

EXERTING FORCES LAB

Purpose:

What are the strengths/amounts and effects of various types of forces?

Materials

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| Station 1: Ball and Water Ball Bucket Water | Station 2: Paper Clips and Magnets Clear plastic cup Paper clips Strong magnet | Station 3: Balloons, fabric and fur Balloons PVC rods Scrap of wool, fur, or an old sock |
| Station 4: Dropping Paper A flat piece of paper A sheet of paper folded so that it is 1/4 its original size A crumpled piece of paper | Station 5: Ramp and Block Wooden blocks or slotted masses board for ramp with two different surface books or blocks to support ramp | Station 6: Rubber-band stretch A rubber band 3 rubber bands knotted in a line 3 rubber bands hooked or knotted together A horizontal support on which to hang the rubber bands 5-7 Film canisters with screw-in hooks, weighted to ~ 20 g each Ruler |
| Station 7: Scales Bathroom scales | Station 8: Book or hanging object A book placed on a table A picture hanging on the wall | Station 9: Strong Arm Set of 0.5 or 1 kg weights (bricks or bags of sand) Sturdy bucket or pail (~ 3-5 gallons) |

Pre-lab Discussion:

1. What do you think is a force?
2. How do you know when you exert a force?
3. Make a list of the different forces you exerted in the last five minutes.
4. How strong a force do you think you can exert?
5. What are some things that can happen to an object when a force acts on it?

Directions:

After answering the questions above, go around each station and at each station create a chart that includes the following:

1. A picture or diagram showing each situation.
2. Are there any forces exerted?
3. What/who is applying the force?
4. What object is receiving/feeling the effect of the force?
5. What effect is the force having on the object?
6. What would you call the force being demonstrated at this station?

At each station, besides the questions above, answer the questions written below too:

Station 1: Ball and Water

1. Place the ball in the bucket of water. What happens to the ball?

2. Are there any forces acting on the ball?

3. Now push the ball all the way under the water and hold it there. What forces do you think act on the ball now?

4. Do you feel any forces acting on your hand as you hold the ball under the water?

Station 2: Paper clips and magnet

1. How can you use the paperclips and magnet to demonstrate forces?

2. What force(s) are involved?

3. How can you figure out the strengths of these forces?

Station 3: Balloons, fabric and fur

1. Inflate the balloons. Hold both balloons up with one hand and observe their behavior. Then rub the balloons with the different materials provided. Describe what happens. What do you think is going on?

2. What is the direction of the forces on the balloons?

Station 4: Dropping Paper

1. Compare how fast the three papers fall to the ground: (be sure to drop the papers from the same height each time!). The three papers are: a sheet of paper held horizontally, a sheet of paper folded to 1/4 its size (held flat), and a piece of paper crumpled into a ball. How do the falling rates compare?

2. Are there any forces involved?

Station 5: Ramp and Blocks

1. Set up a ramp with the board and the books or blocks. Test how far a wooden block or slotted mass will slide on the ramp and floor before stopping. Change the angle of the ramp. What do you observe?

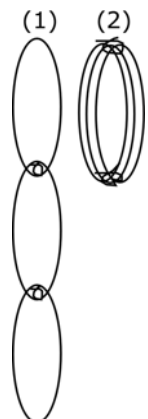
2. Repeat the experiment, changing the ramp surface and record your observations. What forces are involved in the motion of the block?

3. What changes the motion of the blocks/slotted masses?

4. What is the direction of the forces acting on the block/slotted mass?

Station 6: Rubber band stretch

1. Suspend the rubber band from a horizontal support. Predict what will happen if one weighted film canister were hung from the rubber band. How about two? Three? Try it and record your observations.



2. Predict what will happen if you tried the same canisters with two configurations of knotted rubber bands: (1) three rubber bands knotted to each other lengthwise and (2) three tied together so they are side-by-side. Explain your reasoning. Try it and record your observations.
3. What do you think causes the differences between the single rubber band and the two configurations of knotted rubber bands?
4. Is there a practical application for this activity?

Station 7: Bathroom scales

1. Hold up the bathroom scales and use your hands to squeeze on it. What readings do you get?
2. Is it close to your weight?
3. What forces are involved?
4. How does the scale work when a person stands on it?

Station 8: Book on a table or picture on the wall

1. What force(s), if any, act on the book? Explain your reasoning.
2. What force(s), if any, act on the picture hanging on the wall? Explain your reasoning.

Station 9: Bucket and Weights

1. Hold the bucket with your arm outstretched; ask you partner to add 1-kg masses to it. How many 1-kg weights can you hold up for one minute?
2. What are all the forces involved?

Post-lab discussion:

1. At which one of the stations have you exerted a force?

2. Were there any stations where it wasn't you that exerted the force?
 - a) If so what exerted the force?

 - b) What object received the force that was exerted?

 - c) What effect did the force have?

3. At any station, was there always motion when force was exerted?

4. Do you always have to touch an object in order to exert a force?

5. Are there any factors that a person could control to change the amount of force?

6. Summarize what you learned about forces from this activity.

7. Do you know the names of any of the exerted forces? List them.