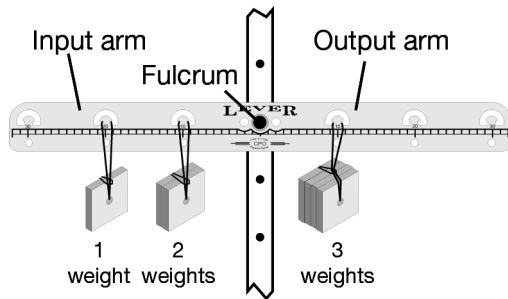


## Investigation 17B: Data and Answers

### 1 Setting up the lever

### 2 Levers in equilibrium

- Yes, the lever does balance.
- The variables are the number of weights and the position(s) at which they can be placed.
- 



### 3 Trying different combinations to balance the lever

Sample data:

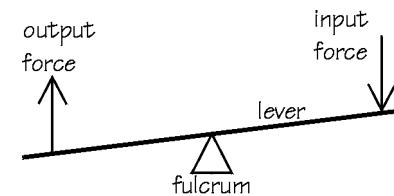
Trial #	
Trial #	
Trial #	
Trial #	

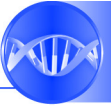
### 4 Determine the mathematical rule for equilibrium

The weight times the distance on one side equals the weight times the distance on the other side. The mathematical rule we found is: (input force)  $\times$  (length of input arm) = (output force)  $\times$  (length of output arm). If there is more than one weight hanging on a side, the force times distance for each weight should be calculated separately, and the total for each calculation should be added together to get the total for that side of the lever.

### 5 What did you learn?

- 





- b. The two ratios are output force/input force and length of input arm/length of output arm. These two ratios are equal to each other.
- c. The length of the output arm must decrease.

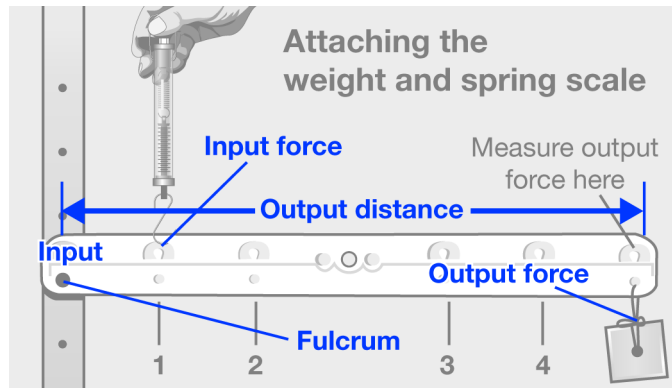
**6 The human body**

Table 1 sample data:

Trial	Output force (N)	Output distance (cm)	Input force (N)	Input distance (cm)	Mechanical advantage
1	2	60	17.6	10	0.11
2	2	60	9.5	20	0.21
3	2	60	5.0	40	0.40
4	2	60	3.9	50	0.51

**7 Stop and think**

- a. Sample diagram:



- b. The output force (hanging weight) represents the human hand.
- c. I predict the mechanical advantage will be greatest when the spring scale is at position 4 and least when it is at position 1.

**8 Doing the experiment**

See Table 1 data in Part 6.

**9 Analyzing your results**

- a. The mechanical advantage is greatest when the spring scale is at position 4 and least when it is at position 1.
- b. Trial 1 shows the correct positions of the fulcrum and forces for the human arm. The input force is very close to the fulcrum.
- c. The human arm has the greatest output distance. A small muscle movement allows the hand to move an object a large distance.
- d. Sample answer:

