Physics 1046  Unit 5 Worksheet : Simple Machines

Answers are found in brackets.

1) Katie forgot her keys and is trying to pry open a window to break into her house. She applies an effort force of 20N on a crow bar. The window has a resistance force of 500N. What is the mechanical advantage of the crowbar? (25)

2) Donnie uses a crowbar to raise a manhole cover weighing 65N. The effort arm of the crowbar is 50cm long. The resistance arm is 10cm long. What is the ideal mechanical advantage of the crowbar? (5.0)

3) The Mike and Hannah are moving to Fredericton. Their friend Dana has offered to help them move their furniture. Dana slides the Hannah’s 2200-N couch up a 6.0-m-long ramp to the moving van, which stands 1.0-m off the ground.
a) What is the ideal mechanical advantage of the incline? (6)
b) If Dana must exert a 500-N force to move the couch up the ramp with a constant speed, what is the actual mechanical advantage of the ramp? (4.4)
c) What is the efficiency of the ramp? (73%)

4) Jack and Jill went up the hill to fetch a pail of water. At the well, Jill used a force of 20.0N to turn a crank handle of radius 0.400m that rotated an axle of radius 0.100m, so she could raise a 60.0N bucket of water.
   a) What is the ideal mechanical advantage of the wheel? (4)
   b) What is the actual mechanical advantage of the wheel? (3)
   c) What is the efficiency of the wheel? (75%)

5) Melissa’s favorite pastime is fishing.
   a) How much work is required for Melissa to reel in a 10.0-kg bluefish from the water’s surface to the deck of her boat, 5.20 m above the water, if the reel of her fishing pole is 85.0% efficient? (600J)
   b) If Melissa supplies a force of 15 N to the reel’s crank handle, what is the actual mechanical advantage of the fishing pole? (6.5)
   c) What is the ideal mechanical advantage of the fishing pole? (7.6)

6) Bob, a stubborn 3500-N mule, refuses to walk into the barn, so Farmer Jeremy must drag him up a 5.0-m ramp to his stall, which stands 0.50-m above ground level.
   a) What is the ideal mechanical advantage of the ramp? (10)
   b) If Farmer Jeremy needs to exert a 450-N force on Bob the mule to drag him up the ramp with a constant speed, what is the actual mechanical advantage of the ramp? (7.8)
   c) What is the efficiency of the ramp? (78%)