What is a class one lever?

Tool Concepts:

- Class one levers consist of a rod, fulcrum, load arm, and effort arm.
- The fulcrum divides the lever into two sides. One side holds a load. This is called the load arm.
- Force is applied to the other side of the fulcrum. This side is called the effort arm.
- If the fulcrum is moved closer to the load, or the load moves closer to the fulcrum, the amount of force needed to lift the load is decreased.
- Class one levers include the seesaw, balance scale, boat oar, pliers, and scissors.

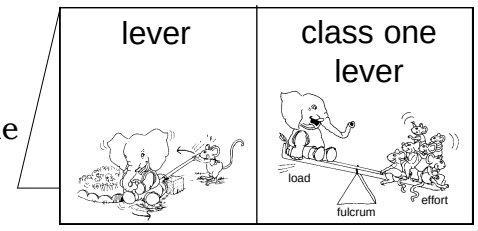
Vocabulary Words: class one lever seesaw load *measurements *accurate

Read: *Lots of Science Library Book #12.*

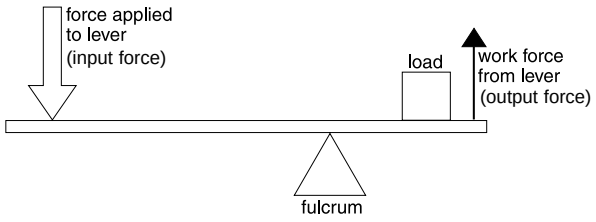
Activities:

Class One Levers – Graphic Organizer

Focus Skills: labeling parts, explaining forces
Paper Handouts: Large Question and Answer Book from Lesson 11
a copy of Graphics 12A–B
Graphic Organizer: On the second tab of the Lever Book, draw/glue Graphics 12A. Write/copy *class one lever* on the top of the tab. Under the tab, draw/glue Graphic 12B.



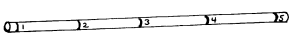
- \ Write/copy the names of the parts of the lever. Draw a black arrow showing where the force, or effort, is applied to this lever. This is called the input force. Draw a blue arrow showing where the force of the lever works, or the output force.
- \\ Label the parts of the lever and list the examples shown on the tab. Explain the load arm and the effort arm of the lever.
- \\\ Complete \\. Explain output force and how to change the amount of output force with this lever.

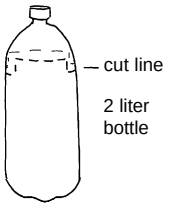


Make a Lab Lever

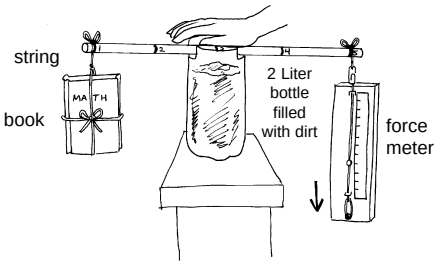
Focus Skill: following directions
Activity Materials: 5/8" x 48" wooden dowel ruler pencil 5 small rubber bands
knife/scissors dirt 2-liter plastic soda bottle

Activity: Use the ruler to mark the dowel at 12" locations. Label each mark with the numbers 1, 2, 3, 4, and 5. Wrap a rubber band tightly around the dowel at each number. These rubber bands will be used for attaching loads and the force meter. This is the rod for the Lab Lever.



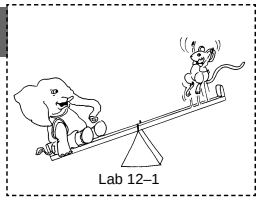


Cut off the top. Cut a U–shaped channel in the side of the bottle at the top. Cut another U–shaped channel directly across from the first cut. Fill the bottle with dirt and rocks for stability. This is the fulcrum for the Lab Lever.

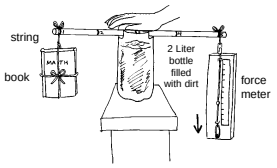


Test your Lab Lever by placing the rod in the channels at the top of the fulcrum at position #3. Ask a partner to put a hand over the fulcrum to keep the lever in place. Attach a load to position #1 while your partner holds the rod at position #3. The load may be tied onto the rod with string. Attach the force meter to position #5 by putting the clip under the rubber band at that position. Pull on the wood of the force meter and observe the amount of force needed to lift the load. This Lab Lever will be used in Labs in Lessons 12, 13, and 14. A partner will be needed for all the labs to hold the lever in place.

Investigative Loop – Using a Class One Lever – Lab 12–1



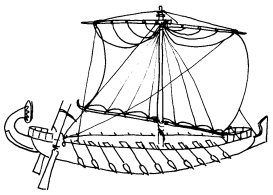
Focus Skills: predicting outcomes, drawing conclusions
Lab Materials: lab lever force meter load bag
Paper Handouts: Lab Book 8.5" x 11" sheet of paper Lab Record Cards
a copy of Lab Graphic 12–1
Graphic Organizer: Make a Pocket Book and glue it side–by–side to the Lab Book. Glue Lab Graphics 12–1 to the left pocket.
Question: How does the placement of a fulcrum affect the amount of force needed to lift a load using a class one lever?
Research: Read *Lots of Science Library Book #12*. Review the question.
Prediction: Predict how different positions of the fulcrum will affect the amount of effort needed to lift the load: "I think it will take more effort to lift a load at position #_____."
Procedure: Place the fulcrum under Position #3 of the rod. Place the load on Position #1. Attach the force meter to Position #5 and pull down to lift the load. Move the fulcrum to Position #2 and follow the same procedure. Move the fulcrum to Position #4 and follow the same procedure.



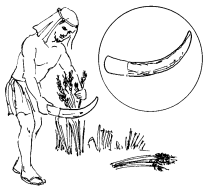
Observations: Observe the force meter as each load is lifted.
Record the Data: Label three Lab Record Cards "Lab 12–1," and the date. Draw the three positions of the fulcrum, one on each card, and record the force meter number required to lift each load.
Conclusions: Compare the amount of force needed to lift the load in each position. Which position required more force? Which one required less force? Compare this to the prediction about the fulcrum.
Communicate the Conclusions: Label a Lab Record Card "Lab 12-1." Explain how the position of the fulcrum affected the amount of force needed to lift the load.
Spark Questions: Discuss questions sparked during the lab.
New Loop: Choose one question to investigate further.
Design Your Own Experiment: Select a topic based upon this *Investigative Loop* experience. See page viii for more details.

Paper Handouts: Timeline Book a copy of Graphics 12C–D

Graphic Organizer: Glue Graphics 12C–D to the appropriate places in the Timeline Book. Copy the date of use on each picture. Draw a line from the graphic to the timeline and color the country where the tool was used. Add any other tools discovered in research to the Timeline Book.



2000 B.C.
Egypt



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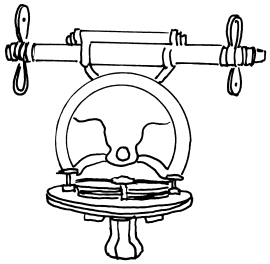
Egypt

Experiences, Investigations, and Research

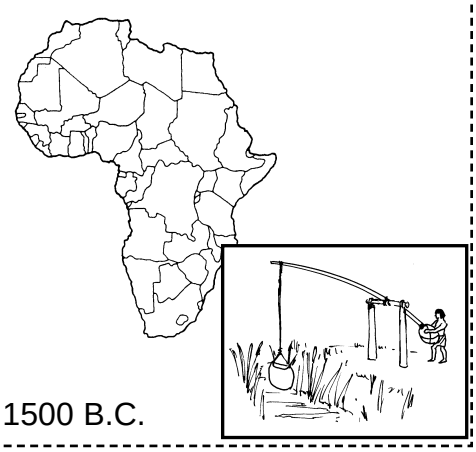
Select one or more of the following activities for individual or group enrichment projects. Allow your students to determine the format in which they would like to report, share, or graphically present what they have discovered. This should be a creative investigation that utilizes your students' strengths.

1. Research and sketch the trebuchet, a medieval war machine. Explain its purposes and describe how it was used.
2. Interview three people with different professions to determine what special tools they use. Speculate as to how these tools developed for each profession.
3. Investigate the invention and use of a hand operated water pump. Describe it as a class one lever.
4. Examine and sketch the following tools: oar, crowbar, weighing balance, scissors, and pliers. Identify and label the fulcrum, rod, effort, and load of each.

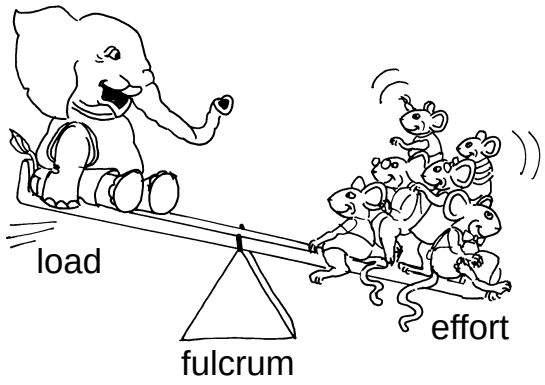
Technology – For centuries, the theodolite has been a surveyor's most important tool. Investigate how it works and its uses today. Add this tool to the *Tools in Time* Timeline Book.



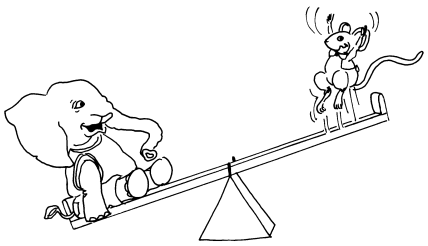
Tools in Time 11–G Egypt



Class One Levers 12–A

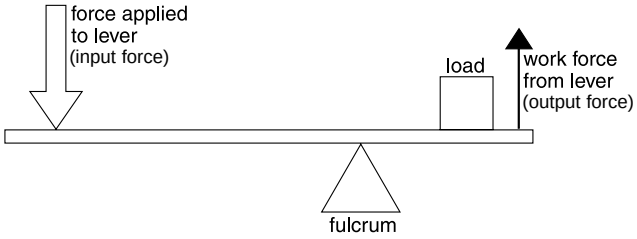


Using a Class One Lever Lab 12–1

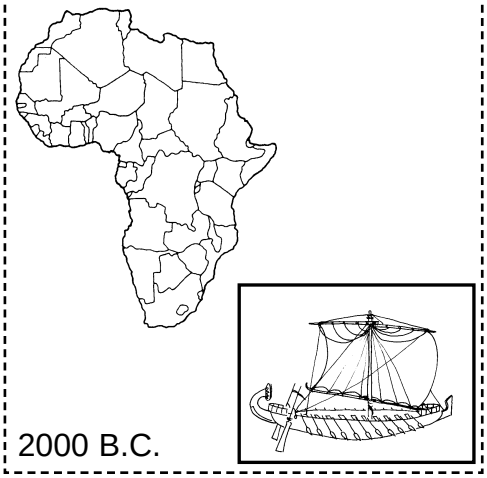


Lab 12–1

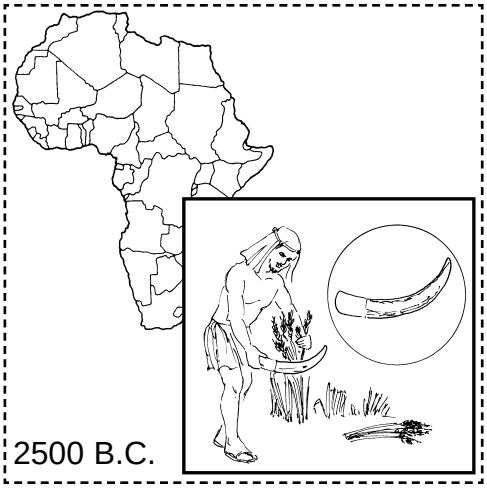
Class One Levers – Inside 12–B



Tools in Time 12–C Egypt

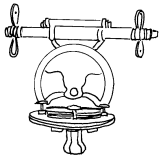


Tools in Time 12–D Egypt

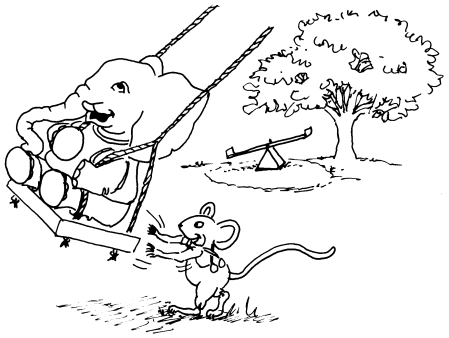


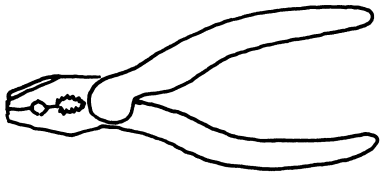
TECHNOLOGY

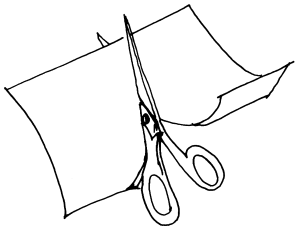
Accurate measurements are extremely important for technology. When a product, such as a car, is made of thousands of parts that could come from all over the world, accurate measurements are essential. Mechanical parts need to be accurate to within 0.0001 of an inch (0.025 mm). For radios and satellites to work, time must be measured accurately to within less than a second per century.

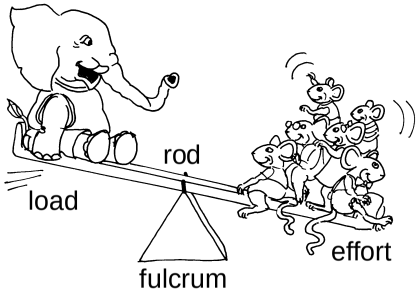


Max and Elmer love to play at the park.





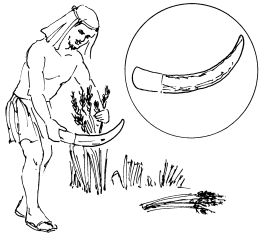


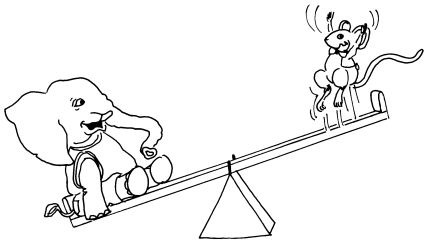


Tools in Time

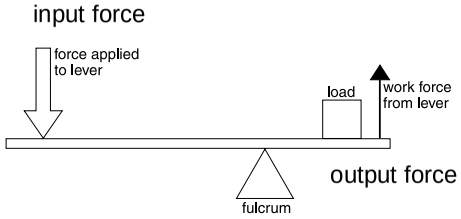
2500 B.C. Egypt

Men cut grain using flint sickles.





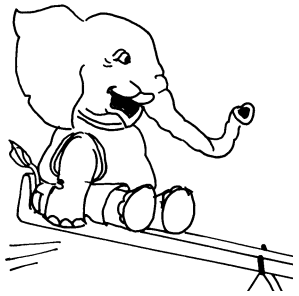
Scientists can determine the amount of force needed to lift a load with a class one lever by using a formula.



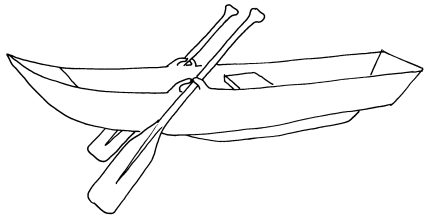
Load x Length of Load Arm = Effort x Length of Effort Arm

Force is applied to the other side of the rod. This side is called the effort arm.

The fulcrum divides the lever into two sides. One side of the rod holds the load. This is called the load arm.



Class one levers are used everyday.

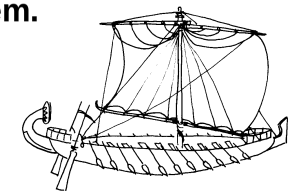


Elmer sits on one end of the seesaw. Max tries to lift Elmer, but Elmer, the load, is too heavy for Max to lift. Then Max gets an idea.

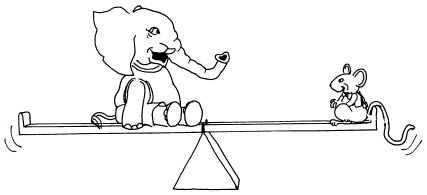
Tools in Time

2000 B.C. Egypt

Large boats, 140 feet in length, were powered by huge oars and an elaborate steering system.



If the fulcrum is moved closer to the load or the load moves closer to the fulcrum, this decreases the amount of force needed to lift the load. So when Max's cousins have to go home, Max asks Elmer to move closer to the middle of the seesaw, or closer to the fulcrum.



Max asks his cousins to sit on his side of the seesaw. With Max and his cousins on one side, there is enough force to lift Elmer off the ground.

The seesaw is an example of a class one lever. Class one levers consist of a rod, fulcrum, load, and effort.

Archimedes said, "Give me a long enough lever and a place to stand, and I will move the earth."