LAB 1 Laboratory Activity

Relationships

Most students will agree that the longer they study for tests, the higher they score. In other words, test grades seem to be related to the amount of time spent studying. If two variables are related, one variable depends on the other. One variable is called the independent variable; the other is called the dependent variable. If test grades and study time are related, what is the independent variable—the test grades or the time spent studying?

One of the most simple types of relationships is a linear relationship. In linear relationships, the change in the dependent variable caused by a change in the independent variable can be determined from a graph. In this experiment you will investigate how a graph can be used to describe the relationship between the stretch of a rubber band and the force stretching it.

Strategy

You will measure the effect of increasing forces on the length of a rubber band.
You will graph the results of the experiment.
You will interpret the graph.

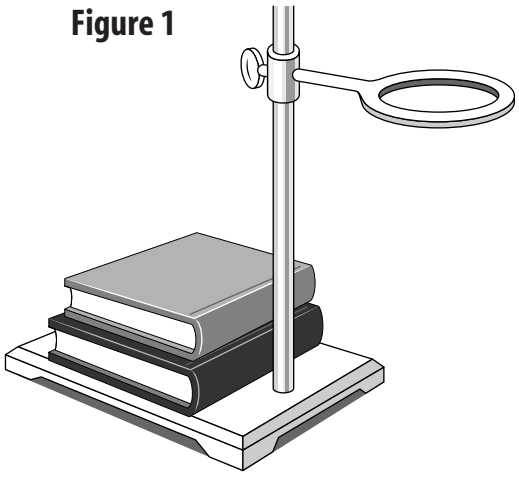
Materials

ring stand
ring clamp
several heavy books
3 rubber bands, equal lengths, different widths
2 plastic-coated wire ties, 10 cm and 30 cm long
metric ruler
100-g, 200-g, and 500-g masses

Procedure

1. Set up the ring stand, ring clamp, and books as shown in Figure 1.
2. Choose the narrowest rubber band. Securely attach the rubber band to the ring clamp with the 10-cm plastic-coated wire tie.
3. Measure the width of the rubber band. Record this value in Table 1 in the Data and Observations section.
4. Measure the length of the rubber band as it hangs from the ring clamp. Record this value in Table 1 as 0 mass.
5. Attach the 100-g mass to the bottom of the rubber band with the second wire tie. Measure the length of the stretched rubber band. Record this value in Table 1.
6. Remove the mass and attach the 200-g mass to the bottom of the rubber band. Measure the length of the stretched rubber band. Record this value in Table 1.

Figure 1



Laboratory Activity 1 (continued)

7. Remove the 200-g mass from the rubber band. Securely wrap the 100-g and 200-g masses together with the wire tie and tighten it. Attach the combined masses to the rubber band with the wire tie. Measure the length of the rubber band and record the value in Table 1.
8. Repeat measuring the lengths of the stretched rubber band for the 500-g mass and the combined masses of 600 g, 700 g, 800 g. Record the values in the data table.
9. Remove the rubber band.
10. Replace the rubber band with a slightly wider one. Hypothesize how the stretching of the wider rubber band will differ from that of the thinner one. Record your hypothesis in the Data and Observations section.
11. Repeat steps 3–9 for the second rubber band.
12. Replace the rubber band with the widest one and repeat steps 3–9 for the third rubber band.

Data and Observations

Table 1

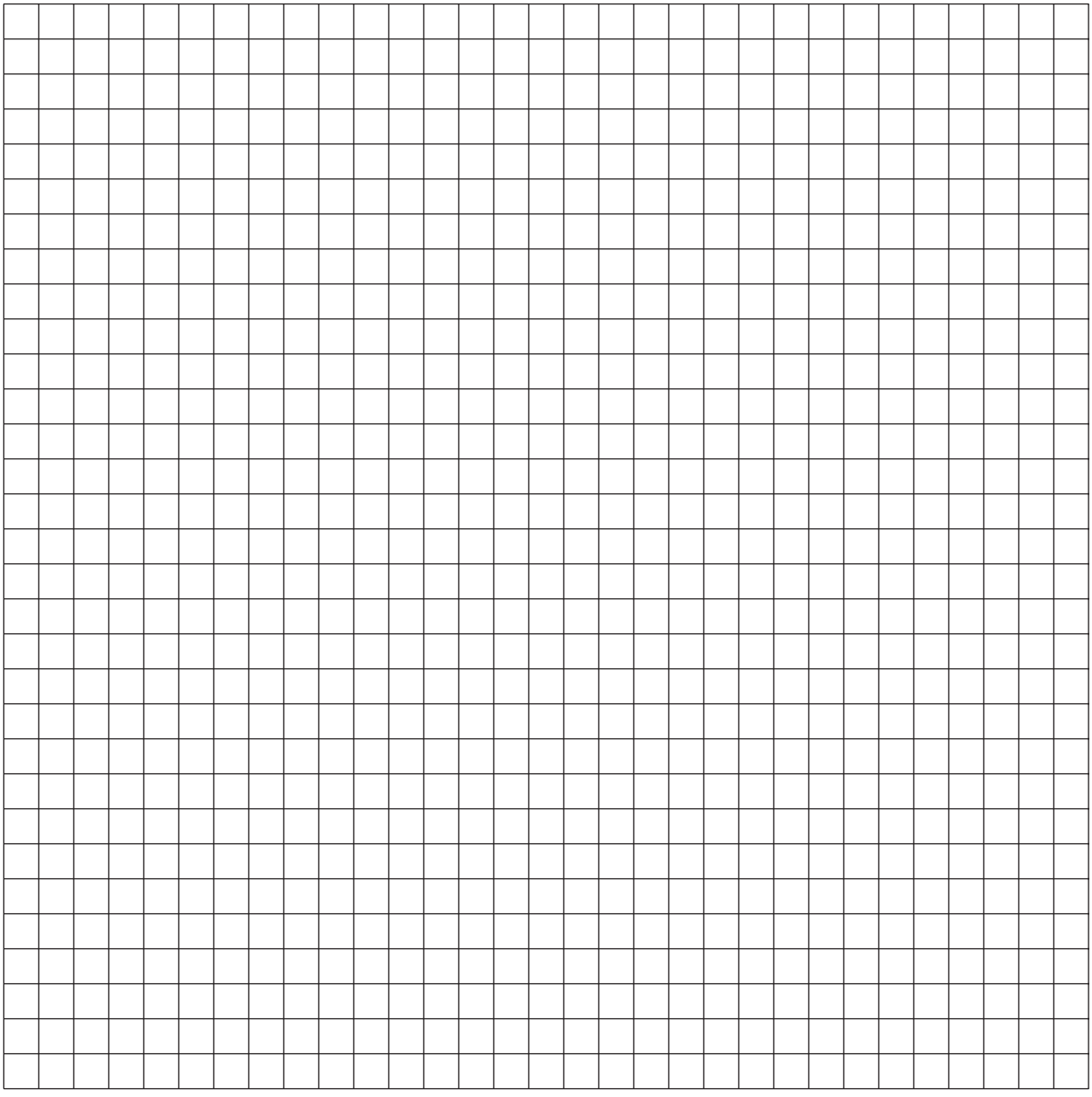
Mass (g)	Length of rubber band (cm)		
	_____ mm width	_____ mm width	_____ mm width
0			
100			
200			
300			
500			
600			
700			
800			

1. Hypothesize how the stretching of a wider rubber band will differ from that of a thinner one.

Laboratory Activity 1 (continued)

2. In most experiments, the independent variable is plotted on the *x*-axis, which is the horizontal axis. The dependent variable is plotted on the *y*-axis, which is the vertical axis. In this experiment, the lengths of the rubber bands change as more mass is used to stretch them. The length of each of the rubber bands is the dependent variable. The mass that is used to stretch them is the independent variable. Use Graph 1 to plot the data for all three rubber bands. Plot the values of the masses causing the rubber bands to stretch on the *x*-axis. Plot the lengths of the rubber bands on the *y*-axis. Label the *x*-axis *Mass (g)* and the *y*-axis *Length (cm).*

Graph 1



Laboratory Activity 1 (continued)

Questions and Conclusions

1. What do the graphs you made describe?

2. What does the steepness of the line of the graph measure?

3. How is the steepness of the three graphs related to the width of the rubber band?

4. How is the flexibility of these rubber bands related to their widths?

5. Explain how someone looking at Graph 1 could determine the length of the unstretched rubber band.

6. Predict the length of each rubber band if a 400-g mass is used to stretch it.

7. How could you use the stretching of one of the rubber bands to measure the mass of an unknown object?

Strategy Check

_____ Can you measure the effect of increasing forces on the length of a rubber band?

_____ Can you graph the results of the experiment?

_____ Can you interpret the graph?