

PLTW – Principles of Engineering

1. The Menjivar's are moving to a new town, so they have called in the ACME moving company to take care of their furniture. Destiny, one of the movers, slides the Menjivar's 2200-N Ikea cabinet up a 6.0-m-long ramp to the moving van, which stands 1.0-m off the ground.

- a) Sketch and annotate the situation described
- b) What is the ideal mechanical advantage of the incline?
- c) If Destiny must exert a 500-N force to move the cabinet up the ramp with a constant speed, what is the actual mechanical advantage of the ramp?
- d) What is the efficiency of the ramp?

2. Jack and Jill went up the hill to fetch a pail of Coca-Cola. 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) Sketch and annotate the situation described.
- b) What is the ideal mechanical advantage of the wheel?
- c) What is the actual mechanical advantage of the wheel?
- d) What is the efficiency of the wheel?

3. Raul, a stubborn 3500-N mule, refuses to walk into the barn, so Farmer MacMenjivar 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?
- b) If Farmer MacMenjivar needs to exert a 450-N force on the mule to drag him up the ramp with a constant speed, what is the actual mechanical advantage of the ramp?
- c) What is the efficiency of the ramp?

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4. A wedge with a mechanical advantage of 0.78 is used to raise a house corner from its foundation. If the output force is 7500 N, what is the input force?

5. An axe used to split wood is driven into a piece of wood for an input distance of 3.0 cm. If the mechanical advantage of the axe is 0.85, how far apart (output distance) is the wood split?

6. A complex arrangement of pulleys forms what is called the block in a block and tackle. The rope used to lift the pulleys and the load is the tackle. A block and tackle is used to lift a truck engine, which has a weight and output force of nearly 7406 N. The input force required to lift this weight using the block and tackle is 308.6 N. What is the mechanical advantage of the block and tackle?