**Simple Machines**

**Lever problems**

1. A lever used to lift a heavy box has an input arm of 4 meters and an output arm of 0.8 meters. What is the mechanical advantage of the lever?
2. What is the mechanical advantage of a lever that has an input arm of 3.0 meters and an output arm of 2.0 meters?
3. A lever with an input arm of 2 meters has a mechanical advantage of 4. What is the output arm’s length?
4. A lever with an output arm of 0.80 meter has a mechanical advantage of 6.0. What is the length of the input arm?
5. A broom is held so that its input arm is 0.40 meters and its output arm is 1.0 meters. What is the mechanical advantage of the broom? What is the speed advantage?
6. A broom with an input arm length of 0.40 meters has a mechanical advantage of 0.50. What is the length of the output arm?
7. A child’s toy rake is held so that its output arm is 0.75 meters. If the mechanical advantage is 0.33, what is the input arm length? What is the speed advantage?

**Ramp problems 10.1**

1. A 5.0-meter ramp lifts objects to a height of 0.75 meters. What is the mechanical advantage of the ramp?
2. A 10-meter long ramp has a mechanical advantage of 5. What is the height of the ramp?
3. A ramp with a mechanical advantage of 8.0 lifts objects to a height of 1.5 meters. How long is the ramp?
4. A child makes a ramp to push his toy dump truck up to his sandbox. If he uses 5.0 Newtons of force to push the 12-newton truck up the ramp, what is the mechanical advantage of his ramp?
5. A ramp with a mechanical advantage of 6 is used to move a 36-newton load. What input force is needed to push the load up the ramp?
6. Gina wheels her wheelchair up a ramp using a force of 80.0 Newtons. If the ramp has a mechanical advantage of 7.0, what is the output force (in Newtons)?
7. **Challenge!** A mover uses a ramp to pull a 1000-newton cart up to the floor of his truck (0.80meters high). If it takes a force of 200 Newtons to pull the cart, what is the length of the ramp?

**General:**

1. A bicycle wheel has an outer radius of 30cm. The chain is attached 6cm from the axle. In order to spin the outer edge of the wheel at 12m/s, how fast the chain be moved?
2. A pulley system is created such that a single rope pulls on a weight 3 times. If the input force is 60N, what is the largest weight that can be used?
3. A worker can apply a maximum sustained force of 800N along a 10m ramp that rises by 1.5m. What is the maximum weight the worker can move up the ramp?
4. A 6mm screw has a shaft **diameter** of 6mm. The screw has a pitch of 0.1mm. What is the mechanical advantage of this screw?
5. The steering wheel on a bus is an example of what type of simple machine?
6. The blade of a knife is an example of what type of simple machine?
7. A stapler is an example of what type of simple machine?