



Non-Contact Force Challenge

ELECTRICIAN & PIPE TRADES

GRADES	LEARNING OBJECTIVE	CONCEPTS
<ul style="list-style-type: none">• Grade 4• Grade 8	Students will investigate and experiment with non-contacts forces and speed to challenge themselves to configure the slowest combination of pipes when a magnet is dropped through.	<ul style="list-style-type: none">• Non-contact force• Magnetism• Rate• Speed

Curriculum connections

GRADE 4 SCIENCE

- Learning outcome: Students investigate how forces can act on objects without contact
 - Skills and procedures: Describe how non-contact forces affect objects.
 - Conduct an investigation to demonstrate magnetic forces on objects.

GRADE 8 MATH

- General outcome: Develop number sense
- Specific outcomes:
 - Demonstrate an understanding of ratio and rate
 - Solve problems that involve rates, ratios, and proportional reasoning

DESCRIPTION

Complete this challenge after using the lab activity to introduce the materials and learning behind non-contact forces. Students will experiment with two non-contact forces: gravity and magnetism. Students will learn about gravity and magnetism as well as magnetic and non-magnetic influences.

How does this connect to electrician apprenticeship? Electricians must understand this principle for a few reasons. Electricians use a voltage testing device called a non-contact voltage testing pen. These pens operate based on the principles of mutual induction. An electrical wire that has current passing through it will create a magnetic field. When the voltage pen is brought into



proximity to this magnetic field, a voltage is induced into the windings, and a light or sound is produced.

TIME

- 20–30 minutes

MATERIALS

Each group will require the following materials:

- 1 magnet
- 3 solid aluminum pipes
- 2 copper pipes
- 1 PVC pipe
- 1 steel pipe
- Cloth for catching magnet
- 1 roll of electrical tape (optional, not included in kit)

Procedure

PREPARATION

- Lay the materials out on a table or desk to ensure all materials are accounted for. Run the task prior to instruction.

STEPS

1. Group students into pairs or groups of three. Have as many materials as possible to equally distribute between the groups. Students will need a bit of space to conduct this challenge.
 - The goal of the challenge is to see which group can make the magnet take the longest time to fall using different pipe combinations. All groups will use more than one set of pipes to create their combination.
2. Length and thickness of material are the variables students can experiment with. Will a long pipe combination be slower than a thick combination?
 - Students may use electrical or masking tape to secure the pipes vertically, or they can hold the pipes in place by hand.
 - To test a pipe combination, one student will drop the magnet and say “drop” at the same time. The other student will start the timer as soon as they hear “drop” and will stop it when the magnet exits the bottom. The student who is not timing will catch the magnet at the bottom. If needed, the timer can also drop or catch the magnet. Make sure the pipes are set up straight and perpendicular to the ground. Remind students not to let the magnet hit the floor.



- Students can record the fall time for each test they complete. Once they achieve a time they are satisfied with, they will perform one final test in front of the class to showcase their slowest successful time.
3. Each group will perform their test one by one, showing the class their pipe combinations and performing their magnet drop time.

Assessment suggestions

ASSIGNMENT SUGGESTION – GRADE 4

Drawing and reflection: Have Grade 4 students draw a picture of their group's pipe combination setup and write a short description of their findings. In their description, students should explain which combination they used, what they observed during the experiment, and their thoughts on why their chosen combination resulted in a slower magnet fall time.

ASSIGNMENT SUGGESTION – GRADE 8

Data analysis and comparison: Provide Grade 8 students with a table containing the recorded data of each group's magnet fall times for different pipe combinations. Ask them to analyze the data, calculate the average fall time for each group, and identify any patterns or trends they observe. Using the average fall time and length of the pipe, calculate the rate of descent in cm/s. Then, have students compare the results between different groups and explain any differences or similarities in their findings. This assessment challenges their data analysis skills and their ability to draw conclusions from the experiment's results.

Web resources

- [Non-Contact Force Kit: Overview](#) (Lethbridge Polytechnic, 2024)
- [Non-Contact Force Kit: Activity Guide](#) (Lethbridge Polytechnic, 2024)

Contributors

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