

ACTIVITY NO. - 3 - Let us Reduce the Effort

Subject	Physics
Class	XI
Chapter/Unit	Dynamics of Rotational Motion
Topic	Principle of Levers
Time	10 minutes
Nature of Activity	pair

What will I learn (Learning Outcome)?

To conclude that for a first class lever , mechanical advantage can be equal to unity, less than unity or more than unity. They will hence establish a relation between length of effort arm and load arm in order to apply least effort to lift a given amount of load (i.e. mechanical advantage greater than unity).

Skills: Analyzing and Creating

What I have to do?

To verify that effort moves farther than load for mechanical advantage to be more than Unity.

What do I require?

A 30 cm range ruler, pen/pencil, a book.

What do I need to know?

A lever is a simple machine which makes our mechanical work easier. It has a fulcrum, load and effort. The mechanical advantage of the lever is the ratio of output force (Load) to input force (Effort). It can also be calculated as ratio of the length of the lever on the applied effort side of the fulcrum to the length of the lever on the load force side of the fulcrum. A lever reaches equilibrium when the forces applied to each of its arms, in respect to its fulcrum, are the same.

➤ Teacher's Activity

Teacher will

1. make pair and explain the responsibility of each member in the pair
2. discuss the concept of equilibrium of a rigid body and types of levers (First Class, Second Class and Third Class) on the basis of placement of fulcrum
3. guide students on how to perform the activity.

How will I proceed?

➤ Student's Activity

1. keep a pen on the table and then keep ruler above it such that it makes an angle of 90° with the pen (like making a sign of $\perp$).
2. On one of the extreme end (call it end L at 30 cm mark) of the ruler keep a book.
3. keep the pen at the midpoint of the ruler (i.e. at 15 cm) and try to lift the book by applying force from the other extreme end of the ruler (end E at 0 cm mark).
4. Repeat step 3 for two different positions of the pen - at the mark 5 cm and 25 cm respectively. Observe the difference in amount of force applied in each case.

What have I observed?

S. No.	Position of pen	Effort Applied - More or Less
1	5 cm	
2	15 cm	
3	25 cm	

What have I learnt?

The lifting of the load was easiest when the Effort Arm is _____ as compared to Load Arm.

What am I curious to learn?

- We use following levers in our day-to-day life:-

Hockey Stick, Tweezers, Fishing Rod, Nut crackers, Wheel barrows, Door, Bottle opener, Crowbars, Scissors, Pliers and See saw

Let us identify the placement of load, fulcrum and effort along with the direction of force (effort as well as load) in each of the above mentioned levers.

Let me evaluate myself

1. What is meant by a rigid body?

2. What is meant by the translational equilibrium and rotational equilibrium of a rigid body?

3. Using a lever, Joe is able to lift a 10,000 N car off of the ground with a force of 1000 N. What is the mechanical advantage of the lever?

4. A pair of scissors is an example of a lever. Where should the material to be cut , is placed so as to reduce the efforts: - near the fulcrum or away from the fulcrum? Explain your answer.

5. A worker needs to haul a cart full of heavy boxes onto the deck of a house. He notices two ramps are set up, one being twice the length of the other one. Will the work done be same in both cases? If not then which one should he choose in order to reduce the amount of work he needs to do? Give reason for your answer.
