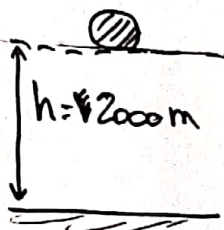


# Nondimensionalization !

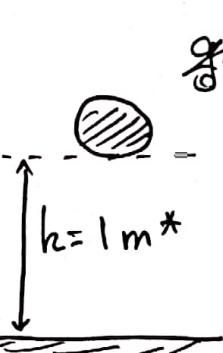
my world

example 1:

$$g = 10 \text{ m/s}^2$$

  $h = 2000 \text{ m}$   $t = \sqrt{\frac{2h}{g}} = \sqrt{\frac{4000}{10}} = 20 \text{ sec}$

Real world

  $g = 1 \text{ m}^*/\text{s}^{*2}$   $h = 1 \text{ m}^*$   $t = \sqrt{\frac{2h}{g}} = 1 \text{ s}^*$


but How many seconds is  $1 \text{ s}^*$

$$g = \frac{1 \text{ m}^*}{\text{s}^{*2}} = 10 \text{ m/s}^2 \Rightarrow \text{s}^{*2} = 400 \text{ s}^2$$

$1 \text{ m}^* = 2000 \text{ m} \rightarrow \text{s}^* = 20 \text{ s}$

As you can see the time of ball fall is  $t = 1 \text{ s}^* = 20 \text{ s}$  which is the same as real world

example 2:

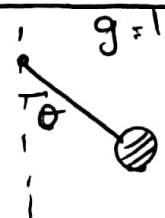
  $\ddot{\theta} = -\frac{g}{L} \sin \theta$   
 $\theta \ll 1 \rightarrow \ddot{\theta} = -\frac{g}{L} \theta$

Real world

$g = 10 \text{ m/s}^2$   
 $L = 0.1 \text{ m}$

$\rightarrow \ddot{\theta} = \frac{-g}{L} \theta = 100 \theta$   
 $\rightarrow \theta = \sin(10t)$

$\theta(t=1) = \sin(10)$

  $g = 1 \text{ m}^*/\text{s}^{*2}$   $L = 1 \text{ m}^*$  my world!

$\rightarrow \ddot{\theta} = \frac{-g}{L} \theta = -\theta$   
 $\rightarrow \theta = \sin(t)$

Now we want to calculate  $\theta$  at  $t = 1 \text{ s}$ . But so  $t = ? \text{ s}^*$

$$g = \frac{1 \text{ m}^*}{\text{s}^{*2}} = 10 \text{ m/s}^2 \Rightarrow \text{s}^* = 10 \text{ s}$$

$L = 1 \text{ m}^* = 0.1 \text{ m}$

$\rightarrow t = 1 \text{ s} = 10 \text{ s}^*$

$\Rightarrow \theta(t=1 \text{ s}) = \theta(t=10 \text{ s}^*) = \sin(10)$