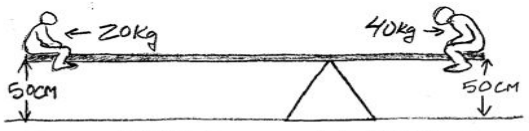
EMG

Q: WHAT WILL HAPPEN TO THE SEE-SAW BELOW IF THE BOY ON THE RIGHT MOVES SLIGHTLY TOWARD THE CENTER? HOW MUCH GPE DOES EACH KID HAVE BEFORE/AFTER?

HW 18-20

AGENDA
SEE-SAWS
SIMPLE MACHINES
INCLINED PLANES
MECHANICAL EFFICIENCY
SCREWS
GEARS?



(AQ)

BEFORE

$GPE_{LEFT} = mgh = (20kg)\left(10\frac{METERS}{SEC^2}\right)(.5\ METERS)\left(\frac{1\ JOULE}{1\ kg\ \frac{METERS^2}{SEC^2}}\right) = 100\ JOULES$

$GPE_{RIGHT} = mgh = (40kg)\left(10\frac{METERS}{SEC^2}\right)(.5\ METERS) = 200\ JOULES$

$GPE_{BEFORE} = 300\ JOULES$

AFTER

$GPE_{LEFT} = mgh = 0\ JOULES\ (h_{LEFT}=0)$

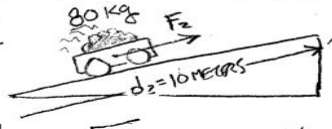
$GPE_{RIGHT} = mgh = (40kg)\left(10\frac{METERS}{SEC^2}\right)(.75\ METERS) = 300\ JOULES$

$GPE_{AFTER} = 300\ JOULES$ ✓

MACHINE - A DEVICE THAT CONVERTS ENERGY FROM ONE FORM TO ANOTHER.

THE SIMPLEST MACHINES JUST TRADE FORCE FOR DISTANCE AND/OR CHANGE THE DIRECTION OF THE FORCE AND DISPLACEMENT VECTORS.
EXAMPLES: LEVERS, INCLINED PLANES, SCREWS, WHEELS, PULLEYS, GEARS, ETC.

INCLINED PLANE



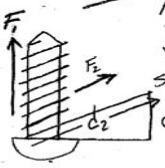
$F_1 = mg = (80kg)\left(10\frac{METERS}{SEC^2}\right) = 800\ NEWTONS$

$GPE = F_1 d_1 = (800\ NEWTONS)(2\ METERS) = 1600\ JOULES$.

TRADING FORCE FOR DISTANCE: $F_2 d_2 \cong F_1 d_1$ $\quad F_2 \cong \frac{F_1 d_1}{d_2} = \frac{1600\ JOULES}{10\ METERS}$ $\quad F_2 \cong 160\ NEWTONS$

SUPPOSE $F_2 = 200$ NEWTONS $\quad \mathcal{E} = \frac{W_{OUT}}{E_{IN}} = \frac{GPE}{F_2 d_2} = \frac{1600\ JOULES}{(200\ NEWTONS)(10\ METERS)} = 80\%$

NOTE: A SCREW IS JUST AN INCLINED PLANE THAT'S BEEN "WOUND UP" ON A SHAFT.
YOU APPLY A SMALL TURNING FORCE OVER A LONG DISTANCE
SCREW APPLIES LARGE VERTICAL FORCE OVER A SHORT DISTANCE



$F_1 d_1 = F_2 d_2$

TWISTING FORCES ARE CALLED "TORQUES" (MORE ON THEM LATER)

GEARS: $F_1 d_1 = F_2 d_2$