

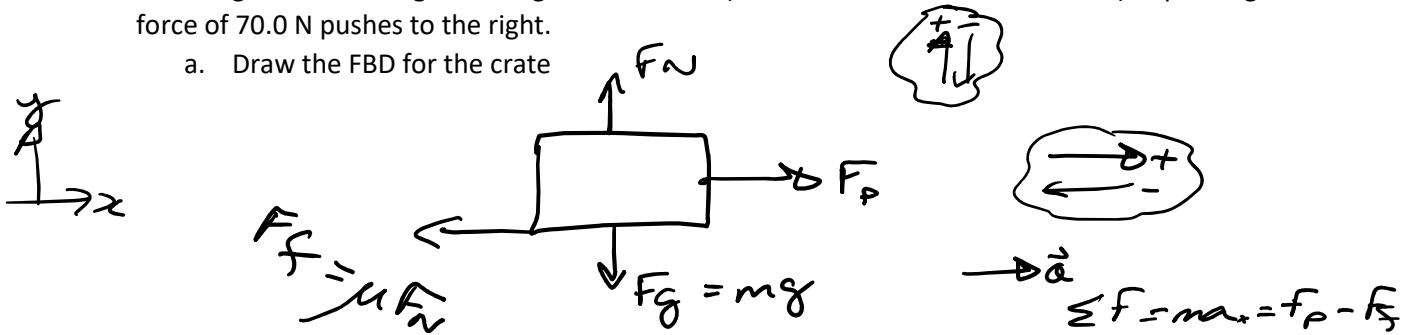
# March 5, 2024 - Physics 11 lesson

- Warm-up/review
- lesson on **elevator problems** (and other things that accelerate vertically .. e.g. helicopter, hot air balloon, etc)

## Warm up/review

1. A 25.0 kg crate is resting on a rough level surface (i.e. the surface is not frictionless). A pushing force of 70.0 N pushes to the right.

a. Draw the FBD for the crate



b. Develop (set up) the Newton's 2<sup>nd</sup> Law equation for the system.

Vertically  $\Sigma F_y = 0 = F_N - mg$  } horizontally  $\Sigma F = ma_x = F_P - F_f$   
 $a_y = 0$  }  $a_x \neq 0$   
 $a \cdot F_N = mg$  }  $ma_x = F_P - \mu mg$   
*substitution*

c. If the crate accelerates to the right at a rate of 2.50 m/s<sup>2</sup>, determine the value of the coefficient of friction between the crate and the ground. *since FN = mg in this case*

*kinetic*  $ma_x = F_P - \mu_k mg$   
 $\mu_k mg + ma_x = F_P$   
 $\mu_k mg = F_P - ma_x$   
 $\mu_k = \frac{F_P - ma_x}{mg}$

d. If the crate starts from rest, what is its speed after 5.00 seconds?

$$\mu_k = \frac{70 - (25)(2.5)}{(25)(9.8)}$$

$$\mu_k = 0.0306$$

$v_i = 0$   
 $a = 2.50 \text{ m/s}^2$   
 $t = 5.00 \text{ s}$   
 $v_f = ?$

$v_f = at + v_i$   
 $= (2.5)(5) + 0$

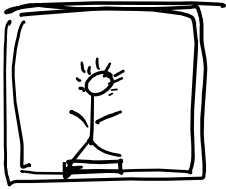
$\vec{v}_f = 12.5 \text{ m/s [to the right]}$

*velocity*

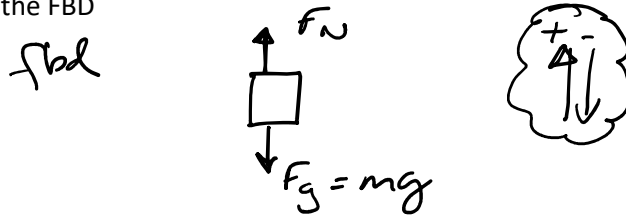
*speed*  $v = 12.5 \text{ m/s}$

2. A person is standing on a scale on an elevator (e.g. a bathroom scale, or the kind of scale you stand on in the Doctor's office to determine your weight):

Sketch



a. Draw the FBD



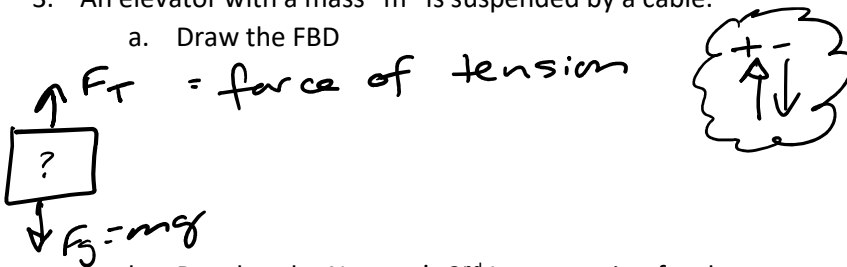
b. Develop the Newton's 2<sup>nd</sup> Law equation for the system

$$\Sigma \vec{F} = m\vec{a} = F_N - mg$$

↻ scale reading  
= apparent weight

3. An elevator with a mass "m" is suspended by a cable.

a. Draw the FBD



(how heavy you feel ... not necessarily how heavy you are)

b. Develop the Newton's 2<sup>nd</sup> Law equation for the system

$$\Sigma F = m\vec{a} = F_T - mg$$

## Dynamics worksheet booklet

- horizontal w friction: ( $\mu$ )  
# 2, 5, 7, 13, 14, ~~15~~, 19
- elevator probs: # 8, 15, 16, 20,

$\Sigma F = m\vec{a}$  probs generally (horizontal)  
1, 3, 4, 6, 9 ( $F_g = mg$ ), 17, 18, 23

concepts # 10, 11, 12

Lesson Next day **Gravitation** # 21, 22, 24, 25, 26

type in answer key  
(d)  $F_N = 7.0 \times 10^2 \text{ N}$   
and answer should have 2 sig figs.