$

$$V_C = \left(8.99 \times 10^9 \frac{Nm^2}{C^2}\right)\left[\frac{-3 \times 10^{-6}\,C}{1.0\,m} + \frac{6 \times 10^{-6}\,C}{1\,m}\right]$$

$\left(\frac{Nm^2}{C^2}\right)\frac{C}{m}$

$$V_C = -2.7 \times 10^4\,V + 5.4 \times 10^4\,V$$

$\frac{Nm}{C} = \frac{J}{C}$

$$\boxed{V_C = 2.7 \times 10^4\,V}$$

How much work would an external force do to put a $-6.0\ \mu C$ charge at point c?

$$W_{ext} = Q\Delta V$$

for a pt charge $V = \frac{kQ}{r}$ what if $r = \infty$

$$V(r=\infty) = \frac{kQ}{\infty} \rightarrow 0$$

$$W_{ext} = Q\Delta V = Q(V_c - V_\infty)$$

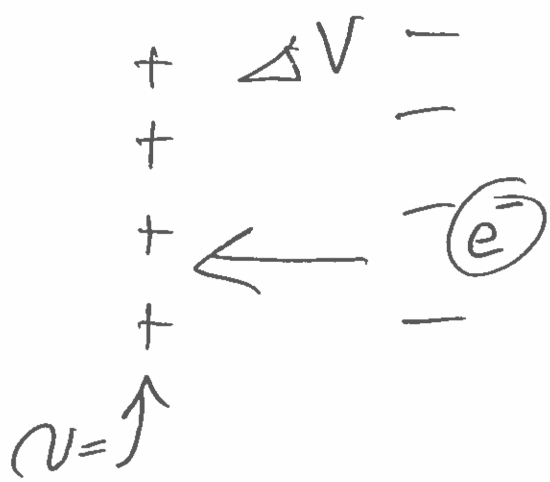
$$W_{ext} = Q V_c$$

$$W_{ext} = (-6 \times 10^{-6}\ C)(2.7 \times 10^{4}\ V)$$

$$W_{ext} = -16.2 \times 10^{-2}\ J$$

$$\boxed{W_{ext} = -0.162\ J}$$

charges are attracted or repelled by ΔV



$\Delta V = 100V$

Assume e^- is at rest on negative side of ΔV how fast when it reaches positive side.

$W_{\text{electric force}}$ is conservative

$$\sum W_{\substack{non \\ cons}} = 0 = \Delta E$$

$$E_- = E_+$$

$$U_{el} = \frac{1}{2} m v_f^2$$

$$(e\Delta V)\ \cancel{\frac{k(e)}{r}} = \frac{1}{2} m_e v_f^2$$

$$e\Delta V = \frac{1}{2}mv^2$$

$$v^2 = \frac{2e\Delta V}{m}$$

$$v = \sqrt{\frac{2e\Delta V}{m}} = \sqrt{\frac{2(1.6\times10^{-19}\,C)(100\,V)}{9.11\times10^{-31}\,kg}}$$

$$\boxed{v = 5.93\times10^{6}\ m/s}$$

common unit of atomic energy
is electron-volt eV

1 electron-volt is energy gained by 1 electron
being accelerated by a 1 Volt potential
difference.

electron in ground state of hydrogen
has -13.6 eV of energy.

If you apply 13.6 Volts to Hydrogen
you ionize Hydrogen.

$$1\,eV = (e)(1\,V) = (1.6\times10^{-19}\,C)(1\,V)$$

$$\boxed{1\,eV = 1.6\times10^{-19}\,J}$$

$$U_{e^-\text{ in } H} = (-e)\,V_H$$

$$V_H = \frac{kQ}{r} = \frac{\left(8.99\times10^{9}\,\frac{Nm^2}{C^2}\right)\left(1.6\times10^{-19}\,C\right)}{\left(5.29\times10^{-11}\,m\right)} \leftarrow \text{Bohr radius}$$

$$V_H = +27.2\,V$$

$$U_{e^-} = (-1.6\times10^{-19}\,C)(27.2\,V)$$

$$\boxed{U_{e^-} = -4.35\times10^{-18}\,J}$$

$$13.6\times1.6\times10^{-19} = -2.17\times10^{-18}\,J$$ – Total energy

$$K = +2.17\times10^{-18}\,J$$