Name: _____

Period: _____

Conservation of Energy Practice

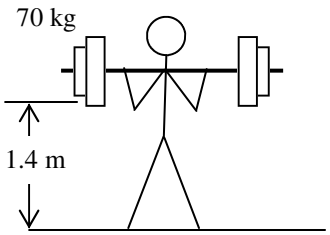
1. Define and give the units for the variables given a the right.

Variable	What it is	Units
m	*mass*	*kg*
v		
P		
k		
g		

Variable	What it is	Units
x		
F		
PEel		
d		
h		

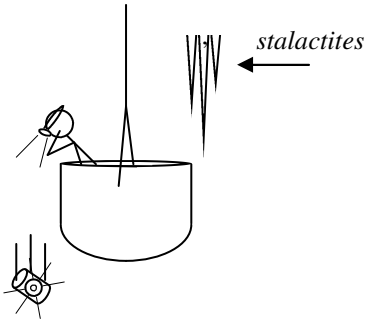
2. A 2 kg mass compresses a spring 1.2m. If the object has 160 J of energy, calculate the spring constant of the spring.

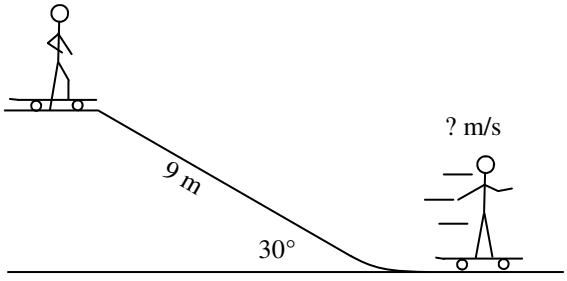
3. A 4 kg object has 180 J of kinetic energy. How fast is it moving?



4. Slim Jim, continually maintaining his svelte body, lifts a 70kg barbell 1.4m above the ground.
   A. How much energy did the barbell have when it was on the ground at rest?
   B. What kind of energy does the barbell have in its current position?
   C. Where did the energy come from?
   D. Calculate the energy it has at its current position.
   E. How much work did Jim do to lift the object?
   F. If he lifted it in 1.5 seconds, how much power did he use?

5. On Slim Jim's last cave adventure he accidentally dropped his lantern while studying a formation of stalactites. The lantern was dropped from 35m up. How fast was it going when it smashed into the cave floor?
   A. What color is his lantern (of course)?
   B. E_{before} = _____ Work? = _____ E_{after} = _____
   C. Conservation of Energy equation:
   D. Substitute the formulas for each type of energy and solve.

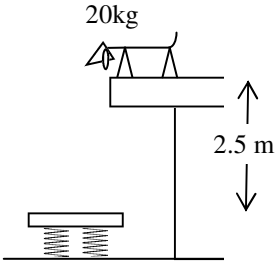




6. Slim "Tony Hawk" Jim starts at rest at the top of a 9m long ramp that is tilted at 30°. How fast is he going at the bottom?
   A. Calculate his height at the top of the ramp.
   B. E_{before} = _____ Work? = _____ E_{after} = _____
   C. Conservation of Energy equation:
   D. Substitute the formulas for each type of energy and solve.

Name: _____

Period: _____

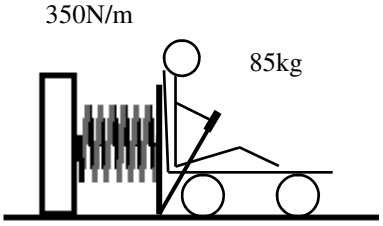


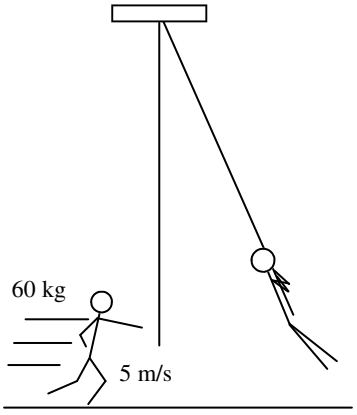
7. Slim Jim's dog "Bim" is on a ledge 2.5m above a spring board. If he compresses it 0.45m, what is the spring constant for the board?
   A. E_{before} = _____ Work? = _____ E_{after} = _____

   B. Conservation of Energy equation:
   C. Solve.

8. Slim Jim finds a giant spring that has a 350 N/m spring constant. Jim figures out how to compress it 1.5 m. If Jim and his spring propelled cart's mass is 85kg, how fast is he going after he releases the lever?
   A. E_{before} = _____ Work? = _____ E_{after} = _____

   B. Conservation of Energy equation:
   C. Solve.



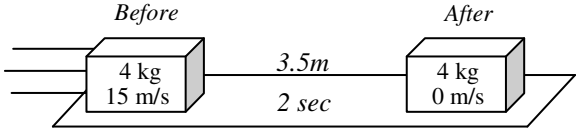


9. Slim Jim runs 5m/s at full speed. If he grabs a rope at the ground, how high off the ground will he swing?
   A. E_{before} = _____ Work? = _____ E_{after} = _____

   B. Conservation of Energy equation:
   C. Solve.

10. A 4 kg object is moving 15m/s. If it stops due to friction in 3.5m, what is the magnitude of the force of friction? (Calculate Fk.)
    A. E_{before} = _____ Work? = _____ E_{after} = _____

    B. Conservation of Energy equation:
    C. Solve.



    D. How much energy did it lose?

    E. Since this energy was lost in 2 seconds, how much power did friction dissipate (use up)?

Conservation of Energy Practice

1. Define and give the units for the variables given a the right.

Variable	What it is	Units
m	mass	kg
v	velocity	m/s
P	power	watts
k	spring constant	N/m
g	acc. due to grav.	$10\ m/s^2$

Variable	What it is	Units
x	displ. of spring	m
F	force	N
PEel	pot. elast. E	J
d	dist.	m
h	height	m

2. A 2 kg mass compresses a spring 1.2m. If the object has 160 J of energy, calculate the spring constant of the spring.

$PE_{el} = \frac{1}{2}kx^2$

$160 = \frac{1}{2}k(1.2)^2$

$320 = k(1.44)$

$k = 222.2\ N/m$

3. A 4 kg object has 180 J of kinetic energy. How fast is it moving?

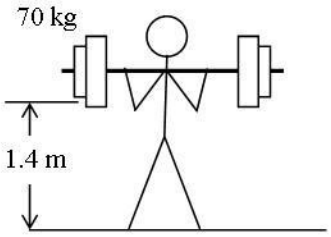
$E_K = \frac{1}{2}mv^2$

$180 = \frac{1}{2}(4)v^2$

$180 = 2v^2$

$v^2 = 90$

$v = 9.5\ m/s$



4. Slim Jim, continually maintaining his svelte body, lifts a 70kg barbell 1.4m above the ground.
   A. How much energy did the barbell have when it was on the ground at rest? 0 J
   B. What kind of energy does the barbell have in its current position? E_p
   C. Where did the energy come from? + Work
   D. Calculate the energy it has at its current position.

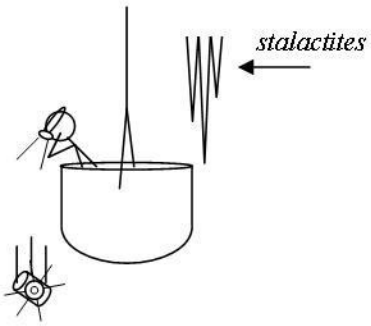
$E_p = mgh = 70(10)(1.4) = 980\ J$

   E. How much work did Jim do to lift the object? 980 J
   F. If he lifted it in 1.5 seconds, how much power did he use?

$P = \frac{W}{t} = \frac{980}{1.5}$

$P = 653.3$ watts

5. On Slim Jim's last cave adventure he accidentally dropped his lantern while studying a formation of stalactites. The lantern was dropped from 35m up. How fast was it going when it smashed into the cave floor?
   A. What color is his lantern (of course)? green
   B. E_{before} = E_p Work? = 0 E_{after} = E_K
   C. Conservation of Energy equation: $E_p = E_K$
   D. Substitute the formulas for each type of energy and solve.



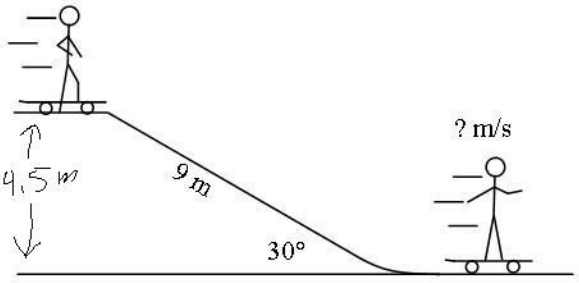
$mgh = \frac{1}{2}mv^2$

$10(35) = \frac{1}{2}v^2$

$350(2) = v^2$

$700 = v^2$

$v = 26.5\ m/s$



6. Slim "Tony Hawk" Jim starts at the top of a 9m long ramp that is tilted at 30°.
   A. Calculate his height at the top of the ramp.

$h = 9\sin 30° = 4.5\ m$

   B. E_{before} = E_p Work? = 0 E_{after} = E_K
   C. Conservation of Energy equation: $E_p = E_K$
   D. Substitute the formulas for each type of energy and solve.

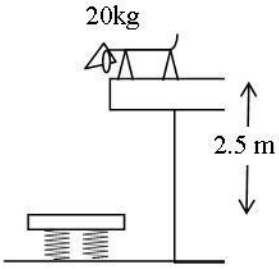
$mgh = \frac{1}{2}mv^2$

$10(4.5) = \frac{1}{2}v^2$

$(45)2 = v^2$

$v^2 = 90$

$v = 9.5\ m/s$



7. Slim Jim's dog "Bim" is on a ledge 2.5m above a spring board. If he compresses it 0.45m, what is the spring constant for the board?

A. E_{before} = E_p Work? = 0 E_{after} = PE_{el}

B. Conservation of Energy equation: $E_p = PE_{el}$

C. Solve.

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

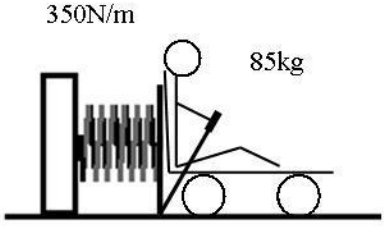
$20(10)(2.5) = \frac{1}{2}k(.45)^2$

$500 = \frac{1}{2}k(.45)^2$

$1000 = .2025k$

$k = 4938$ N/m strong spring!

8. Slim Jim finds a giant spring that has a 350 N/m spring constant. Jim figures out how to compress it 1.5 m. If Jim and his spring propelled cart's mass is 85kg, how fast is he going after he pulls the release lever?



A. E_{before} = PE_{el} Work? = 0 E_{after} = E_K

B. Conservation of Energy equation: $PE_{el} = E_K$

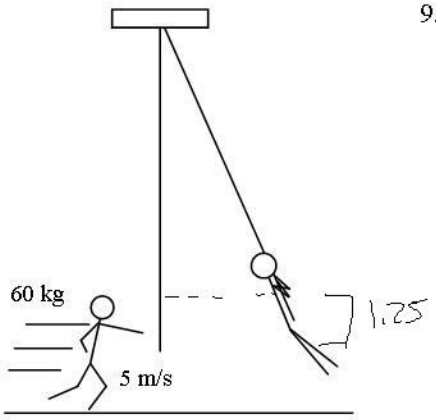
C. Solve.

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

$350(1.5)^2 = 85v^2$

$787.5 = 85v^2$

$v = 3.04$ m/s (not so fast)



9. Slim Jim runs 5m/s at full speed. If he grabs a rope at the ground, how high off the ground will he swing?

A. E_{before} = E_K Work? = 0 E_{after} = E_p

B. Conservation of Energy equation: $E_K = E_p$

C. Solve.

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

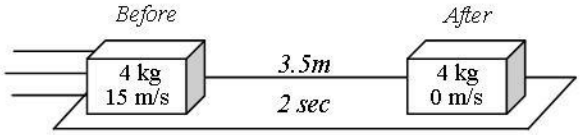
$\frac{1}{2}(5^2) = 10h$

$\frac{1}{2}(25) = 10h$

$12.5 = 10h$

$h = 1.25$ m

10. A 4 kg object is moving 15m/s. If it stops due to friction in 3.5m, what is the magnitude of the force of friction? (Calculate Fk.)



A. E_{before} = E_K Work? = $-W$ E_{after} = 0

B. Conservation of Energy equation: $E_K - W = 0$

C. Solve.

$\frac{1}{2}mv^2 - F_d = 0$

$\frac{1}{2}(4)(15^2) = F(3.5)$

$450 = 3.5F$

$F = 128.6$ N

D. How much energy did it lose?

$E_K = 450$ J

E. Since this energy was lost in 2 seconds, how much power did friction dissipate (use up)?

$P = \frac{W}{t} = \frac{450}{2} = 225$ watts