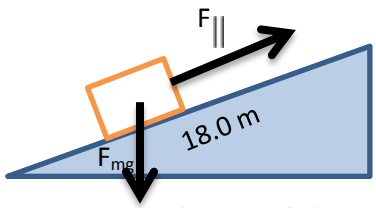
Name _____ Date _____ Period_____

Answer the following questions about simple machines on a separate sheet of paper.

1. Stan raises a 1000. N piano a distance of 5.00 m using a set of pulleys. Stan pulls 20.0 m of rope.
   a. How much effort force did Stan apply if this was an ideal machine?
   b. What force is used to overcome friction if the actual effort is 300. N.
   c. What is the work output?
   d. What is the work input?
   e. What is the ideal mechanical advantage?
2. A mover's dolly is used to deliver a refrigerator up a ramp into a house. The refrigerator has a mass of 115 kg. The ramp is 2.10 m long and rises 0.850 m. The mover pulls the dolly with a force of 496 N up the ramp. The dolly and ramp constitute a machine.
   a. What work does the mover do?
   b. What is the work done on the refrigerator by the machine?
   c. What is the efficiency of the machine?
3. A pulley system lifts a 1345 N weight a distance of 0.975 m. Paul pulls the rope a distance of 3.90 m, exerting a force of 375 N.
   a. What is the ideal mechanical advantage of the system?
   b. What is the mechanical advantage of the system?
   c. How efficient is the system?
4. The ramp in the figure to the right is 18.0 m long and 4.50 m high.



4.50 m

   a. What force parallel to the ramp ($F_{||}$) is required to slide a 25.0 kg box to the top of the ramp if friction is neglected?
   b. What is the IMA of the ramp?
   c. What is the real MA and the efficiency of the ramp is a parallel force of 75.0 N is actually required?
5. Because there is very little friction, the lever is an extremely efficient simple machine. Using 90.0% efficient lever, what input work is required to lift an 18.0 kg mass a distance of 0.50 m?
6. What work is required to lift a 215 kg mass a distance of 5.65 m using a machine that is 72.5% efficient?
7. A motor having an efficiency of 88% operates a crane having an efficiency of 42%. With what speed does the crane lift a 410 kg crate of machine parts if the power supplied to the motor is 5.5 kW?
8. A complex machine is constructed by attaching the lever to the pulley system. Consider an ideal complex machine consisting of a lever with an IMA of 3.00 and a pulley system with an IMA of 2.00.
   a. Show that the IMA of this complex machine is 6.00.
   b. If the complex machine is 60.0% efficient, how much effort must be applied to the lever to lift a 540 N box?
   c. If you move the effort side of the lever 12.0 cm, how far is the box lifted?