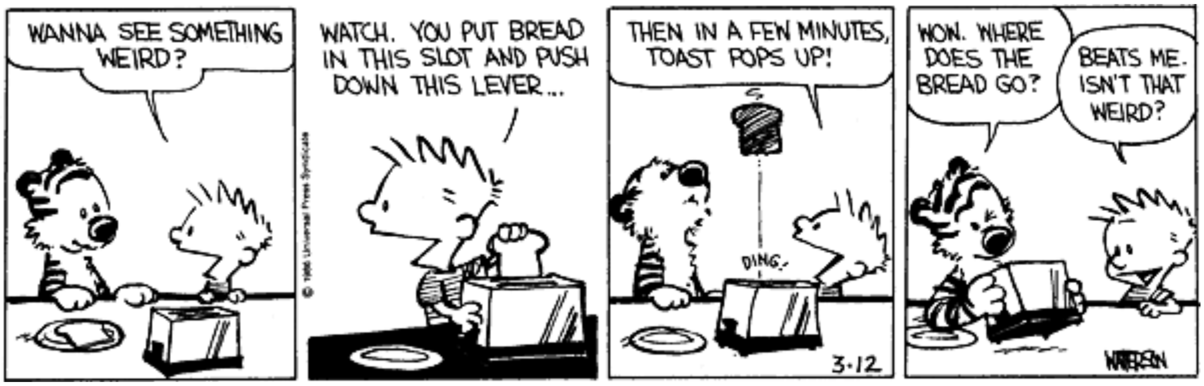
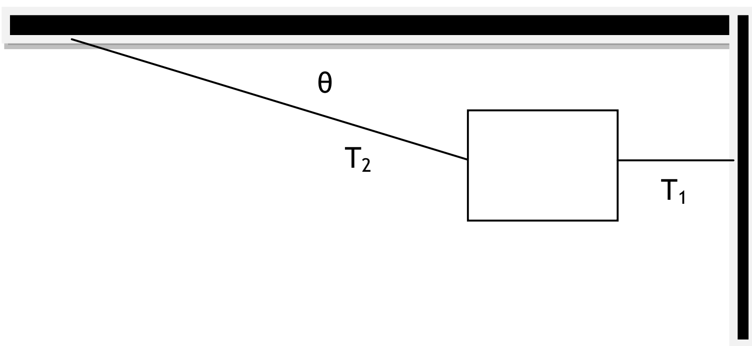
AP Physics C   Name ______________________________

Conservation of Energy Problems



1.



a. A 10 kg box is suspended by two strings as shown above. The angle θ is 25^0. Assume the cord on the right is perfectly horizontal. Find the tension in both cords.

T_2 = 231.9 N
T_1 = 210.2 N

b. The left-hand cord in the diagram above is 2 meters long. If the right-hand string is suddenly cut, determine the speed of the box as it passes through its equilibrium position.

v = 4.76 m/s

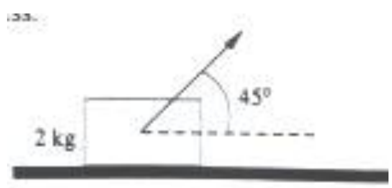
2. A block of mass m moving at speed v slams into a spring of spring constant k. The spring compresses a distance x. A block of the same mass moving with twice the velocity will compress the spring how far?

a. x   b. 2x   c. 4x   d. 8x   e. 0

2x

Name ________________________________

3. A 2 kg block is being pulled across a frictionless surface as shown below. The magnitude of the force is 10 Newtons.



a. What is the normal force acting on the box?

N = 12.5 N

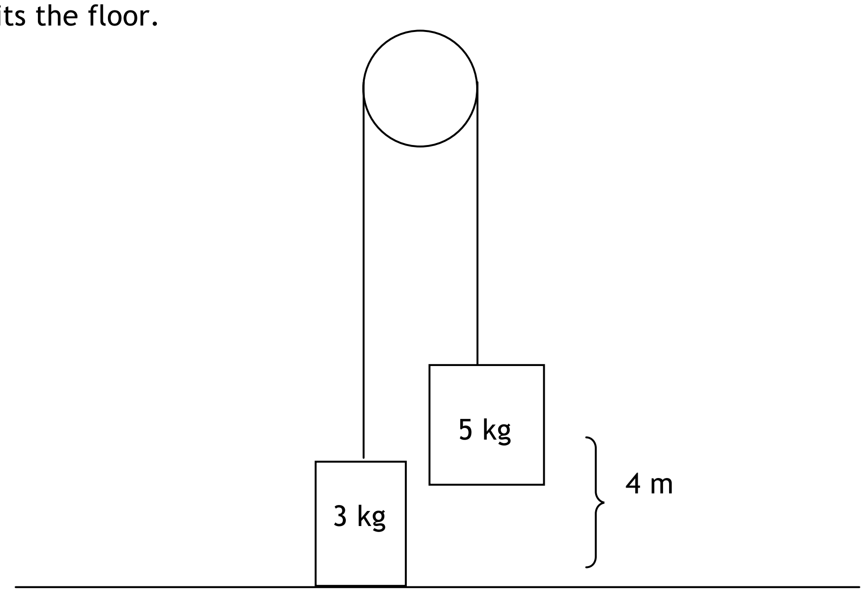
b. What is the acceleration of the box?

a = 3.5 m/s^2

c. How much work is done on the box after 5 seconds?

W = 312 J

4. Two masses are connected over a light, frictionless pulley by a REALLY LONG light string as shown below. The 5 kg mass is released from rest. Determine the speed the 3 kg block has when the 5 kg block hits the floor.



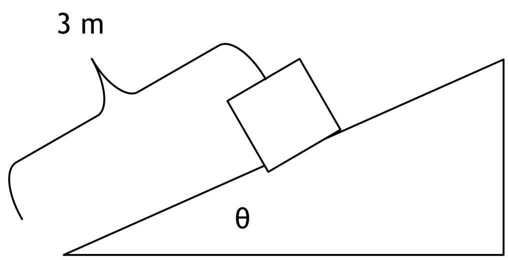
v = 4.43 m/s

Now determine the maximum height of the 3 kg mass. Hint: The answer is NOT 4 meters.

h_{max} = 9 m

AP Physics C Name ______________________________
Conservation of Energy Problems

5. A 5 kg block is set into motion up an inclined plane with an initial speed of 8 m/s. The block comes to rest after traveling 3 meters up the ramp, which has an angle $\theta=30^0$.



a. Determine the net work done on the block

W_{net} = -160 J

b. Calculate the block's change in potential energy

ΔU = +73.5 J

c. Calculate the average frictional force exerted on the block.

f_{avg} = 28.8 N

d. What is the coefficient of kinetic friction between the incline and the block?

μ_k = 0.68

6. A single conservative force F=2x + 4 acts on a 5 kg particle, where x is in meters and F is in Newtons. As the particle moves along the x-axis from x=1 m to x=5 m, calculate each of the following:

a. The work done by this force

W = 40 J

b. The change in potential energy of the particle

ΔU = -40 J

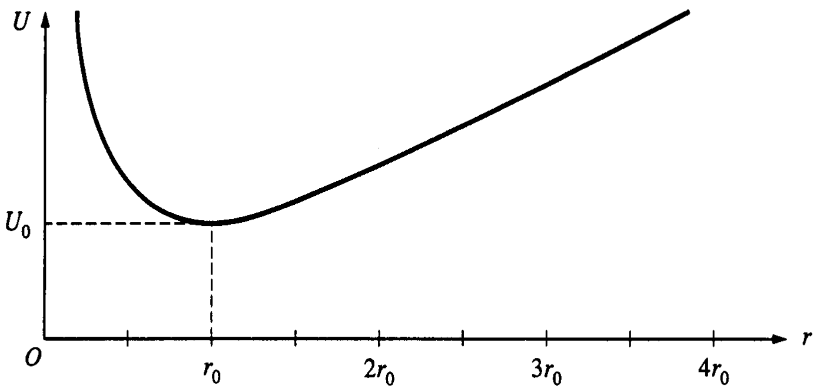
c. The speed of the particle at x=5 meters if its speed at x=1 m is 3 m/s.

$v(5)$ = 3 m/s

AP Physics C
Conservation of Energy Problems

Name ______________________________

1995M2. A particle of mass m moves in a conservative force field described by the potential energy function $U(r) = a(r/b + b/r)$, where a and b are positive constants and r is the distance from the origin. The graph of U(r) has the following shape.



a. In terms of the constants a and b, determine the following.

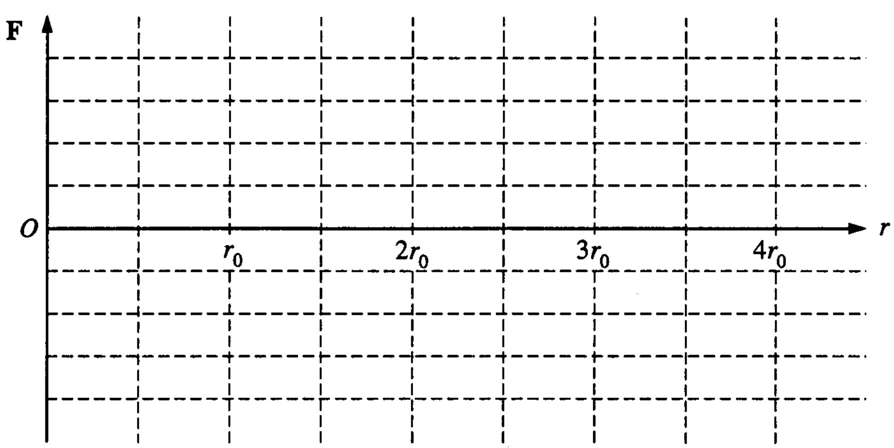
i. The position r_o at which the potential energy is a minimum

$r_0 = b$

ii. The minimum potential energy U_o

$U_{min} = 2a$

b. Sketch the net force on the particle as a function of r on the graph below, considering a force directed away from the origin to be positive, and a force directed toward the origin to be negative.



Hint #1: F is the inverse slope of the U vs r curve

$F = -dU/dr$

Hint #2: Where is the x-intercept of this graph?

AP Physics C Name ______________________________

Conservation of Energy Problems

The particle is released from rest at $r = r_o/2$

c. In terms of U_o and m, determine the speed of the particle when it is at $r = r_o$.

$$v = \sqrt{\frac{U_0}{2m}}$$

d. Write the equation or equations that could be used to determine where, if ever, the particle will again come to rest. It is not necessary to solve for this position.

Instantaneously: When it has a potential energy equivalent to that at $r_0/2$.

Full Rest: Never!

e. Briefly and qualitatively describe the motion of the particle over a long period of time.

…will oscillate between ______ and ______...