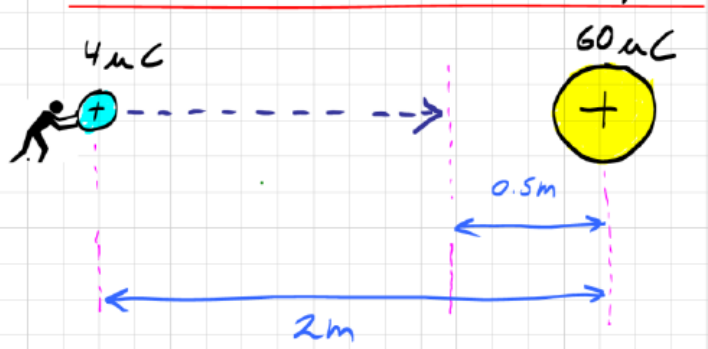
Example Solutions

Note Title

ELECTRIC POTENTIAL STARTER EXAMPLES

1/7/2015

1



$W = \Delta E_p$ WORK TO MOVE PARTICLE = CHANGE IN POTENTIAL ENERGY

$$W = E_{p_2} - E_{p_1}$$

$$W = \frac{kQq}{r_2} - \frac{kQq}{r_1}$$ (SIGN OF CHARGE IS IMPORTANT.)

$$W = \frac{9.0\times10^9(4\times10^{-6})(60\times10^{-6})}{0.5\text{m}} - \frac{9.0\times10^9(4\times10^{-6})(60\times10^{-6})}{2\text{m}}$$

$$W = 4.32\text{ J} - 1.08\text{ J}$$

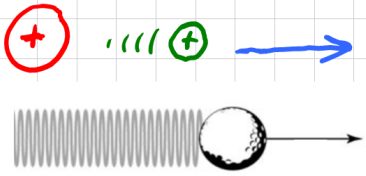
$W = 3.24$ J

(2) CONSERVATION OF ENERGY

$$E_{p_1} + KE_1 = E_{p_2} + KE_2$$

$$KE_1 - KE_2 = E_{p_2} - E_{p_1}$$

REPELLED LIKE A SPRING



Just like a spring **Potential Energy** is turned into **Kinetic Energy** upon release.

$$\boxed{-\Delta KE = \Delta E_p}$$ REMEMBER THIS

or

$$\boxed{-\Delta E_p = \Delta KE}$$ TRUE

EXPLANATION: LOSS OF POTENTIAL ENERGY = GAIN IN KINETIC

OR VICE VERSA

LAW OF CONSERVATION OF ENERGY

$$-\left(\tfrac{1}{2}mv_2^2 - \tfrac{1}{2}mv_1^2\right) = \Delta E_p$$ (ZERO)

$$\boxed{\Delta E_p = Q\Delta V}$$

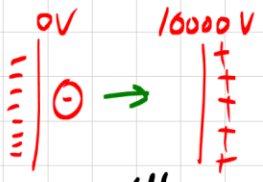
$$-\tfrac{1}{2}mv_2^2 = Q(\Delta V)$$

$$-\tfrac{1}{2}mv_2^2 = -1.6\times10^{-19}(10000V)$$

$$\tfrac{1}{2}(9.11\times10^{-31})v_2^2 = 1.6\times10^{-15}\ J$$

$$v_2 = 5.9\times10^{7}\ m/s$$

ELECTRON



200m!!!

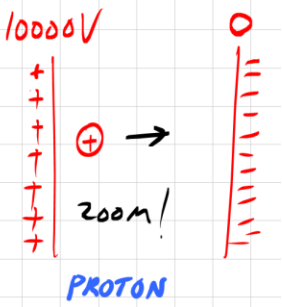
PROTON

$$-\tfrac{1}{2}mv_2^2 = Q\Delta V$$

$$-\tfrac{1}{2}mv_2^2 = 1.6\times10^{-19}(-10000\,V)$$

$$\tfrac{1}{2}(1.67\times10^{-27})v_2^2 = 1.6\times10^{-15}\,J$$

$$v_2 = 1.38\times10^{6}\ m/s$$



(3) $-\Delta KE = \Delta E_p$ $\quad E_p = Q\Delta V$

$$-\tfrac{1}{2}mv_2^2 = Q\Delta V$$

SIGNS MATTER (ENERGY)

$$-\tfrac{1}{2}(9.11\times10^{-31})(1.8\times10^{7})^2 = (-1.6\times10^{-9}C)(\Delta V)$$

$\Delta V = 922$ VOLTS!

(4) $V = V_1 + V_2$ (SIGNS IMPORTANT!)

$$V = \frac{kQ}{r_1} + \frac{kQ}{r_2}$$

SIGNS MATTER

$$V = \frac{9\times10^{9}(1.5\times10^{-6})}{5} + \frac{9\times10^{9}(-1\times10^{-6})}{3}$$

$$V = 2700\,V + (-3000)$$

$V = -300\,V$