NAME_____

LIFTING A LOAD

Problems: Can you lift a load using only one finger?
Does it always take the same amount of force to lift a load?
Where should you press to lift a load with the least amount of force?

Materials:

Lever set up
Spring scale or force probes
Weights

Procedure:

Part 1---

1. Use the lever set up and weights to investigate possible answers to the problems.
2. Record your observations in the data section.

Part 2 ---

1. Using the lever set up, put the load 10.0 cm from the fulcrum.
2. Put the spring scale or force sensor 25.0 cm from the fulcrum on the other side.
3. Measure the effort it takes to lift the load so that the lever is balanced. Record this information in the data table.
4. Move the spring scale or force sensor to 20.0 cm from the fulcrum. Leave the load at 10.0 cm from the fulcrum. Measure and record the effort.
5. Move the spring scale or force sensor to 15.0 cm from the fulcrum. Leave the load at 10.0 cm from the fulcrum. Measure and record the effort.
6. Move the spring scale or force sensor to 10.0 cm from the fulcrum. Leave the load at 10.0 cm from the fulcrum. Measure and record the effort.
7. Move the spring scale or force sensor to 5.0 cm from the fulcrum. Leave the load at 10.0 cm from the fulcrum. Measure and record the effort.

8. Move the spring scale or force sensor to 2.5 cm from the fulcrum. Leave the load at 10.0 cm from the fulcrum. Measure and record the effort.

Part 3 ---

1. Using the lever set up, put the load 25.0 cm from the fulcrum.
2. Put the spring scale or force sensor 10.0 cm from the fulcrum on the other side. Measure and record the effort.
3. Move the load to 20.0 cm from the fulcrum. Leave the spring scale or force sensor at 10.0 cm from the fulcrum. Measure and record the effort.
4. Move the load to 15.0 cm from the fulcrum. Leave the spring scale or force sensor at 10.0 cm from the fulcrum. Measure and record the effort.
5. Move the load to 10.0 cm from the fulcrum. Leave the spring scale or force sensor at 10.0 cm from the fulcrum. Measure and record the effort.
6. Move the load to 5.0 cm from the fulcrum. Leave the spring scale or force sensor at 10.0 cm from the fulcrum. Measure and record the effort.
7. Move the load to 2.5 cm from the fulcrum. Leave the spring scale or force sensor at 10.0 cm from the fulcrum. Measure and record the effort.

Data:

Part 1 ---

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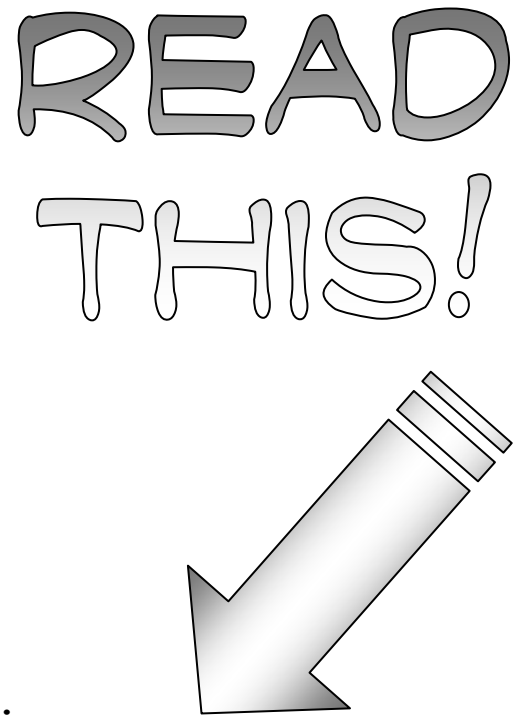
Part 2 ---

Position of Effort (cm from fulcrum)	Effort (Newtons)
25.0	
20.0	
15.0	
10.0	
5.0	
2.5	



Graph this information using a line graph:

(Refer to page 15 of *The Nature of Science*)

To do this you must remember: the independent or manipulated variable goes on the X-axis (horizontal axis, the one that runs along the bottom of your graph), the dependent or responding variable goes on the Y-axis (vertical axis, the one that runs up and down on the side of the graph).

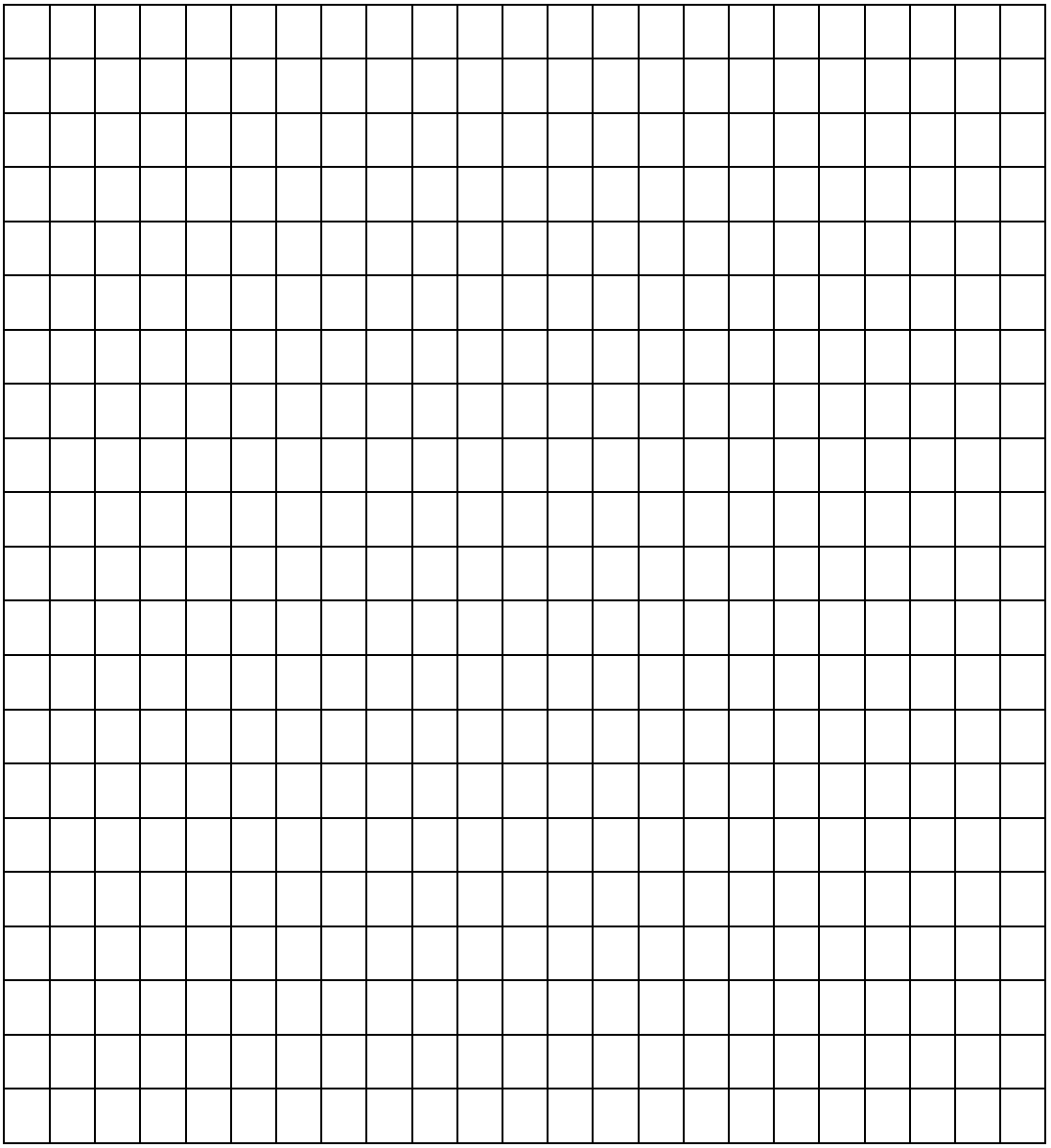
Number each axis in even intervals. Intervals are determined by looking at the smallest and largest numbers in the data table.

Label each axis with the variable (position of effort, effort) and the units used to measure the variable (cm, newtons).

Give the graph a title that describes the information in the graph.

Title_____

Responding or Dependent Variable_____



Specific
Variables

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General Manipulated or Independent Variable

Adapted from the FOSS Levers and Pulleys kit

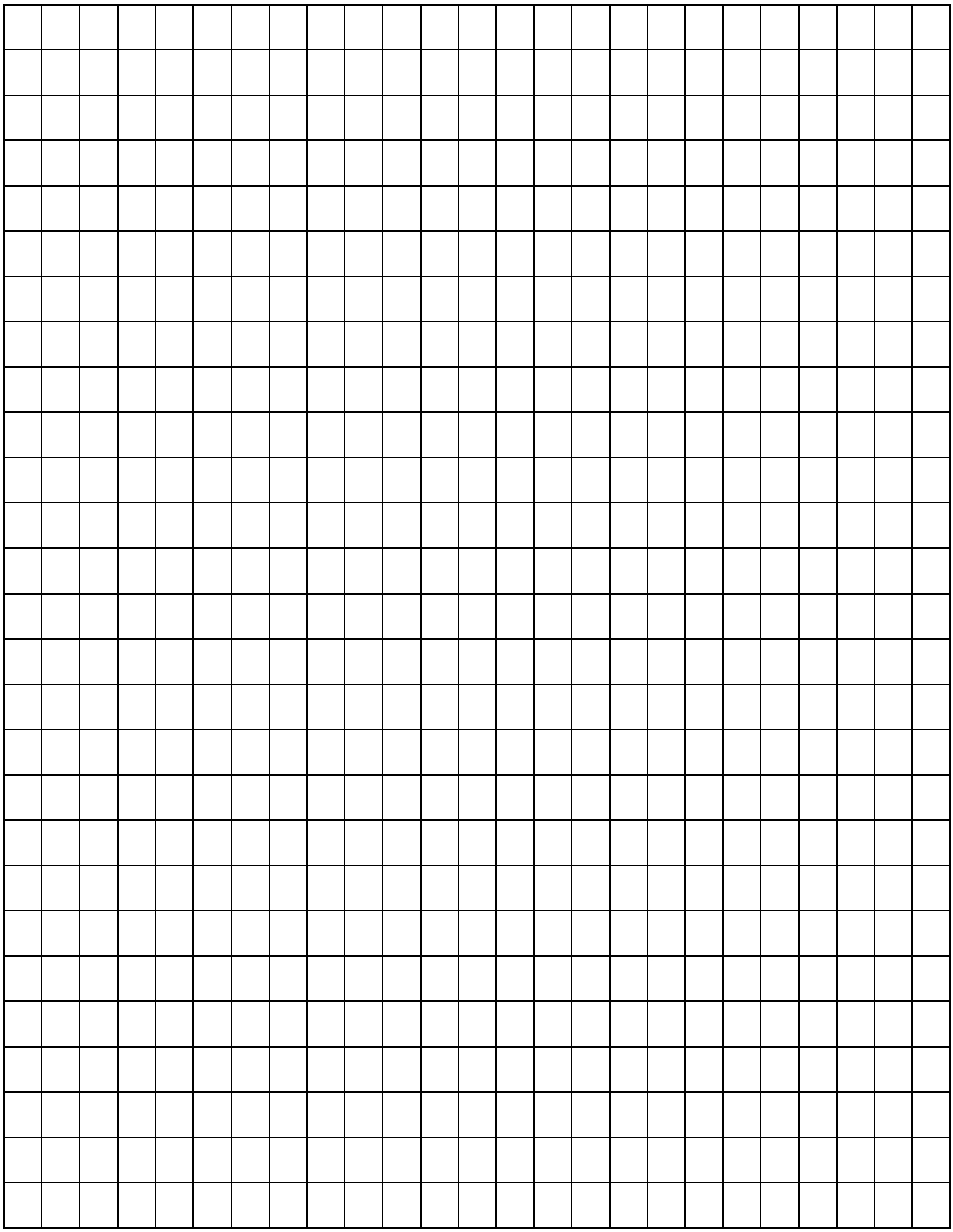
Data (con't.)

Part 3 ---

Position of Load (cm from fulcrum)	Effort (Newtons)
25.0	
20.0	
15.0	
10.0	
5.0	
2.5	

Graph this data using the same rules you followed in Part 2.

Use the graph paper on the next page.



Adapted from the FOSS Levers and Pulleys kit

Analysis and Conclusions:

1. What are the four parts of a lever system?_____

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2. In what ways can a lever provide an advantage?_____

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3. What is the relationship between the load and effort that gives a lever user the greatest advantage?_____

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4. When the load is at a constant position on the lever arm, how can you make it easier to lift the load? _____

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5. What is the difference between the weight of the load and the amount of effort needed to lift it?_____

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6. How does your graph of Part 2 compare to your graph of Part 3?

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7. What is the relationship between the location of the load on the lever system and the effort it takes to move it?_____

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8. Every graph is a picture that tells a story. What stories are your graphs telling?_____

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9. Predict: How much effort would it take to lift a load at 10cm if the effort were applied at 22 cm? At 13 cm? At 30cm? Explain your answers.

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10. Predict: If a 4.0 N effort were required to lift the load at 10 cm, where was the effort applied? Explain your answer.

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11. How did you use the graph to make your predictions?

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12. What were the manipulated / independent variables in these experiments? _____

13. What were the responding / dependent variables in these experiments?

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14. What were some controlled variables in these experiments?

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