Quiz on 0.2 reading:

According to Galileo, the strength of a plank of wood is proportional to:

a) its cross-sectional area ✓

b) its volume

c) its density

d) its surface area ~ 1/2 credit

e) its linear density

Reading due 1/27: 1.1, 1.2

Solutions to HW assigned 1/20

0-6: $134\,mg \times \frac{1g}{1000mg} \times \frac{1kg}{1000g} = 134 \times 10^{-6}\,kg$

$= \boxed{1.34 \times 10^{-4}\,kg}$

0-13: The units are wrong:

$1.54\,m/s^2 \times 3.29\,s = 5.07\,m/s$,

not $5.07\,m$.

0-18 a) b: meters

c: meters/second ← (because ct must be in meters)

k: seconds

This assumes we make the simplest choice of meters & seconds for length and time. I suppose you could choose furlongs and weeks, but it's not recommended...

b) $\frac{dy}{dt} = 0 - c\left(1 + k \cdot e^{-t/k}(-1/k)\right)$

$= c\left(e^{-t/k} - 1\right)$

c) The terminal velocity is $-c$.

d) $\frac{dv}{dt} = c\left(e^{-t/k}(-1/k) - 0\right) = -\frac{c}{k}e^{-t/k}$

e) For t large, $e^{-t/k}$ is small, so acceleration $-(\epsilon/k)e^{-t/k}$ is ~~..~~ then small.

20 a) $v_f^2 - v_0^2 = 2a\Delta x$

$a = 3g$
$v_f = 7.9\times10^3\,m/s$
$g = 9.8\,m/s^2$
$\Delta x = ?$
$R_{earth} = 6.4\times10^6\,m$
(in back of book)

v_0 = velocity of earth's rotating surface

$$v_0 = \frac{2\pi R_{earth}}{1\ day} = 4.6\times10^2\,m/s$$

To 2 sig figs, both v_f^2 and $v_f^2 - v_0^2$ equal $6.2\times10^7\,(m/s)^2$, so we can ignore v_0.

$$v_f^2 = 2a\Delta x \Rightarrow \Delta x = v_f^2/(2a) = 1.1\times10^6\,m$$

b) $1.1\times10^6\,m = 1100\,km$ is ~~..~~ too long for a practical rail gun.

Next HW, due 1/27:

Chapter 0: # 24, 25, 26, 35, 37

mass = density × volume

$$m = \rho \quad V$$

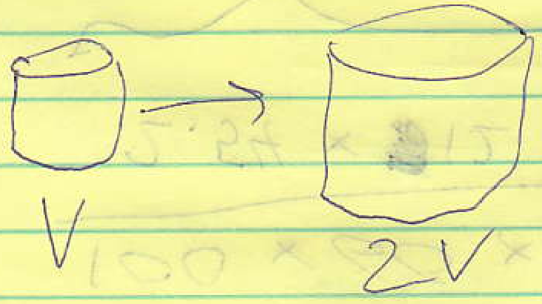
$$\rho = 1 g/cm^3 \quad (H_2O)$$

$$V = 1 m^3$$

$$m = \frac{1g}{cm^3} \times 1m^3 \times \left(\frac{\overbrace{100}^{10^2} cm}{1m}\right)^3$$

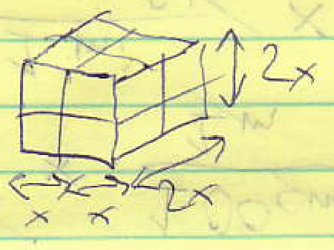
$$m = 10^6 g \times \frac{1 kg}{10^3 g} = 10^3 kg$$

Cylindrical tank.



If I double the volume but keep the shape constant, what is the ratio of the new height to the old height?

$\sqrt[3]{2}$



$(2x)^3 = 8x^3 \Rightarrow 2$ too big

$1.5^3 = 3.375$

$\Rightarrow 1.5$ too big

$V = kL^3$ $\quad 2 = \frac{V_{new}}{V_{old}} = \frac{\cancel{k} L_{new}^3}{\cancel{k} L_{old}^3}$

k depends on shape

$1.26 = \sqrt[3]{2} = \frac{L_{new}}{L_{old}} \Leftarrow \left(\frac{L_{new}}{L_{old}}\right)^3$