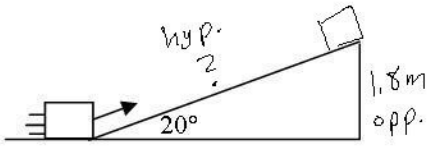
Name: _____

Period: _____

31. Can a simple machine ever have an efficiency greater than 100%? Why or why not?

Against Law of Conservation of Energy. Means getting more E out than you put in.



32. A frictionless ramp is inclined at 20°. An object going 6 m/s slides up.
A) Find the final height of the object.

$E_k = E_p$ → $\frac{1}{2}mv^2 = mgh$ → $\frac{1}{2}(6^2) = 10h$ → $\frac{1}{2}(36) = 10h$ → $18 = 10h$ → $h = 1.8\text{m}$

Note: Since you are looking for height (which is vertical) you don't care about the ramp's angle. Ep will give you h.

B) ***How far up the ramp does it roll?***

"how far up ramp" is the hypo. h is opp. the angle, so use sin.

$\sin 20° = \frac{opp}{hyp.}$ → $.342 = \frac{1.8}{H}$ → $.342H = 1.8$ → $H = \frac{1.8}{.342} = 5.26\text{m}$

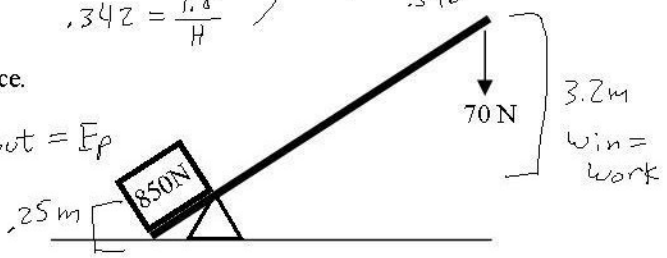
33. A person pushes down on a lever 3.2 meters to lift a 850 N object 0.25 meters up. The person pushes down on the lever with 70 N of force. Find the efficiency of the lever.

You put in work to get out Ep. So, Win = Fd and Wout = mgh Remember that m = 85 kg OR realize that mg = the weight of the object, which = 850 N.

$W_{in} = Fd = 70(3.2) = 224\text{ J}$

$W_{out} = E_p = mgh = 850(.25) = 212.5\text{J}$

$E_{ff} = \frac{W_{out}}{W_{in}} = \frac{212.5}{224} = 95\%$



34. A 1.2 kg rock is dropped from 20 meters. The rock is going only 15 m/s just before it hits the ground because of air friction.
A) How far does friction act on the rock? 20m
B) How far does the rock drop? 20m
C) Does all of the Ep turn into Ek? No (friction)
D) Does friction add or subtract energy?
E) Find the force of air friction on the rock.

For dropped objects the height for Ep (h) is the same as the distance for friction (W = Fd). So h = d = 20 m

$E_p - W = E_k$

$mgh - Fd = \frac{1}{2}mv^2$

m's don't cancel

$1.2(10)(20) - F(20) = \frac{1}{2}(1.2)(15)^2$

$240 - 20F = 135$

$240 = 135 + 20F$

$240 - 135 = 20F$

$105 = 20F$

$5.25\text{N} = F$

↑ notice: less E_k than E_p due to friction

35. A 6 kg object going 2 m/s speeds up to 7 m/s due to a 4 N force.
A) How many meters does the force act?

$E_k + W = E_k$

$\frac{1}{2}mv^2 + Fd = \frac{1}{2}mv^2$

$\frac{1}{2}(6)2^2 + 4(d) = \frac{1}{2}(6)7^2$

$3(4) + 4d = 3(49)$

$12 + 4d = 147$

$4d = 147 - 12 = 135$

$d = 135/4 = 33.75\text{m}$

B) What is the acceleration of the object?

$F = ma$

$4 = 6a$

$a = 4/6 = .67\text{m/s}^2$

(or could have used a kinematic eq.)

36. A 4 kg mass going 6 m/s stops by compressing a spring 1.3 meters. Find the spring constant of the spring. (VEO)
(VEO—variables and equation only. Give equations, put in numbers, and do not solve.)

$E_k = PE_{el}$

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

$\frac{1}{2}4(6^2) = \frac{1}{2}k(1.3)^2$

stop (VEO)

This is all you need if I write VEO.

solution (for the curious)

½'s cancel

$4(6^2) = k(1.3^2)$

$144 = k(1.69)$

$k = 144/1.69 = 85.2\text{ N/m}$

37. A 5 kg object is dropped from 30 meters up. How fast is it going 10 meters above the ground? (VEO)

$E_p = E_p + E_k$

10 m above the ground it has Ep and since it's moving it also has Ek.

$mgh_b = mgh_A + \frac{1}{2}mv^2$

$5(10)30 = 5(10)10 + \frac{1}{2}(5)v^2$

DONE: VEO

solution: m's cancel

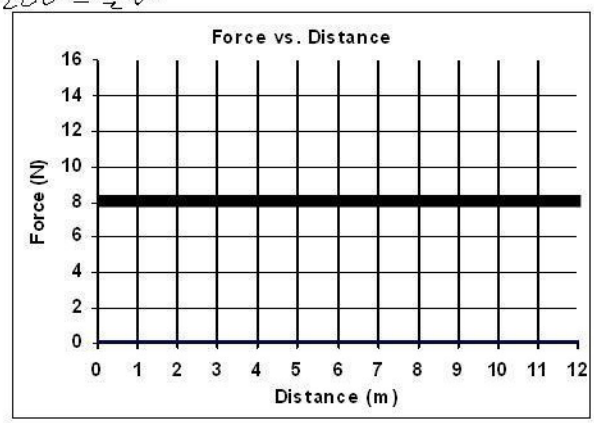
$300 = 100 + \frac{1}{2}v^2$

$200 = \frac{1}{2}v^2$

$400 = v^2$

$20\text{m/s} = v$

38. A 3 kg object is originally at rest is pushed on by the force shown on the graph at the right.



A) Find the work done on the object in the first 10 m.

$W = Fd$

$W = 8(10) = 80\text{ J}$

B) Find the final velocity of the object.

$0 + W = E_k$

$80 = \frac{1}{2}(3)v^2$

$160 = 3v^2$

$53.3 = v^2$

$v = 7.3\text{ m/s}$