# MiSP Simple Machines/Levers Assessment L3

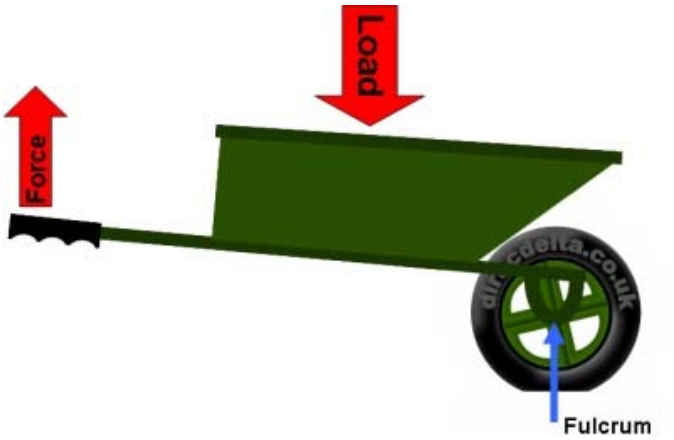
Name _____ Date _____

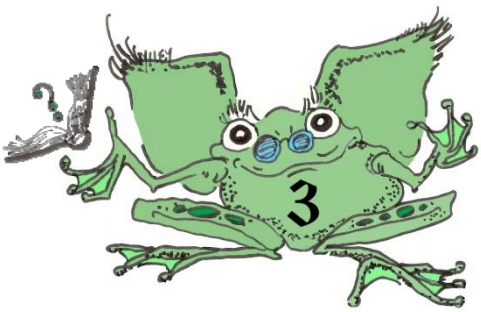
## Introduction:

A second-class lever has the resistance (load) between the fulcrum and the effort. The mechanical advantage is always equal to or greater than 1.0. Therefore, the effort force is always less than the effort that would be necessary to move the resistance (load) if the lever was not used.

A wheelbarrow is a second-class lever. Below is data from using a wheelbarrow to move a 30 kg rock. The effort (lift) is always applied at the end of the handles, 150 cm from the fulcrum. The fulcrum is where the wheelbarrow is joined to the axle of the wheel. The effort has to only lift the handle 10 cm for the wheelbarrow to roll.

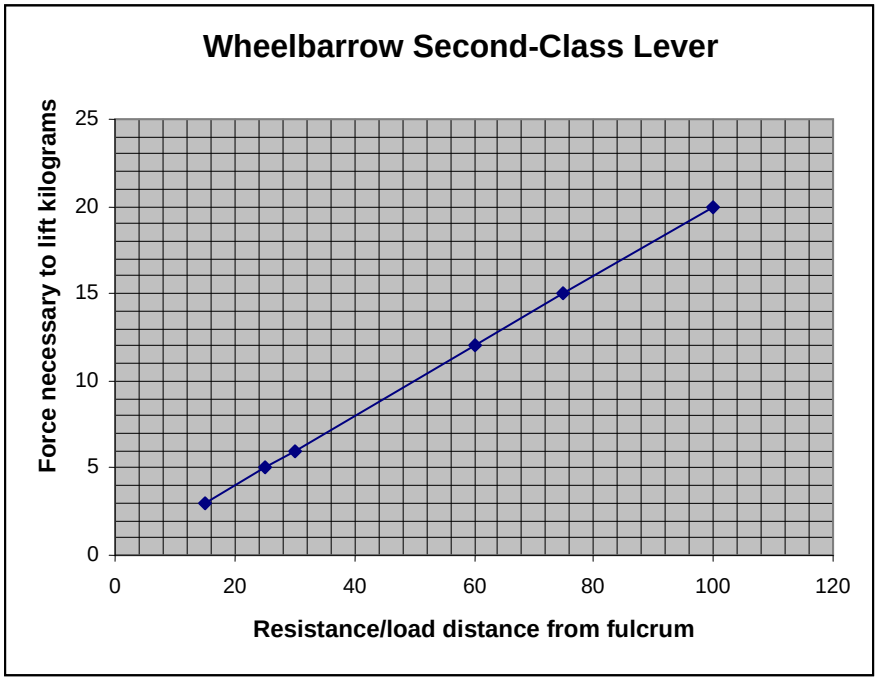
The rock is placed in different positions and the force needed to lift the wheelbarrow handle 10 cm is measured. The data chart indicates the mass that the force feels like it is lifting. (Kilograms are mass, not force.)



| 30 kg Rock Position — distance of resistance (load) from the fulcrum (cm) | Distance from the fulcrum to the handle — effort distance (cm) | Mechanical Advantage | Kilograms (kg) effort force feels like it is lifting |
|---|---|---|---|
| 15 | 150 | 10 | 3 |
| 25 | 150 | 6 | 5 |
| 30 | 150 | 5 | 6 |
| 60 | 150 | 2.5 | 12 |
| 75 | 150 | 2 | 15 |
| 100 | 150 | 1.5 | 20 |

The graph below shows the relationship between the resistance (load) distance from the fulcrum and the effort needed to lift the handles of the wheelbarrow:

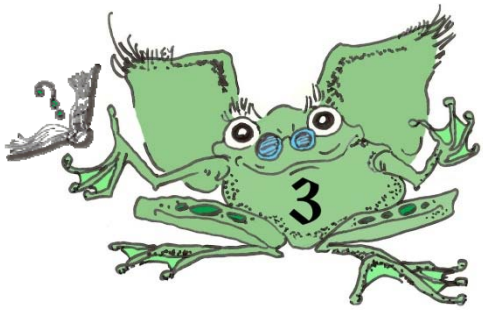



1. Based on the data chart and graph, where should the rock be placed in the wheelbarrow if the person moving the wheelbarrow wants to use the LEAST effort to lift the handles?

   _____

2. How much effort (in kilograms) would be needed if the rock was placed at 56 cm (resistance distance) from the fulcrum?

   _____kg



3. Complete this sentence: When using a second-class lever, as the resistance (load) distance from the fulcrum _____, the effort increases.

4. What is the unit rate of change (slope) for the wheelbarrow graph?

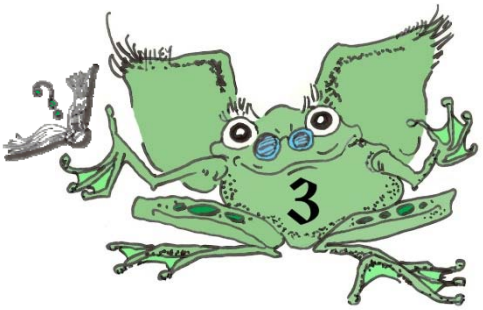
5. A unit rate of change can be a negative (-) or positive (+) number. What is the sign of the unit rate of change calculated in #4? What does that tell you about the relationship of the resistance distance and the effort force?

_____

_____

_____

6. Determine the *y*-intercept for the line on the wheelbarrow graph.



7. Using the unit rate of change calculated in #4 and the *y*-intercept from #6, what is the formula for the wheelbarrow graph line?

8. Using the formula from #7, what force (measured in kg) would be needed if the rock was placed at 110 cm?

_____

9. Although a line in math has no beginning or end, the wheelbarrow example on this worksheet would make it illogical to substitute resistance (load) / rock distances equal to or greater than 150 cm. Why?

_____

_____

_____