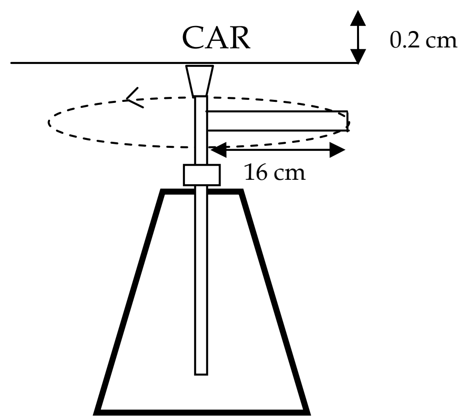
W6.07c

Energy

Simple Machines-Mechanical Advantage

-Solve Using Energy Methods-



1. Imagine a car jack acts like screw, as shown above. When the handle of the jack (which is 16 centimeters long) makes *one complete circle*, the car is lifted 0.20 centimeters. To lift the side of the car, the jack supplies 4,500 N of force.
    a. What is the ideal mechanical advantage of the jack?
    b. If the jack is only 35% efficient, with what force must you supply to the jack handle to lift the car?
    c. Why is the efficiency for a screw fairly poor?

2. Mr. Grant, who works for a moving company, needs to lift a 45-kilogram chair onto a truck, which is 1.1 meters above the ground. He decides to slide the chair up a 3.6-meter long ramp.
    a. How much work needs to be done on the chair to get it on the truck?
    b. What is the ideal mechanical advantage of the ramp?
    c. Assuming that the ramp is frictionless (he puts the chair on a dolly), with what force must Mr. Grant push to move the chair up the ramp?

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<u>Energy</u>-KEY

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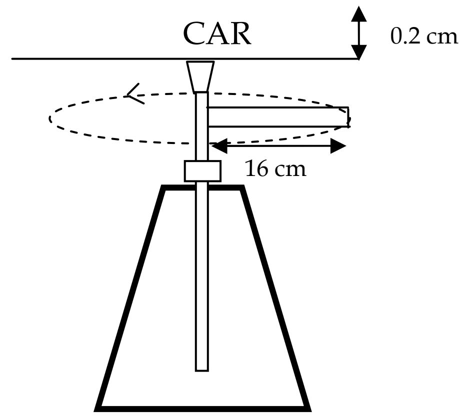

   a. What is the ideal mechanical advantage of the jack?
   b. If the jack is only 35% efficient, with what force must you supply to the jack handle to lift the car?
   c. Why is the efficiency for a screw fairly poor?

   a. IMA = 502.5 : 1 [100.5 cm/ .2 cm]

   b. AMA = 175.875 : 1 [eff(IMA) or .35(502.5)]

   c. A screw is a <u>long</u> incline wrapped around a shaft. A lot of energy lost to friction.

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   a. 495 joules [work =ΔGPE]

   b. IMA = 3.27 : 1 [3.6 m / 1.1 m]

   c. 137.5 newtons [$w_{parallel} = F_{push}$]