

# Lever Action

<b>Standard 3240-04</b>	Students will construct various machines and compare the work done by them.	<b>Topic:</b> Changes in force, motion and energy <b>Course:</b> 3240-04
<b>Objective 3240- 0401</b>	Construct simple machines and use them to measure and analyze work done by them.	
<b>ILO's:</b>	<b>1a</b> Make observations and measurements <b>2d</b> Collect and record data using procedures designed to minimize error. <b>5a</b> Know science terminology appropriate to grade level. <b>6d</b> Construct tables, graphs, charts, diagrams and models to describe and summarize data.	

## Description of Activity:

*Title of Activity:* Lever Action

*Activity Overview:* Students will be introduced to the concept of levers. They will then be given time to discover how levers work and what type of levers exist.

*Duration of Activity:* 50 minutes

### *Materials, Facilities and Resources:*

a hammer, a nail, a 2 foot long 2x4 stud, 10 - 12 meter sticks, 10 -12 heavy weights (bricks, texts, 1 kg. weights, etc.) 10 - 12 sturdy plastic mugs to serve as fulcrums (laying sideways on table).

## Background Information:

The three parts of a lever, fulcrum, resistance arm and effort arm, work together to make it possible to lift a weight using less force. The placement of the fulcrum, resistance and effort on the lever determine what type it is. There are 3 types of levers. They are classified as 1st class, 2nd class, and 3rd class. They can be diagrammed as follows:

$\frac{\text{R} \quad \quad \text{E}}{\text{F}}$	$\frac{\quad \quad \text{R} \quad \text{E}}{\text{F}}$	$\frac{\quad \quad \text{E} \quad \quad \text{R}}{\text{F}}$
1st class	2nd class	3rd class

Which lever is used depends on the job that needs to be done. The screwdriver is an example of a 1st class lever, a wheelbarrow is a 2nd class lever and a broom is a 3rd class lever. In this activity a 1st class lever should be easiest to use, especially if the resistance arm is shorter than the effort arm.

## **Teaching and Learning Strategies:**

*Ensure Inquiry:* Do Not discuss levers until after the nail demonstration.

Do Not discuss the 3 types of levers until the students have completed their experiments.

*Prerequisite Instruction:* none

## **Invitation to Learn:**

1. Pound a nail into the 2" x 4" stud and have students attempt to remove the nail without using the hammer.
2. After several students have attempted to remove the nail, allow one student to use the hammer to remove the nail.
3. Ask the students, "Why was it easier to remove the nail by using the hammer?" Follow this up by having the students label (on their activity sheet ) the forces acting on the hammer.
4. Tell the students that the hammer was acting as a lever.
5. Describe the key elements of a lever (fulcrum, effort, resistance) and have the students indicate these in their activity sheets by the drawing of the hammer.
6. Arrange the students in groups of 3 and pose the problem: What arrangement of a fulcrum, a force and a resistance will provide the greatest ease in lifting a weight if only your "pinky" finger is used as the applied force?
7. Tell the students to try as many combinations as possible (minimum of 7 ). Encourage students to use a variety of placements and arrangements of the effort, resistance and fulcrum. Tell the students to keep track of all lever arrangements.
8. Allow for 25 minutes of investigation.
9. Following the investigation phase, go around the room and have each group draw their most successful and their least successful arrangements on the board. Make sure that the fulcrum, effort and resistance are indicated on the drawings.
10. Introduce the 3 types of levers by using the students drawings. Indicate which drawings are 1st class levers, 2nd class levers and 3rd class levers and explain why they fit these categories. If a type of lever is missing, draw this one on the board and ask if any students tried this arrangement.
11. Introduce the concept of work. (Work = force x distance)
12. Tell the students the weight of the object they were lifting. See if they can generate the idea that they traded force (weight of object) for distance (movement of the lever arm)

*Safe Operating Procedures:* No unusual hazards exist.

## Summary of Learning:

*Assessment of Learning:* Evaluate the student's activity sheets.

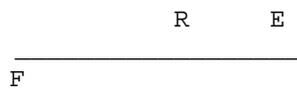
*Multiple Choice Items:*

1. How does using a lever make lifting an object easier?

- a. it reduces the weight of the object
- b. it reduces the work
- c. it trades force for distance
- d. it requires more energy but less work
- e. it doesn't make it easier

answer: c

2. What type of lever is illustrated by the following arrangement?



- a. a 1st class lever
- b. a 2nd class lever
- c. a 3rd class lever
- d. a 4th class lever
- e. a 5th class lever

answer: b

## Student Activity Sheet for "Lever Action"

1. Drawing of hammer:  
(label fulcrum, resistance, effort)

2. Your data: label drawings

- fulcrum
- resistance
- amount of effort as high, medium or low.

a.

b.

c.

d.

e.

f.

g.

Analysis Questions:

1. Which type of lever made it easiest to lift the weight?
2. Diagram this lever:
3. What does a lever "trade" for force?
4. Name three commonly used levers.