Bellwork 5/4

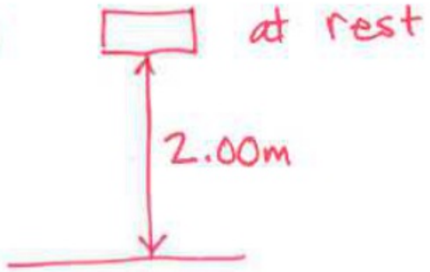
a 3 kg mass falls from a height of 4 m to a height of 2 m. Calculate

① $P_F - P_i = ?$ } what do you notice
② $W_g = ?$ } about these quanties?

Answers to Last Night's Homework

1.

a)



Given

Weight (F_g) = 20.0N

h = 2m

Solve

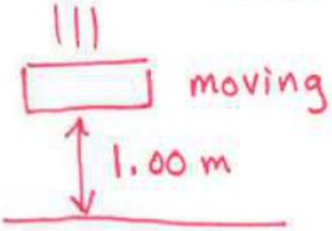
$P = mgh$

$P = (20.0N)(2m) = \boxed{40J}$

Note: $20.0N = mg$

$\Rightarrow m = \frac{20N}{9.8\frac{m}{s^2}} = 2\,kg$

b)



① Given

h = 1.00 m

② Think

In part a) the book was at rest, $v = 0\frac{m}{s} \Rightarrow K = 0J$. Therefore, the potential energy in part a) equals the total Energy: $E = \overset{0}{K} + P$

$E = 40J$ ← this never changes!

③ Solve

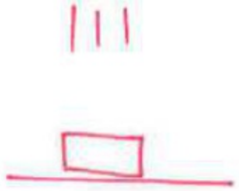
$E = K + P$

$40J = K + mgh$

$40J = K + 20N(1m)$

$\boxed{K = 20J}$

c)



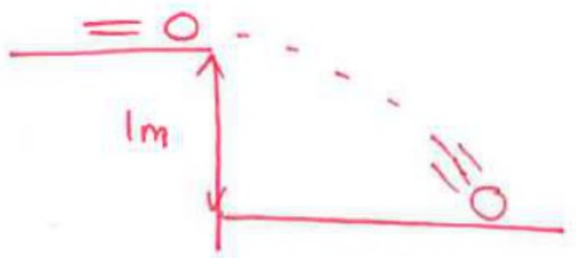
$E = K + \cancel{P}^{\,0}$ because height = 0m

$40J = \frac{1}{2}mv^2$

$40J = \frac{1}{2}(2kg)v^2$

$\boxed{v = 6.32\frac{m}{s}}$

2.



Given
- $m = 0.50\ kg$
- $v_i = 5\ \frac{m}{s}$
- $h = 1\ m$
- $v_f = ?$

$$K = \frac{1}{2}mv^2 \quad + \quad P = mgh \quad = \quad E$$ formulas

on the table:

$$K_i + P_i = E$$

$$\frac{1}{2}(0.50\ kg)(5\ \tfrac{m}{s})^2 + (0.50\ kg)(9.8\ \tfrac{m}{s^2})(1\ m) = E$$

$$6.25\ J + 4.9\ J = E$$

$$11.15\ J = E$$ (total energy does not change)

on the floor:

$$K_f + P_f = E$$

$$K + 0 = 11.15\ J$$

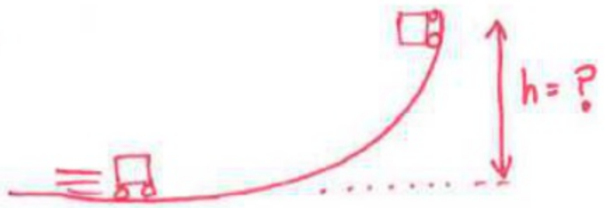
$$\frac{1}{2}(0.50\ kg)(v)^2 = 11.15\ J$$

$$V = 6.68\ \frac{m}{s}$$

$$K = \frac{1}{2}mv^2$$

$$P = mgh$$

3.



Given
$m = 0.026\ kg$
$V_i = 5.79\ \frac{m}{s}$
$h = ?$

Think: at the bottom, $P_i = 0\ J$. at the top, car is briefly at rest, so $V_f = 0\ \frac{m}{s} \Rightarrow K_f = 0\ J$

on the bottom: $K_i + P_i = E$

$$\frac{1}{2}(0.026\ kg)(5.79\ \tfrac{m}{s})^2 + 0\ J = E$$

$$0.4358\ J = E$$ (total energy does not change)

on the top: $K_f + P_f = E$

$$0 + mgh = 0.4358\ J$$

$$(0.026\ kg)(9.8\ \tfrac{m}{s^2})(h) = 0.4358\ J$$

$$h = 1.71\ m$$

4.

$K + P = E$

	$(K = \frac{1}{2}mv^2)$	+ $(P = mgh)$	$= E$
Start	0J	196J	196J
A	196J	0	196J
B	196 − 98 = 98J	98J (use formula)	196J
C	158.8J	39.2J	196J

A: $196J = \frac{1}{2}(1kg)v^2 \Rightarrow$ $\boxed{v = 19.90 \frac{m}{s}}$

B: $98J = \frac{1}{2}(1kg)v^2 \Rightarrow$ $\boxed{v = 14 \frac{m}{s}}$

C: $158.8J = \frac{1}{2}(1kg)v^2 \Rightarrow$ $\boxed{v = 17.8 \frac{m}{s}}$

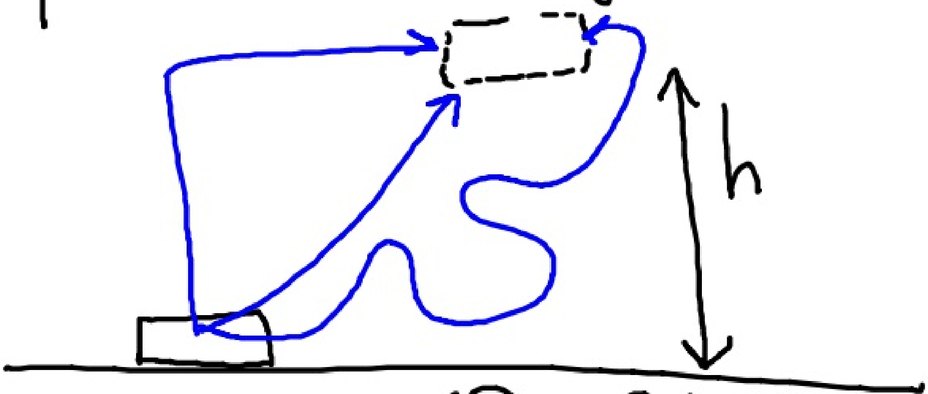
Work done by gravity =

$-$(change in P)

$$W_g = -(P_f - P_i)$$

Implications

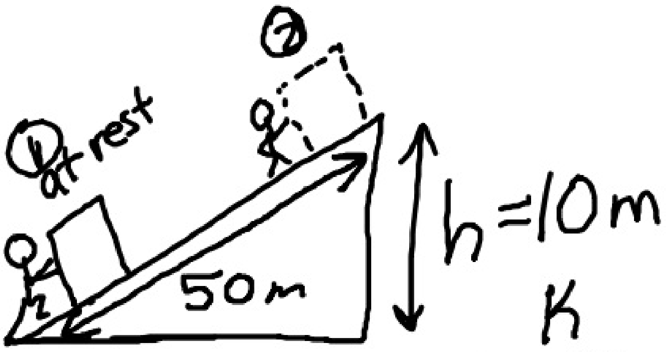
W_g does not depend on path of object

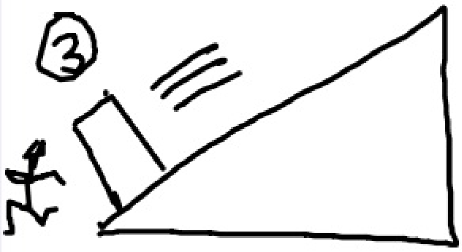


$$W_g = -(P_f - P_i)$$

$$W_g = -(mgh - 0)$$

$$W_g = -mgh$$





	K	P	E
①	0	0	0
②	0	5880J	5880J
③	5880J	0	5880J

?

m = 60 kg

Where does Energy come from?

* When a NONCONSERVATIVE (N.C.) Force does work on an object, it transfers energy into/out of object.

N.C. Forces

→ Friction

→ Any Applied force