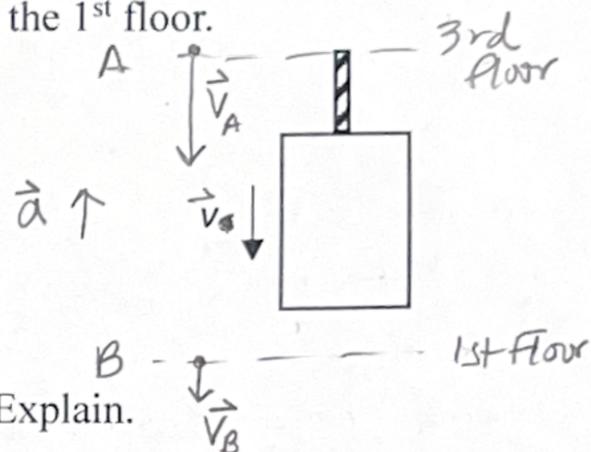


Work and Energy 3

1. **New Facts:** Copy the new facts from today's activity page into your booklet. Memorize.

2. **Elevator:** A cable is used to move an elevator. This elevator is moving down with decreasing in speed. Initial time: when it passes the 3rd floor. Final time: when it passes the 1st floor.

a. Sketch and Translate, but don't choose a system yet.



b. Compare the magnitudes of the tension force and the gravitational force. Explain.

$T > F_G$ because the acceleration vector points up, which means $\Sigma \vec{F}_{on\ el.}$ points up, so T must be greater than F_G

c. Choosing the system as the elevator and the Earth, complete the following steps:

- Simplify and Diagram
- Represent mathematically

Initial time: When passing 3rd floor Final time: When passing 1st floor

Ext forces: \vec{T} of cable

Work: $\vec{T} \uparrow \Delta \vec{r} \downarrow \} W_{c on el}$ is -

"c" means cable

$E_i + \Sigma trans. = E_f$

$K_A + U_{GA} + W_{c on el} = K_B + U_{GB}$

d. Choosing the system as the elevator only, complete the following:

- Simplify and Diagram
- Represent mathematically

Initial time: When passing 3rd floor Final time: When passing 1st floor

Ext forces: \vec{T} and \vec{F}_G

Work: $\vec{T} \uparrow \Delta \vec{r} \downarrow \} W_{c on el}$ is -

$\vec{F}_G \downarrow \Delta \vec{r} \downarrow \} W_{E on el}$ is +

no $U_G!$

earth, cable

elevator

+1 $W_{E on el}$

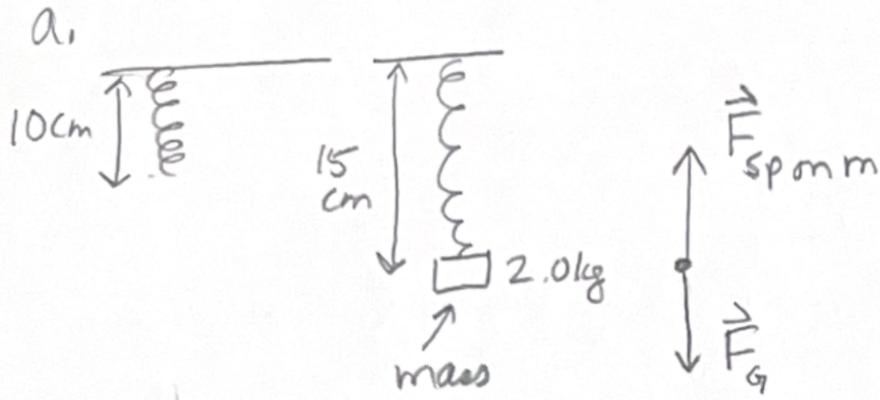
-3 $W_{c on el}$

$E_i + \Sigma trans. = E_f$

$K_A + W_{E on el.} + W_{c on el} = K_B$

Same as before in part c.

3. Spring force: p. 228 #27. Include a force diagram and force organizer in your solution.



F_{spring}	$F_{spring} = +kd$
F_g	$F_g = -mg$

$$a_y = \frac{\sum F_{on\ m\ y}}{m}$$

$$0 = \frac{+kd - mg}{m}$$

$$kd = mg$$

$$k = \frac{mg}{d} = \frac{(2.0\text{ kg})(10\text{ N/kg})}{(0.05\text{ m})} = 400\text{ N/m}$$

$$d = 0.05\text{ m}$$

b. $m = 3.0\text{ kg}$

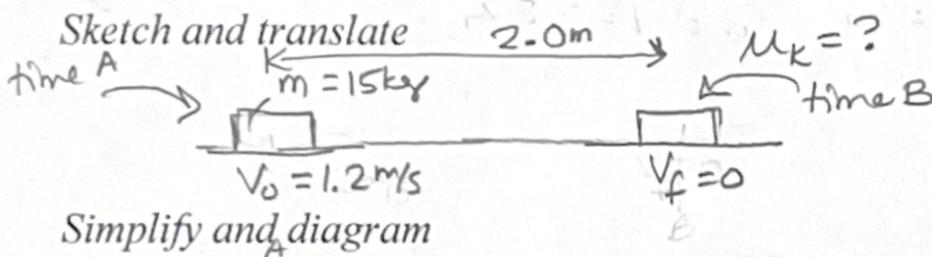
From N2L, $kd = mg$

$$d = \frac{mg}{k} = \frac{(3.0\text{ kg})(10\text{ N/kg})}{400\text{ N/m}} = 0.075\text{ m}$$

k stays the same b/c same spring.

Length of spring = $10\text{ cm} + 7.5\text{ cm} = 17.5\text{ cm}$

4. Friction force: p. 229 #33. Show the problem-solving steps:

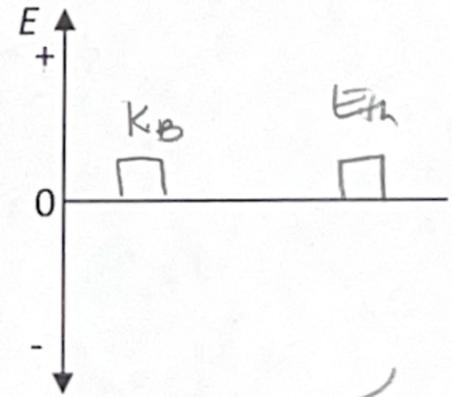
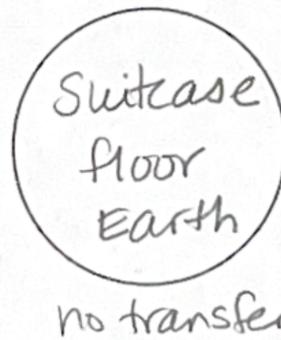
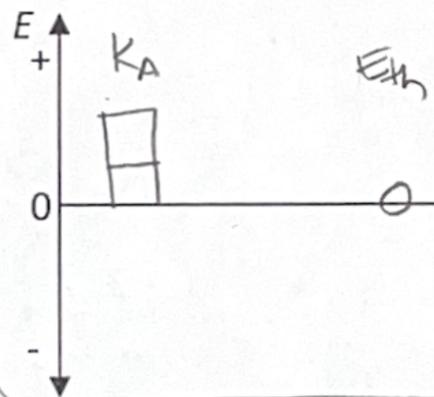


Ext forces: none

Work: none

Initial time: When $v = 1.2\text{ m/s}$

Final time: When $v = 0$



Represent mathematically

$$E_i + \sum \text{transfers} = E_f$$

Solve

This comes directly from the bar chart

$$K_A + 0 = K_B + E_{th}$$

$$\mu_k n \Rightarrow \mu_k (mg)$$

$$\frac{1}{2}mv_A^2 = \frac{1}{2}mv_B^2 + f_k d$$

$$\frac{1}{2}mv_A^2 = \frac{1}{2}mv_B^2 + \mu_k mgd$$

$$\frac{.5mv_A^2 - .5mv_B^2}{mgd} = \mu_k$$

$$\mu_k = \frac{(.5)(15\text{ kg})(1.2\text{ m/s})^2 - (.5)(15\text{ kg})(0)^2}{(15\text{ kg})(10\text{ N/kg})(2.0\text{ m})}$$

$$\mu_k = \frac{10.8 - 0}{300} = 0.036$$