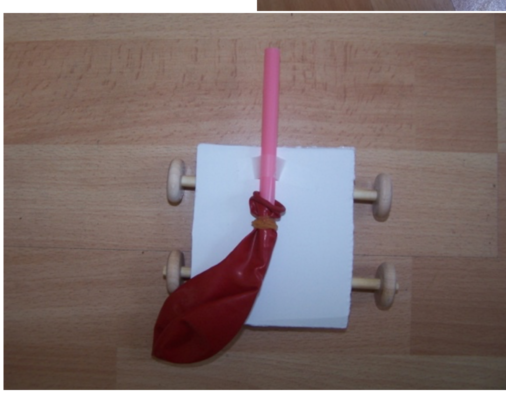
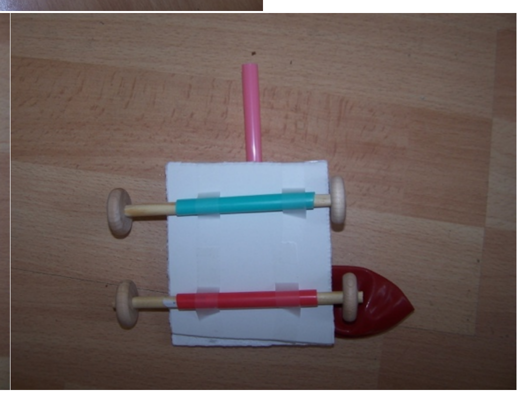
FORCES CAUSING MOVEMENT

Grade 3

A FACILITATOR'S GUIDE





Developed by Sue McKee for Let's Talk Science in Ottawa

Thank you for volunteering for Let's Talk Science! The following manual will help guide you through the workshop. Please read this manual before visiting the group you are working with.

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Important Notes

Introduction & Guidelines

- This manual is meant as a guide to help you prepare for your activity. The introduction includes questions that get at the curriculum link/science concept the workshop covers. You are not expected to memorize this manual. It is a guide and we want you to bring your own experiences and your style of teaching into it.
- As a general guideline, do not speak longer than the age of the students at one time.
- Most workshops fit well in a 1-hour time period but some like bridge building or some high school activities are a little longer.
- Practice your introduction and test out the activities beforehand so you can anticipate sections that may take more time or may be difficult for students.
- If you are working with a partner, work out roles and responsibilities before the visit.

Safety

As a Let's Talk Science volunteer, safety must be foremost in our minds during all activities. As STEM role models, volunteers must always also model safe science practices.

Always keep in mind the following precautions:

- Emphasize and demonstrate appropriate safety procedures throughout the presentation.
- Be professional but have fun.
- Keep workspaces clean to avoid tripping hazards.
- Allergens should have been checked before reserving the kit (e.g. allergies to latex balloons).
- **Activity Specific Safety: Ask students to not aim their pompom popper at others.**

WHMIS

An overview of Canada's Workplace Hazardous Materials Information System (WHMIS) is included in these materials at the end of this manual where needed. No WHMIS sheets are included with this activity.

Overview of the Workshop

Grade Level and Curriculum Learning

Grade 3: *There are several types of forces that cause movement. Forces cause objects to speed up, slow down, or change direction through direct contact or through interaction at a distance.*

Materials if we're dropping off at the school

Activity 1: Pompom Poppers

Pompom (3-4 per student)
Paper cup with the end cut out (1 per student)
1 balloon with about 1-1.5 cm at the end (not the neck end) cut off (per student)
3 rolls of electrical tape per class (if the teacher can distribute the tape); if the teacher cannot distribute the tape and kits are being done individually for each student, they should include a roll of scotch type tape (not electrical tape)

Activity 2: Balloon Cars

Small piece of cardboard (rectangle about 3 inches by 4 inches roughly) – (per student) – this is their car body
1 ½-piece of a large diameter straw with 1 balloon attached using an elastic to the end that is not cut. (per student)
2 sets of wheels on axles (per student) Note: the wheels come off
2 pieces of wide diameter straw (about 1/3 of a straw for each piece) (per student)
4-6 rolls of Scotch tape per class (each student needs 4-6 pieces about 5 cm each to attach the 2 straw pieces to the bottom of the car and another piece or two to attach the straw with the balloon)
If students have their own markers, they could use these to decorate their cars
Extra pompoms for testing
Extra balloons in case some break

Materials if not dropping off at the school

Activity 1: Pompom Poppers

Pompom or marshmallow
Paper cup with the end cut out (this can be a smaller or larger cup)
1 balloon with about 1.5 cm cut off the end opposite the neck of the balloon
tape

Activity 2: Balloon Cars

Small piece of cardboard (rectangle about 3 inches by 4 inches roughly)
Something for wheels and axles – 2 skewers and 4 plastic water bottle tops with a hole in the tops, for example (the tops need a hole in the centre that should be done with adult help)
A straw large enough for the skewer/axle to move freely in
½ piece of straw
Tape
Balloon

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Timing of the Workshop

	Approx. Time (min)	Description
Introduction	5-7 minutes	Introduce yourself and the curriculum learning for forces causing movement.
Activity 1: Pompom Poppers	10-15 minutes	Make the poppers and have the students experiment with using more or less force. Short discussion on what they found.
Activity 2: Balloon Cars	15-20 minutes	Make the cars and test them for adding more or less force and be sure the students look at what happens when they hit an object (e.g. a wall).
Wrap up	5-7 minutes	Discussion on their findings

Activity

Note: *The* ***questions*** *you might ask are in* ***bolded blue font****. Some things you might say are in blue font and the possible answers are in square brackets in black font. Actions are in purple font.*

Introduction

Hi everyone! My name is ______________. We are Let's Talk Science volunteers from the University of Ottawa or Carleton University. I study [simple terms] ________ at the University of Ottawa or Carleton University. I decided to study _____ because [when I was your age I loved… I think it's important to… I'm curious about…].

Ask the teacher if she/he can pick students to answer questions as you ask them. Also, you might not be able to hear the answers so the teacher might have to repeat the answers. If you cannot see the students because the camera doesn't extend to where they can see you on a screen, you'll have to rely on the teacher to know if the students are ready for the next step.

With this activity, they students could either test their cars in the classroom (this would be ideal) OR if the teacher would prefer them not to blow up balloons because of the pandemic, we can connect them to our Flipgrid and the students could take their cars home to do the testing and video it on Flipgrid. You could demonstrate some ways to test their car before you end the lesson if the students aren't testing their cars in the classroom.

We're/I'm here today to do some fun experiments to illustrate/see how forces cause movement.

What is a force? [push or pull]. A force makes things move and sometimes change direction.

What are some forces we see in nature? [erosion, tornados, ice, etc.] The high winds can make things in nature move – like soil, trees, or building.

What other forces can make us or other things move? [gravity, friction, magnetism – they might not come up with these so we might have to give hints like, what force pulls us toward the earth].

Forces are acting on us and other objects all the time, but **why aren't we or the objects in the room always moving?** [the forces are balanced]. Put a pompom or something that rolls in the screen view. Take this pompom for instance. We say it is at rest (not moving), but in fact there are forces acting on it. **Can you name one of the forces acting on it?** [gravity] Gravity is pulling down and since it is not moving through the floor, the floor must be pushing up. We can't see this so it makes is hard to understand sometimes, but we can see that the pompom is not moving and if there is no movement, the forces acting on the pompom or us or any other object are balanced.

Try this: Put your hands together at your chest and push on your hands with equal force from each arm/hand. **What happens?** [no movement].

Now put more force on one hand than the other by pushing harder with one hand than the other. W**hat happens?** [your hands move to one side because the forces are now unbalanced].

Give the pompom a push. **When were the forces balanced?** [when the ball is at rest at the beginning and then again when it stops moving]. **When were the forces unbalanced?** (when we give it a push and when it rolls down the ramp). **What force is acting on it as it rolls across the floor?** [friction]

Has anyone ever heard of the physicist, Isaac Newton? He developed a law about motion that states that an object at rest will remain at rest and an object in motion will remain in motion, unless acted upon by an outside force. If something is moving and there is no outside force, it will just keep moving; or if something is at rest and there is no outside force, it will remain at rest.

Let's think about a few examples. **If I get on my skateboard and give a push with my foot, do I keep going until I put my foot down?** [no]. **Why not?** [friction between the wheels and ground slow me down and eventually I stop].

When you are on your bike, friction is also at work to slow you down and to stop you. **Where is friction working when you are on your bike**? [wheels and the ground, and the brake pads and your wheel rims, and maybe even your feet and the ground if you put your foot down]

Forces are acting all around us all the time. Today we're going to do a few experiments and build a couple of items to help us understand forces a little better.

Activity #1: Pompom Poppers

First, we'll make a pompom popper. Show an example. With this we'll experiment with what happens when we apply less force and what happens to the pompom when we apply more force to an object. Before we make these, **what do you predict or guess will happen when you apply more force using the balloon to the pompom?** [it should go further]

Safety: Although we are only using pom poms, do not aim them at your classmates (especially their faces)

Ask the teacher to distribute a cup, pieces of tape, and a balloon with the end cut off to each student (or to distribute individual kits if the teacher requested individual kits). If students are given individual kits, ask them to take these materials out of their bag.

Build the pompom poppers and let them experiment for at least 5 minutes.
Each student builds their own popper and keeps it. Start them with only one pompom and then give them more so they can see what happens when they use more – e.g. do they all come out the same height? Take them through the steps below.

- Turn the cup with the hole in the bottom upside down
- Place the balloon that has the end cut off over the base of the cup - Show them how to put two hands into the cut end of the balloon so they can stretch it out wider than the base of the cup.
- Put the tape around the balloon and the cup to hold the balloon on
- Tie a knot in the balloon at the neck
- Use crayon/marker to put their name on their cup

If needed ask the teacher to distribute a few pompoms to each student. They test using one pompom to start.

- Ask the students to get out of their chairs and test out the popper to see what happens when they add more or less force (or they could test them in their chairs but they will have to get up to retrieve the pompoms)

While they are testing their poppers, ask the teacher to hand out the car bodies (cardboard pieces), 2 small straw pieces, and pieces of tape. [If the students each have their own individual kit, this step isn't necessary as they will have it at their desks already.]

Action: After ~5 minutes, have them sit down again ask some or all of this before building the balloon cars.

C**an anyone describe, using force words (e.g. push, pull, gravity, etc.), what happened to their pompom when they added more or less force?** [You might have to help them or get them started…For example, I pulled a lot/a little on the balloon which pushed the pompom and my pompom went further/not as far as when I pulled a lot/a little. Or when I pulled a little on the balloon it pushed the pompom out but then gravity pulled it to the floor.]

What happened when you had more pompoms in the popper? Did they all come out the same height? [no] Why do you think they didn't? [if a pompom is on top of another pompom it is exerting a force – a push on the pompom below so the lower ones have an extra push down on them compared to the top ones]

Activity #2: Balloon Cars

Now we'll build a balloon car to see how forces work on the floor rather than in the air and you'll be able to see how forces can cause a change in direction of your car. Think about what forces are acting on your cars as you watch them move and then again when they are not moving (e.g. where are the pushes and pulls happening). If you can't blow up a balloon, you can still push the car and it will work very well!

Build and test the balloon car

Ask the teacher to distribute, one cardboard piece, 2 small straw pieces and tape (or ask the students to remove these from their individual kit if they have an individual kit). Take the students through the directions below.

- Have the students decorate the cardboard with the crayons or their own markers and put their name on it.
- Add two straws one near each of the long ends of the rectangle and tape with scotch tape. Be sure these are parallel and taped securely. If the straws can move, the axles will also move and the car won't go straight.
- Take one wheel off one end of one of the sets of wheels and axles and slide it through one of the straws.
- Do the same with the other set of wheels and axles and the 2nd straw.
- Turn the car over.
- Tape the straw with the balloon on it so the straw hangs off the cardboard and don't put tape on the balloon (see the photo)
- Have them blow up the balloon and hold the end of the straw gently so the air doesn't escape and then place their car on the floor and let go of the straw. Now they are ready to do the testing with the car.

NOTE: Like any car, they might need repairs from time to time. For example, the straw might start falling off so they will need to put more tape. If the wheels aren't parallel you might have to help some straighten their wheels. Students can easily build this car if you take them through step by step, but there may be some that will need more help than others to build and you will have to rely on the teacher to help.

Also if there is enough time, you could add a math component to this by having the students measure how far their car goes when they change the amount of air in the balloon. Teachers usually have rulers in the classroom.

Action: When there is 5-7 minutes left in the class, have them sit back down at their desks or on the floor.

Wrap-Up

Like we did with the pompom popper can you describe what happened with your car using force words? [get a few students to describe – help them with force words if they need it]

When were the forces balanced? [when the car was still] **UNotealanced**? [as it raced along the floor]. **What happened when it hit a wall or some other object?** [it changed direction or maybe it just stopped] **Why?** [the force from the wall pushed it in another direction] Isaac Newton said a body or object in motion stays in motion unless an outside force acts upon it. **What force stopped your car?** [friction]

Does anybody have any questions?
NOTE: If you have extra time, you can ask if they have any questions about university or being a student or about your research.

Thank you for having us in your class today!

Additional Information

Background Info
No extra background is needed to do this activity.

WHMIS Sheets
N/A