Simple Machines— Station One—1st Class Levers

This station should have 2 levers set up. One where the fulcrum is @ .5m and one where it is @ .65m. **Don't change them in any way!** You should also have Newton scale and a meter stick.

Hooked Side = Input Weighted Side = Output

A) Draw the levers in your notes and use the drawings to record your results.

B) Record output force that the mass has on the lever.

C) Record the input force.

D) Calculate the AMA of each lever.

E) Move the input side of **each lever** down (toward the ground) 10 cm. On the output side of lever, measure how far the weight moves up.

F) How are the AMA you calculated (in D) and the ratios in distances measured (in E) related?

G) Calculated the IMA for each lever. Are the same as the AMAs you calculated in D?

Simple Machines— Station two —2nd Class Levers

This station should have 2 levers set up. One where the mass is @ .5m and one where it is @ .75m. **Don't change them in any way!** You should also have Newton scale and a meter stick.

Hooked Side = Input Weighted Side = Output

A) Draw the levers in your notes and use the drawings to record your results.

B) Record output force that the mass has on the lever.

C) Record the input force.

D) Calculate the AMA of each lever.

E) Move the input side of **each lever** up (toward the sky) 10 cm. On the output side of lever, measure how far the weight moves up. Do your numbers match? Why?

F) How are the AMA you calculated (in D) and the ratio in distances measured (in E) related?

G) Calculated the IMA for each lever. Are the same as the AMAs you calculated in D?

Simple Machines—Station Three--Pulleys

This station should have string, a ring stand, pulleys and Newton scales.

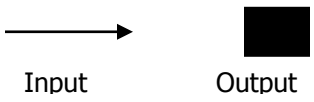
Take extra care to not mess up the stringing of the pulleys.

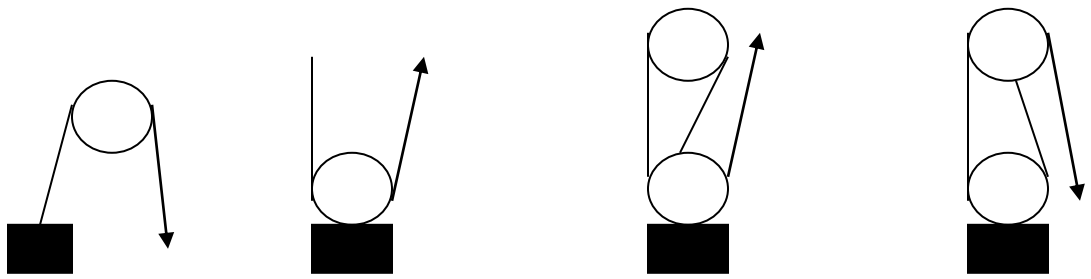
A) Look at the pictures below. Predict which set-up will require LESS pulling force on the string in order to get the mass to lift up off the table.

B) For each set-up, measure the output force and the input force.

C) For each set-up, measure the distance the mass is raised & the amount of cord pulled. How do these numbers relate to the AMSs calculated?

C) Sketch the set-up of the 2 Newton scales and what they each read. Unhook the mass from the scales and find out what its weight's force is. Discuss with your group what this has to do with pulley





A B C D

Simple Machines—Station Rube

Surf around for Rube Goldberg ideas & inspiration!!

Simple Machines--Station Six—Screws and Wedges

This station should have two screws, screwdrivers, boards, scissors paper, and tape. There should also be some examples of wedges

A) Take the screws and write down what makes them similar and what makes them different.

B) Predict which one will be easier to get to screw into the board.

C) Screw each screw into the board. Record which one was easier to turn.

D) Record which one went into the board faster.

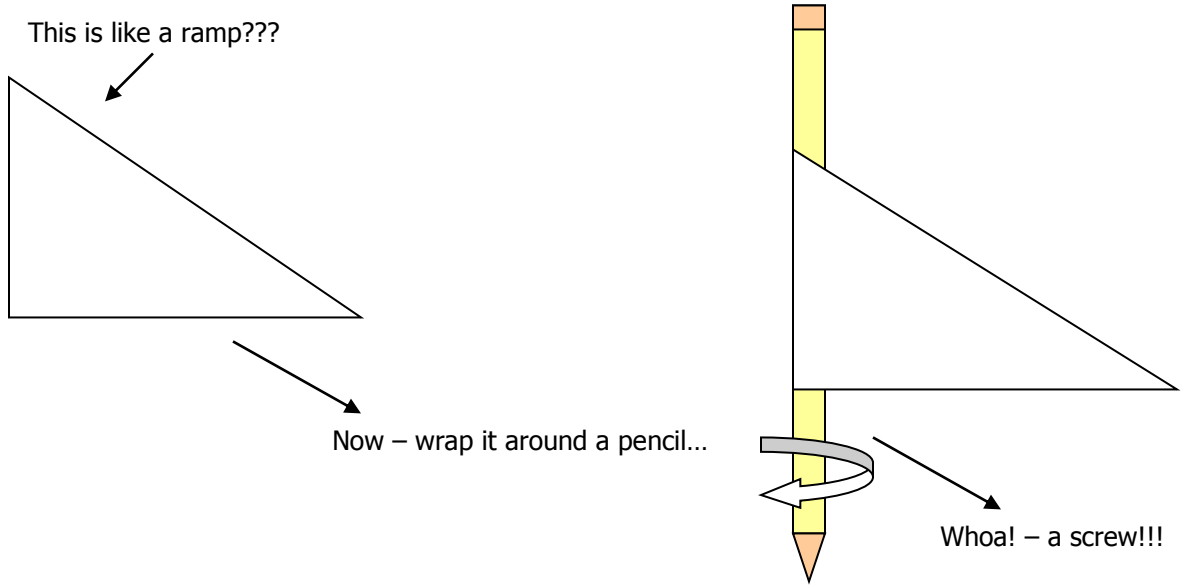
E) Calculate the IMA of the BIG bolt at this station.

F) Cut a piece of paper just like the dashed-line figure below. Wrap it around a pencil. Record what happens, by either drawing the results or by describing this in words.

Wedge

A) Use the wedges that are at this station to do work.

B) When would you use a wedge?



Simple machines—Station Seven—Wheel and axle

This station should have a LEGO elevator at it. There should be a big wheel a little wheel, and another LEGO piece.

A) Use the little wheel to crank the elevator up.

- Count the number of turns to lift the weight. Record.

B) Next, replace the little wheel with the big wheel and use it to crank the elevator up.

- Count the number of turns to lift the weight. Record.

WHY DO THESE NUMBERS TURN OUT THE WAY THEY DID??

C) Which one was easier to crank, the big wheel or the little wheel?

- Why might this be?? How do you know??

D) If the diameter of the axle at this station is .5cm, calculate the IMA of BOTH the big and small W&A systems.

- Why can you say that a W&A is truly a lever?

Simple machines—Station Eight

Take the online quizzes at the following sites!

http://www.edinformatics.com/math_science/simple_machines/simple_machines_quiz.htm

http://glencoe.mheducation.com/sites/0078778115/student_view0/unit6/chapter20/math_practice_2.html

LESSON SUMMARY

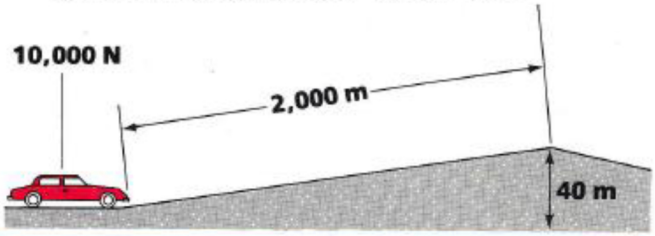
- An inclined plane is a slanted surface, or ramp.
- The MA of an inclined plane is equal to its length divided by its height.
- A wedge is two inclined planes back to back.
- A screw is an inclined plane wrapped around a cylinder.

CHECK *Write true if the statement is true. If the statement is false, change the underlined term to make the statement true.*

1. A wedge is an inclined plane wrapped around a cylinder.
2. The MA of an inclined plane is equal to its length divided by its height.
3. A plane is a slanted surface.
4. Nuts and bolts are examples of wedges.
5. An inclined plane decreases the size of the effort force.
6. A wedge is made up of two inclined planes.

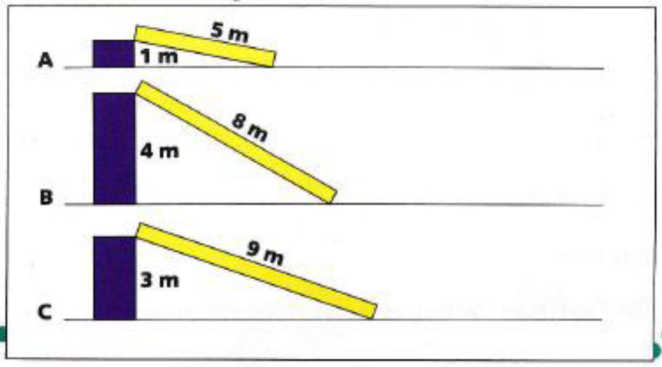
APPLY *Complete the following.*

7. How could you increase the MA of an inclined plane?
8. **Calculate:** How much input force would be needed to push the car up the hill?



Skill Builder

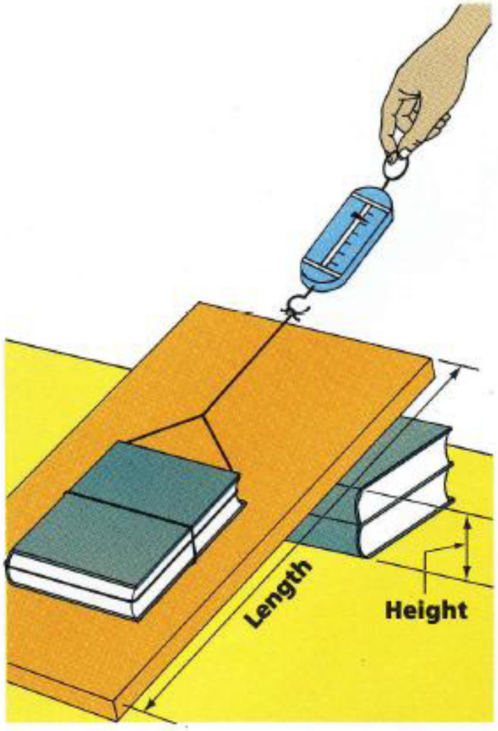
Interpreting a Diagram The diagram shows three ramps: A, B, and C. Which ramp has the smallest MA? Explain.



ACTIVITY

FINDING THE MA OF AN INCLINED PLANE

1. An inclined plane has been set up for you (you're welcome...) You can thank me later...
2. Use the metric ruler to measure the length and height of the inclined plane. Record your measurements.
3. Use the spring scale to measure the force (output) required to lift the mass. Record this number.
4. Use the spring scale to pull the mass up the inclined plane. Record the input force shown on the scale.



Questions

1. What is the ideal MA of the inclined plane using the formula MA = length/height?
2. What is the actual MA of the inclined plane using the formula MA = force output/force input ?
3. **Hypothesize:** Why is the actual MA less than the ideal MA?

LESSON SUMMARY

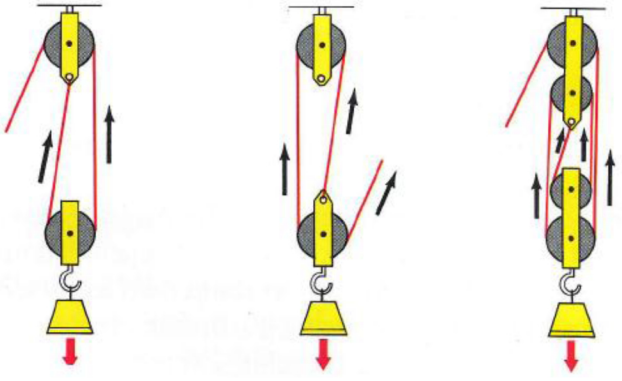
- A pulley is a rope wrapped around a wheel.
- Fixed pulleys change the direction of the effort force.
- Movable pulleys increase the size of the effort force.
- A pulley system is made up of fixed and movable pulleys.

CHECK *Write true if the statement is true. If the statement is false, change the underlined term to make the statement true.*

1. A fixed pulley can increase the effort force.
2. The mechanical advantage of a fixed pulley is two.
3. A block and tackle is an example of a pulley system.
4. The MA of a pulley system with four supporting ropes is 8.
5. A movable pulley can change only the direction of a force.

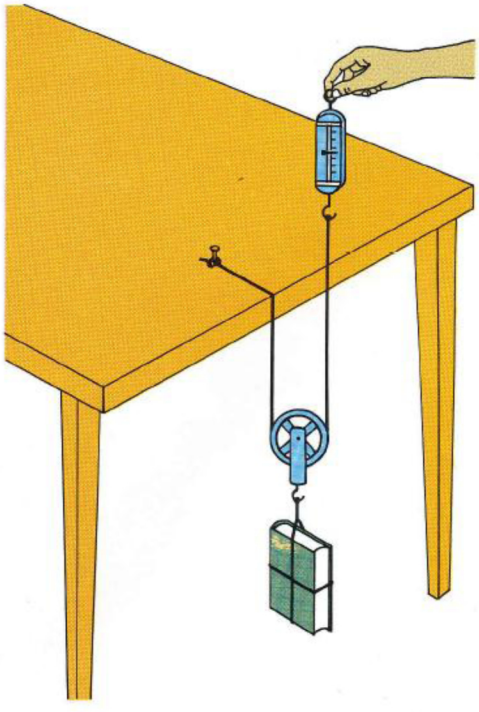
APPLY *Complete the following.*

6. **Classify:** What kind of pulley is used on a clothesline? Explain.
7. **Analyze:** What is the MA of each of the pulley systems shown in the diagram?



ACTIVITY

USING A MOVABLE PULLEY



1. The pulley has been set up for you... (you're welcome...)
2. Use the spring scale to lift the mass. Record the force needed to lift the mass 20 cm.
3. Attach the movable pulley to the mass and spring scale as shown.
4. Use the pulley to lift the mass the same distance. Record the input force needed to lift the mass.

Questions

1. How much force was needed to lift the mass without the pulley?
2. How much force was needed to lift the mass with the pulley?
3. What is the AMA of the movable pulley?