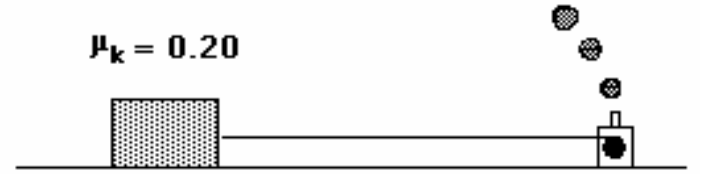
Name_____

Date _____ Pd___

Work and Energy
Worksheet 1

1. A 200. kg box is pulled at constant speed by the little engine pictured below. The box moves a distance of 2.5 m across a horizontal surface. The force of friction acting on the box is 400 N.



a) Draw a free-body force diagram of the box.

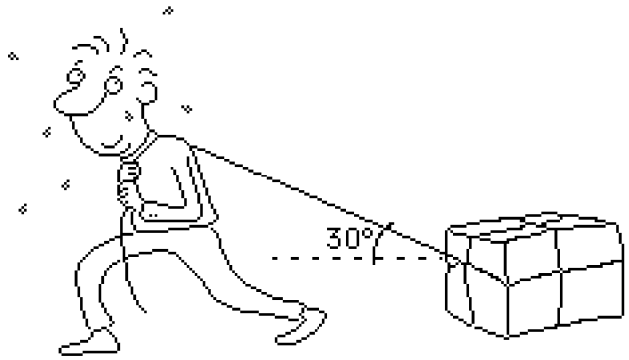
b) How much energy is transferred by the engine?

c) What type of motion would occur if the engine pulled with a force of 500 N?

d) Calculate the acceleration of the box in these circumstances.

2. How far could the box in problem 1 be pulled *at constant velocity* with the expenditure of 8,000 J of energy?

3. A person pulls a 50. kg box pictured below with a force of 100 N. The force of kinetic friction is 75 N.



a. Sketch a force diagram for the box.

b. How much of the force acts in the direction of motion? How much energy is transferred (via working) by the person who pulls the box a distance of 10.m?

c. Is the box moving at constant speed? Explain how you know. What does this tell you about the kinetic energy E_k of the system?

Name_____

Date _____ **Pd**____

Worksheet 2

1. A 60. kg student jumps from the 10. meter platform at UMD's swimming complex into the pool below.
   a. Determine her GPE at the top of the platform.

   b. How much KE does she possess at impact? What is her velocity at impact?

   c. Repeat steps a and b for a 75 kg diver.

   d. If she jumped from a platform that was twice as high, how many times greater would be her velocity at impact?

   e. How much higher would the platform have to be in order for her velocity to be twice as great?

3. A bullet with a mass of 10. g is fired from a rifle with a barrel that is 85 cm long. Assuming that the force exerted by the expanding gas to be a constant 5500 N, what speed would the bullet reach?

5. A 24 kg child descends a 5.0 m high slide and reaches the ground with a speed of 2.8 m/s.

   How much energy was dissipated due to friction in the process?

   Step 1: Calculate the GPE at the top.
   Step 2: Calculate the KE at the bottom.
   Step 3: Find the difference between the two.

6. Suppose a scrawny 20 kg Wyle Coyote was shot straight up with an initial velocity of +50 m/s.

   Assuming that all his initial KE was transformed into GPE, what is the maximum height he could reach?

Worksheet 3

1. A 60 kg box is lifted by a rope a distance of 10 meters straight up at constant speed. How much power is required to complete this task in 5 seconds?

2. Hulky and Bulky are two workers being considered for a job at the UPS loading dock. Hulky boasts that he can lift a 100 kg box 2.0 meters vertically, in 3.0 seconds. Bulky counters with his claim of lifting a 200 kg box 5.0 meters vertically, in 20 seconds.
   Which worker can produce more power?

3. A 1994 Ford Mustang is driving down a road with a constant speed of 30 m/s. The engine must exert a 5000 N force to maintain this speed.

   a. What is the power output of the engine?

4. An 82 kg hiker climbs Sugarloaf mountain. During a two hour period, the hiker's vertical elevation increases by 540 meters.

   a. Calculate the climber's ΔGPE.

   b. Find the power generated to increase the hiker's GPE.

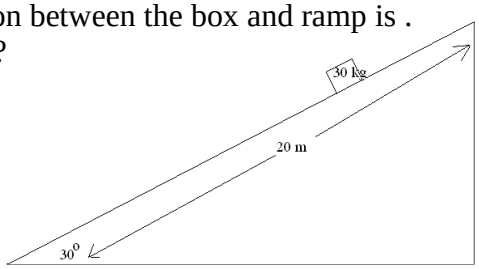
5. How long would it take a 7.5 KW motor to raise a 500 kg piano to an apartment window 10 meters above the ground?

6. The trains on a roller coaster are raised from 10 m above ground at the loading platform to a height of 60 m at the top of the first hill in 45 s. Assume that the train (including passengers) has a mass of 2500 kg. Ignoring frictional losses, what power motor would be required to accomplish this task?

7. Your electric utility company sends you a monthly bill informing you of the number of kilowatt-hours you have used that month.
   a. Is the utility charging you for energy or power? Explain.

   b. How many joules does your 1600W blow drier transfer if you dry your hair in 5.0 min?

8. A 30 box slides down a ramp that makes an angle of 30° with the horizontal. If the coefficient of friction between the box and ramp is . 3, what is the KE of the box at the bottom of the ramp?



How fast is the box going at the bottom of the ramp?