Newton's Second Law

$$\vec{F}_{net} = m\vec{a}$$

* $\vec{F}_{net}$ and $\vec{a}$ are both vectors (choose one direction as +)
* FBDs are key to your solving the problem
* Think $\vec{F}_{net}$ as the result of a tug of war between two forces.

+

$\vec{F}_{net} = 50 - 20\ N$

$\vec{F}_{net} = +30N$

↑ to the right

+

$\vec{F}_{net} = 20N - 50N$

$\vec{F}_{net} = -30N$

↑ to the right

+

$\vec{F}_{net} = 50N + 20N = 70N$

Combining Kinematics + Dynamics

motion forces.

MP 165

$m = 9.1 \times 10^{-31}\,kg$

$v_1 = 0$

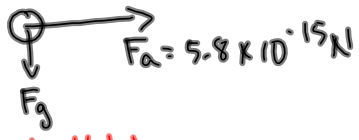
$v_2 = ?$

$F_a = 5.8 \times 10^{-15}\,N$

$\Delta d = 3.5\,mm$

Find the accelerations of the electron:

$\rightarrow +$



(negligible)

$\vec{F}_{net} = m\vec{a}$

$F_a = ma$

$a = \frac{F_a}{m}$

$a = \frac{5.8 \times 10^{-15}\,N}{9.1 \times 10^{-31}\,kg}$

$a = 6.4 \times 10^{15}\,m/s^2$

Find the final velocity:

$v_1 = 0$

$v_2 = ?$

$\Delta d = 3.5\,mm = 3.5 \times 10^{-3}\,m$

$a = 6.4 \times 10^{15}\,m/s^2$

$v_2^2 = v_1^2 + 2a\Delta d$

$v_2^2 = 0^2 + 2\left(6.4 \times 10^{15}\,\frac{m}{s^2}\right)\left(3.5 \times 10^{-3}\,m\right)$

$v_2 = 6.7 \times 10^{6}\,\frac{m}{s}$

kinematics $\longleftrightarrow$ a $\longleftrightarrow$ dynamics

$(v_1, v_2, \Delta d, \Delta t)$ (F_{net}, m)

MP|166

$\vec{F}_a = 9.50\,N\,[S]$

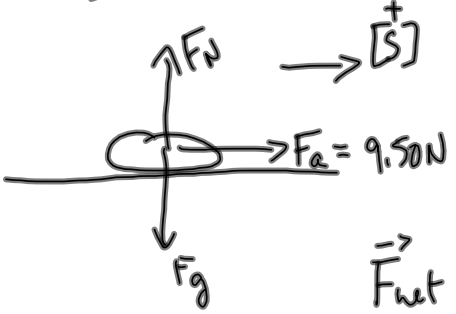
$m = 20.0\,kg \quad \vec{v}_1 = 0$

$\Delta t = 1.86\,s$

a) $\vec{a}_{ave} = ?$

b) $\vec{v}_2 = ?$

Find the acceleration:



$\vec{F}_{net} = m\vec{a}$

$\vec{F}_a = m\vec{a}$

$\vec{a} = \dfrac{\vec{F}_a}{m}$

$\vec{a} = \dfrac{9.50\,N\,[S]}{20.0\,kg}$

$\vec{a} = 0.475\,\dfrac{m}{s^2}\,[S]$

Find v_2:

$v_1 = 0$

$\Delta t = 1.86\,s$

$\vec{a} = 0.475\,\dfrac{m}{s^2}\,[S]$

$v_2 = ?$

$\vec{a} = \dfrac{\Delta \vec{v}}{\Delta t}$

$\vec{a} = \dfrac{\vec{v}_2 - \vec{v}_1}{\Delta t}$

$\vec{a}\Delta t = \vec{v}_2 - \vec{v}_1$

$\vec{v}_2 = \vec{v}_1 + \vec{a}\Delta t$

$\vec{v}_2 = 0 + \left(0.475\,\dfrac{m}{s^2}\,[S]\right)(1.86\,s)$

$\vec{v}_2 \doteq 0.884\,\dfrac{m}{s}\,[S]$

TO DO

① PP|168

② Assignment due Wed.