Name, Date, Hr/Per_____

Simple Machines, IMA, AMA and Efficiency

Ideal Mechanical Advantage

1. a. A simple machine would be considered ideal if it had no friction that's because some of the effort that is put into the machine is wasted in overcoming friction.
   b. Ideal Mechanical Advantage has the symbol IMA.
   c. Ideal Mechanical Advantage can be determined by the following equation:

$$\text{ideal mechanical advantage} = \frac{\text{effort distance}}{\text{resistance distance}} = \frac{\text{length of ramp}}{\text{height of ramp}} \qquad IMA = \frac{d_E}{d_R}$$

Actual Mechanical Advantage

2. a. Actual machines have friction. They are not as have as high of a mechanical advantage as ideal machine because some of the effort is lost in overcoming friction.
   b. Actual Mechanical Advantage has the symbol of AMA.
   c. Actual Mechanical Advantage can be determined by the following equation:

$$\text{actual mechanical advantage} = \frac{\text{resistance force}}{\text{effort force}} \qquad AMA = \frac{F_R}{F_E}$$

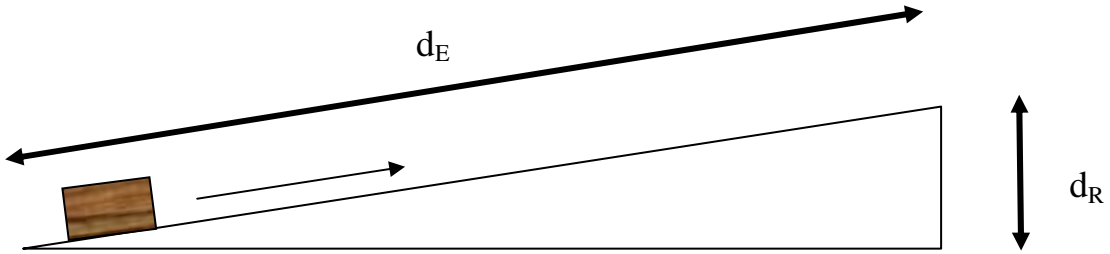
Efficiency

3. a. A machine multiplies force. How effective the machine is in that is called efficiency.
   b. Efficiency is expressed as a percentage.
   c. Efficiency can be determined by the following equation:

$$\text{efficiency} = \frac{\text{actual mechanical advantage}}{\text{ideal mechanical advantage}} \times 100 \qquad \text{efficiency} = \frac{AMA}{IMA} \times 100$$

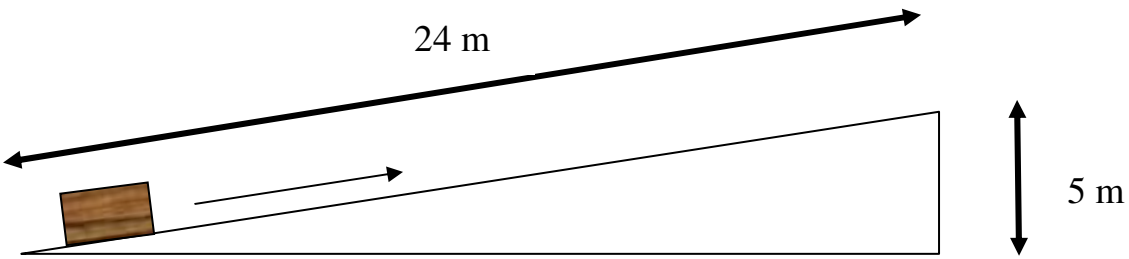
Inclined Planes

4. The following is how you tell the IMA of an inclined plane.

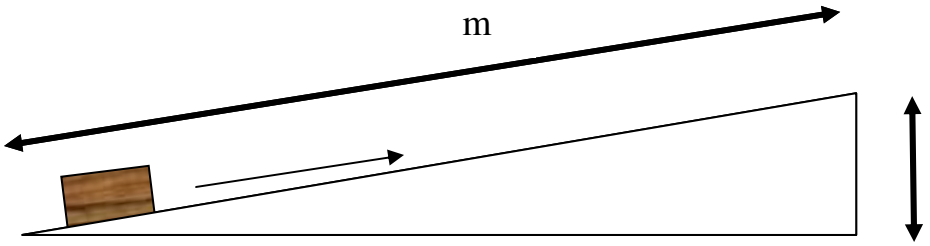


$$\text{ideal mechanical advantage} = \frac{\text{effort distance}}{\text{resistance distance}} = \frac{\text{length of ramp}}{\text{height of ramp}} \qquad IMA = \frac{d_E}{d_R}$$

a.. What is the IMA of this ramp? Show your work.



b. What is the IMA of this ramp? Show your work.



5. To determine the AMA of the inclined plane, you must use force. The effort force is what is measured with a spring scale in Newtons. The resistance force is weight of the box in newtons.
The equation is:

actual mechanical advantage = $\frac{\text{resistance force}}{\text{effort force}}$

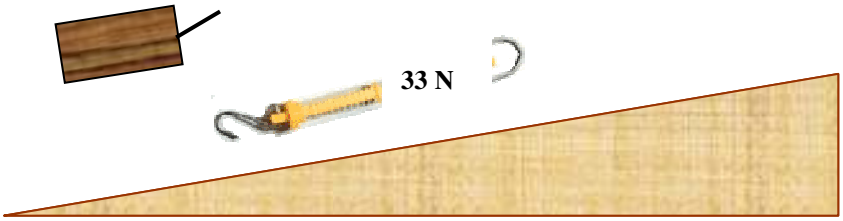
$$AMA = \frac{F_R}{F_E}$$

35 N

actual mechanical advantage = $\frac{\text{resistance force}}{\text{effort force}}$

$$AMA = \frac{F_R}{F_E} = \frac{35\ N}{15\ N} = 2.3$$

a. Calculate the AMA of the ramp below. Show your work.



105 N

b. Calculate the AMA of the ramp below. Show your work.

325 N

6. The efficiency of a machine can be determined by the following equation.

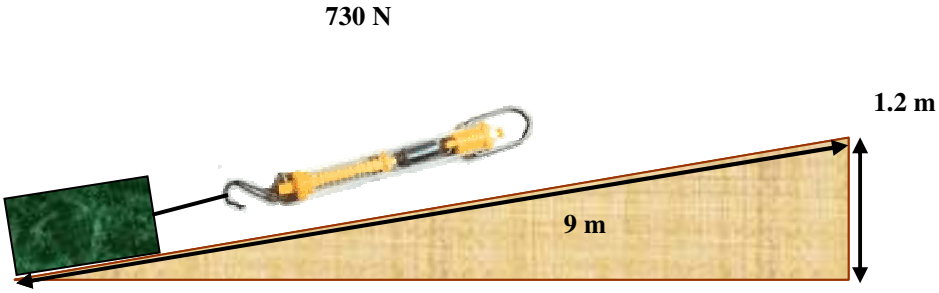
efficiency = $\frac{\text{actual mechanical advantage}}{\text{ideal mechanical advantage}} \times 100$

efficiency = $\frac{AMA}{IMA} \times 100$

783 N

a. Determine the efficiency based on the diagram below. Show work.

b. Determine the efficiency based on the following diagram. Show your work.



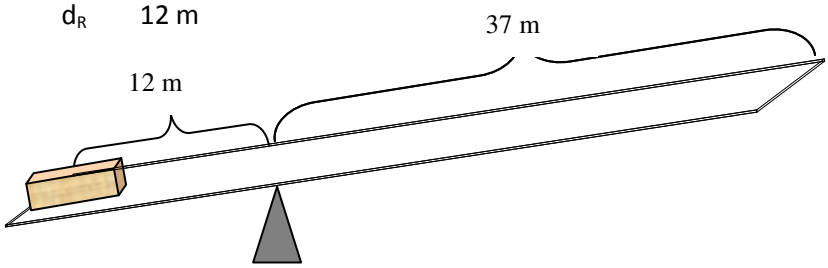
4933 N

Levers

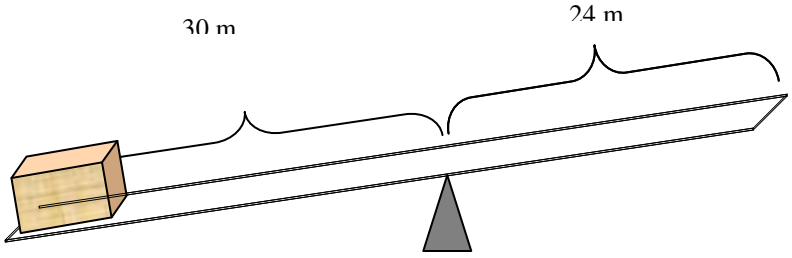
5. To find the Ideal Mechanical Advantage of a lever, use the following equation.

ideal mechanical advantage = $\frac{\text{effort distance from fulcrum}}{\text{resistance distance from fulcrum.}}$

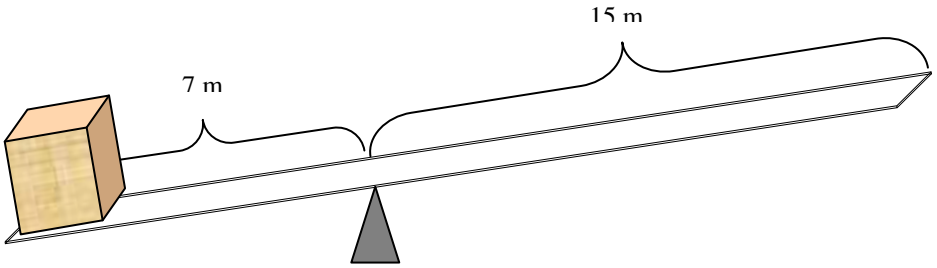
IMA = $\frac{d_E}{d_R} = \frac{37\text{ m}}{12\text{ m}} = 3.08$



b. Determine the IMA for the following. Show your work.



c. Determine the IMA for the following. Show your work.



Pulleys

8. The ideal mechanical advantage of a pulley is determined by counting the number of supporting ropes. Look at the following examples.

Mechanical Advantage and Efficiency

[random worksheet that doesn't have a title - …a force of 100 n is applied to a simple machine in order to lift a bix that weighs 300 N….etc]

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IMA, AMA & Efficiency

[have not made new copy yet]