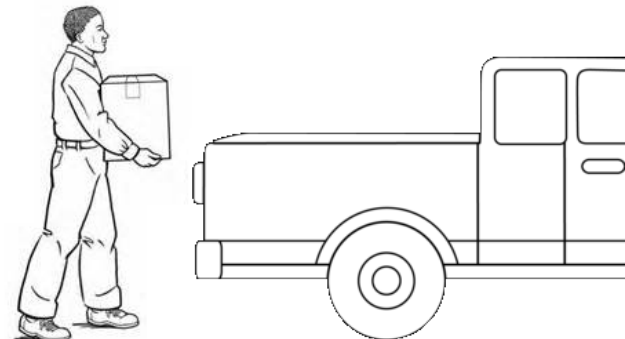# Work, Mechanical Advantage, and Efficiency

1. A container has a mass of 36 kg. How much does the container weigh?

2. If you were to lift the container, and place it on the back of a truck, 115 cm high, how much work would you do?

3. If it was a windy day, and it took you 450 J of energy to get the container to the back of the truck, how efficient were you?
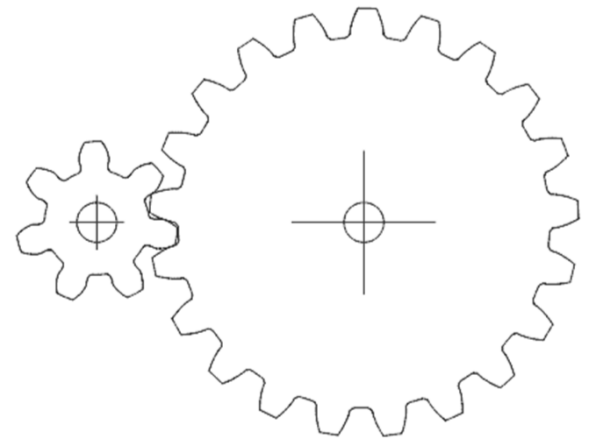
4. For the lever shown below, what effort force would be needed to raise the load?

5. What is the mechanical advantage of this lever?
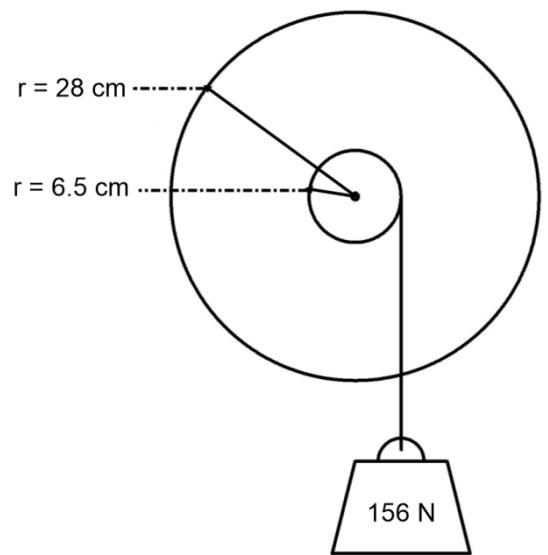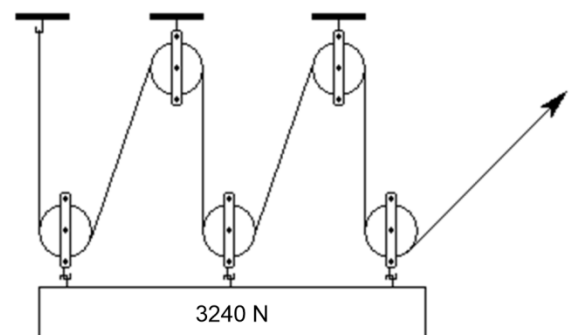
283 N

F_E

126 cm

37 cm
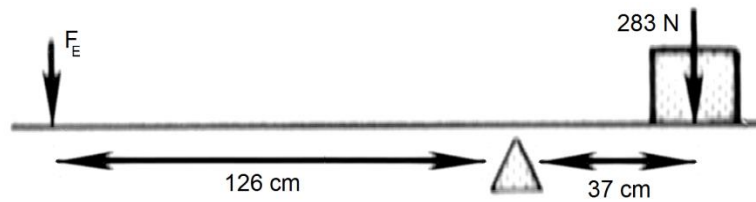
6. If the larger gear below is turned at a rate of 60 rotations per minute, at what rate would the smaller gear turn?

7. For each of the following three simple machines:
    a. What is the ideal mechanical advantage?
    b. How much force, ideally, would be needed to move the object?

3.9 m

12 kg

1.6 m

r = 28 cm

r = 6.5 cm

156 N

3240 N
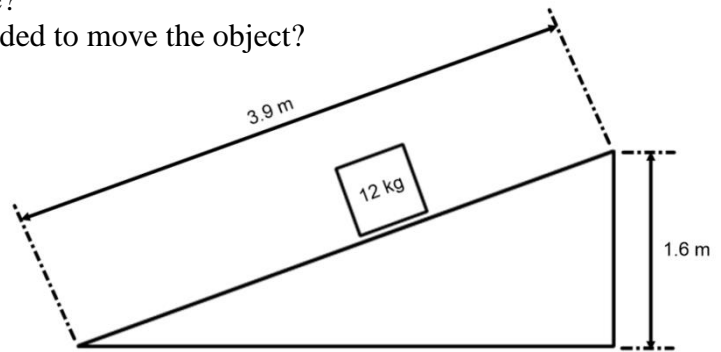
8. The following system combines a variety of simple machines. The box is to travel up a ramp. There is a cable used to raise the box up the ramp, that cable moves through a variety of pulleys. The pulley system is attached to a winch.
   a. What is the mechanical advantage of this system?
   b. How much force, ideally, should you need to use to move the box?
   c. If the box moves to the top of the ramp by turning the crank arm with a force of 15 N, how efficient is the system?
* Note, this is a level 4 question, do what you can, but understand that not all students will be able to get a full solution. However, everyone should attempt it.

D = 13 cm

r = 21 cm

1.4 m

3.6 m

15.3 kg