W6.07a

Energy

Simple Machines-Mechanical Advantage

-Solve Using Energy Methods-

1. For a particular pulley system, you pull down with 120 N worth of force in order to lift a box with a mass of 65 kilograms. When you do this, you find that the pulley raises its load by 7.0 centimeters for every 38.5 centimeters of rope that you pull.
   a. What is the ideal mechanical advantage?
   b. What is the mechanical advantage?
   c. What is the efficiency of the pulley system?

2. A ramp has an ideal mechanical advantage of 4.0, and a mechanical advantage of 3.0. The ramp is 2.0 meters high, and a 45-kg crate is being lifted.
   a. What is the length of the ramp?
   b. What is the force necessary to push the crate up the ramp?
   c. What is the input work?
   d. What is the output work?
   e. Assuming the loss of energy is due to friction, what is the coefficient of friction between the ramp and crate?

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a. IMA = 5.5 : 1 [38.5 cm/ 7 cm]

b. AMA = 5.416 : 1 [650N / 120N]

c. Eff. = 98.47% [AMA/IMA]

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a. 8 meters
b. 150 newtons
c. 1,200 joules [150 N(8 m)]
d. 900 joules
e. μ=0.086 [F_f(8 m) = 300 J so F_f=37.5, F_n=435.7 N]