Keeping It Simple–Six Simple Machines

Problem To explore and use simple machines to understand how they make "work" easier

Teacher Note This activity is divided into six stations where six small groups will rotate through each station to explore and use simple machines. This exploration may be completed over 2-3 days. To set-up the activity:

1. Gather and set up materials for each station as listed.
2. Number the stations.
3. Copy student procedure directions for each station and place on appropriate table.
4. Divide students into six groups and pass out Simple Machines Data charts 1 and 2 (pp. 34 and 35).
5. Assign each group a station and explain how to rotate through the stations. Station 1 will move to Station 2, and so on.
6. It may be helpful to set a timer so that students will all rotate at the same time.
7. At the end of the activity, discuss the questions and the various simple machines.

1) Inclined Plane

Problem Which ramp will make moving a large piece of furniture the easiest?

Procedure

1. Attach the spring scale to the string around the paperback books.
2. Lift the books with the spring scale.
3. Read and record on the data sheet the number of grams it took to lift the books.
4. Use the wooden plank or cardboard and the protractor to construct a ramp that has a 60-degree angle. Put one end of the inclined plane on a stack of books. Pull the books up the inclined plane, keeping the spring scale parallel to the ramp.
5. Read and record in the Data Chart 1 (p. 34) the number of grams needed to move the books up the ramp.
6. Repeat steps 4-5 using a 30-degree inclined plane

Ramp with 60-degree angle

Materials

Inclined Plane

wooden plank or sturdy piece of cardboard
stack of books
protractor
2 paperback books tied together with string
spring scale

Questions

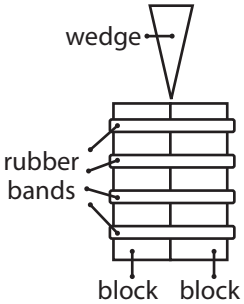
1. Did the ramp make the work easier?
2. Which ramp made the work easiest? Why?
3. What happened to the length of the inclined plane as the angle became smaller?
4. How can you use an inclined plane to help you in everyday life?

2) Wedge

Problem How can a wedge help separate two objects?

Procedure

1. Use the rubber bands to band the two same sized blocks of wood together. If you can easily pull them apart, add more rubber bands.
2. Use the smaller third block of wood to pry the banded blocks apart. Record your observations in Data Chart 1.
3. Use the wedge to pry apart the banded blocks. Record your observations in Data Chart 1.



Materials

Wedge

blocks of wood the same size
one smaller block
rubber bands
wedge of wood

Questions

1. What happened when you tried to separate the banded blocks with the smaller block of wood?
2. Compare what happened when you used the block and then the wedge to separate the banded blocks? Explain why there was a difference.
3. How can you use a wedge to help you in everyday life?

Keeping It Simple (continued) Six Simple Machines

3) Wheel and Axle

Problem

Does a larger handle on a screwdriver make work easier?

Procedure

1. Observe the screwdrivers and determine which part of the screwdriver is the wheel and which part is the axle. Discuss and record in Data Chart 1 (p. 34).
2. First, use the screwdriver with the smaller handle. Turn the screwdriver until about half the screw is inserted into the wood. Observe and rate the amount of force needed to turn the screw into the wood.
3. Use the second screwdriver to finish inserting the screw into the wood. Observe and rate the amount of force used. Record.
4. Compare the amount of force used in steps 2 and 3.

Materials

Wheel and Axle

two screwdrivers that are the same length but have different sized handles
piece of wood
6 screws (1 for each group)

Questions

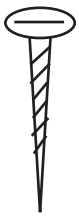
1. Which screwdriver made it easier to insert the screw into the wood?
2. Explain you answer.
3. How can you use a wheel and axle in everyday life?

4) Screw

Problem

To understand that the pitch of a screw determines the difficulty of turning the screw

Procedure



Each group should use a new set of predrilled holes.

1. Observe each screw and nail and note any differences in Data Chart 2 (p. 35).
2. Place screw A in one of the predrilled holes.
3. Use the line drawn on top of the screw to count the number of turns it takes using the screwdriver to insert the screw entirely into the block of wood.
4. Record the number of turns in your data chart. Observe the amount of force used and record.
5. Repeat steps 2-4 with screw B.
6. Using just your hands, try to insert the nail into the wood. Use the line drawn on top of the nail to help you count the number of turns.
7. Record the number of turns and your observations in the data chart.
8. Compare and contrast inserting the nail, Screw A, and Screw B.

Materials

Screw

block of soft wood with 12 predrilled holes
6 nails (1 for each group)
6 sets of 2 wood screws with different pitch but equal length (pitch is the distance between the treads or ridges)
1. use permanent marker and draw a line across the top of each screw and nail
2. use tape to label screws A (larger pitch) and B (smaller pitch)

screwdriver
goggles

Questions

1. How did the nail work in relation to the two screws?
2. Did you find one screw works better than the other?
3. What was the difference between the screws?
4. Which one needed more turns? Why?
5. How can screws make a difference in everyday life?

Keeping It Simple (concluded) Six Simple Machines

5) Lever

Problem

How does moving the fulcrum affect the amount of force needed in a lever system?

Materials

Lever
30-cm ruler
dictionary
small object such as a pencil or base 10 block for fulcrum
spring scale

Procedure

1. Place the dictionary 26 cm from the edge of the table.
2. Place one end of the ruler under the dictionary so that the 1-cm mark is covered.
3. Place the fulcrum under the ruler at the 24 cm mark.
4. Attach the spring scale to the ruler so that it is hanging downward. Gently pull on the spring scale until you just begin to lift the dictionary. See diagram 1.
5. Read and record in Data Chart 2 (p. 35) the number of grams used.
6. Keeping the 1-cm side of the ruler underneath the dictionary, move the fulcrum to the 15-cm mark. Repeat steps 4-5.
7. Repeat step 6, using 6 cm as the fulcrum's position.

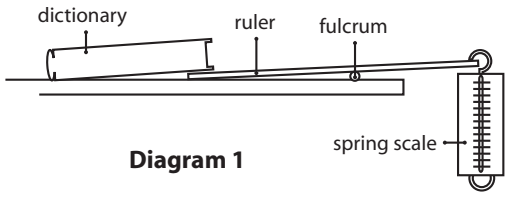


Diagram 1

Questions

1. Did the number of grams used to lift the dictionary change when you moved the fulcrum? How?
2. If you wanted to lift a heavy load, where should you place the fulcrum?
3. How can you use levers to help you in everyday life?

6) Pulley

Problem

How do pulleys make work easier?

Materials

Pulley
two single pulleys
ring stand
500 g weight
80 cm of string
spring scale

Procedure

1. Use the spring scale to lift the weight off the floor or desk. Read and record the number of grams.
2. Attach the pulley to the ring stand.
3. Attach one end of the string to the weight.
4. Loop the other end through the pulley and attach the spring scale to the end of the string. See diagram 1.
5. Pull down on the spring scale to measure how many grams are needed to lift the weight and record in Data Chart 2 (p. 35).
6. Using a second pulley, construct the pulley system below. See diagram 2.
7. Pull up on the spring scale to lift the weight. Read and record grams in the data chart.

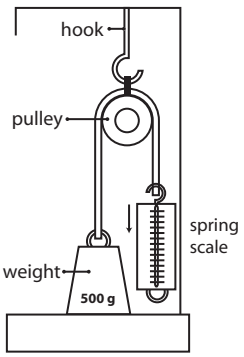


Diagram 1

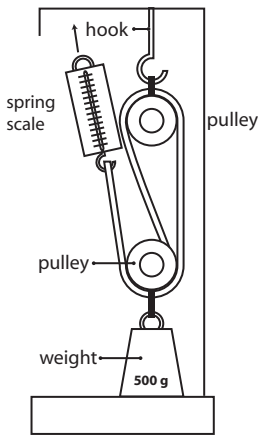


Diagram 2

Questions

1. Was there a difference between not using a pulley and using one pulley?
2. What was the difference between using one pulley and using two pulleys?
3. Why would anyone want to use just one pulley?
4. How can pulleys help you in everyday life?

Keeping It Simple Data Chart 1

Inclined Plane

Inclination in degrees	Grams
0 º	
30 º	
60 º	

Questions:

1. _____

2. _____

3. _____

Wedge

Object	Rate Observed Force
Small block	
Wedge	

Questions:

1. _____

_____

2. _____

_____

3. _____

_____

Wheel and Axle

On a screwdriver, the wheel is the _____ and the axle is the _____.

Screwdriver	Rate the Observed Force
Small-handled screwdriver	
Large-handled screwdriver	

Questions:

1. _____

_____

2. _____

_____

3. _____

_____

Keeping It Simple Data Chart 2

Screw

Observations (compare and contrast nail, screw A, and Screw B).

Screw	Number of Turns	Rate Observed Force
Nail		
Screw A		
Screw B		

Compare and contrast the insertion of screws A and B and the nail.

Questions:

1. _____

2. _____

3. _____

4. _____

5. _____

Lever

Position of Fulcrum	Grams
24 cm	
15 cm	
6 cm	

Questions:

1. _____

2. _____

3. _____

Pulley

Number of Pulleys	Grams
0	
1	
2	

Questions:

1. _____

2. _____

3. _____

4. _____