

LESSON TITLE: FLUIDS: WATER AND AIR FLOW (PART 1)

TOTAL TIME: TWO 50-MINUTE PERIODS

BRIEF DESCRIPTION

In this lesson, students will watch *The House That STEM Built: Fluids: Water and Air Flow* video. This video discusses how air flows throughout a house with an HVAC system. The video also discusses how water flows to houses in both rural and urban communities and how it travels throughout a house once inside. Throughout the video, students will have a worksheet with a series of questions to answer. All answers can be found directly in the video. In the second lesson, students will create their own experiment to demonstrate air pressure.

CURRICULUM OUTCOMES

Taken from the pre-2021 New Brunswick Grade 8 Science curriculum.

GENERAL CURRICULUM OUTCOMES

Forces in fluids.

SPECIFIC CURRICULUM OUTCOMES

309-2: Describe the movement of objects in terms of balanced forces and unbalanced forces.

309-4: Explain qualitatively the relationships among pressure, volume, and temperature when liquid and gaseous fluids are compressed or heated.

NEW BRUNSWICK GLOBAL COMPETENCIES ACHIEVED¹

- Critical Thinking and Problem-Solving
 - Learners formulate and express questions to further their understanding, thinking, and problem-solving.
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LEARNING OBJECTIVES

The learner will be able to

- explain the process of air flow within a home using an HVAC system,
 - explain negative air pressure in a home, and
 - explain the flow of water to a rural home vs. an urban home.
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MATERIALS

- Loose leaf.
 - Pencil or pen.
 - Handout titled “Grade 8 Video Questions for *Fluids: Water and Air Flow*”.
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¹ https://www2.gnb.ca/content/dam/gnb/Departments/ed/pdf/K12/curric/competencies/NBCompetencies.pdf?fbclid=IwAR1ldrZs1gFgiNm8rC4oz7Fmx6mSn-6t_QJkenev0eD33rZ-foYYn6bmdmc also available at <https://tinyurl.com/nb-competencies>

BEFORE CLASS

Print one copy of “Grade 8 Video Questions for *Fluids: Water and Air Flow*” for each student.

WARM-UP: 5 MINUTES

Tell students that today’s video will discuss water and air flow within a home. Give one copy of the handout titled “Grade 8 Video Questions for *Fluids: Water and Air Flow*” to each student.

Students will formulate one question they have about water and air flow in a home. At the end of the video, students will state whether their question was answered in the video. If their question was not answered, they will research the answer.

ACTIVITY: 35 MINUTES

Start watching *The House That STEM Built: Fluids: Water and Air Flow* video. The video will be played more than once. Therefore, no pauses are necessary.

As students are watching the video, the teacher should be circulating to make sure students are focusing on the video, staying quiet, and answering the questions.

Once the video has finished playing through once, give students **5 minutes** to fill in answers and check which answers they still need.

Start playing the video again. This will be the second time they have viewed the video.

After the video has finished the second time, provide approximately **5 minutes** for students to finish writing their answers.

The teacher will determine whether the video needs to be played a third time based on the number of students who have not completed all fifteen questions on the worksheet.

CONCLUSION: 10 MINUTES

The video discussed a way that anybody can determine whether their home has a negative air pressure. Students will do the same activity to determine whether the school (or classroom) has a negative air pressure.

- The teacher will take students to the entrance of the school. However, if the classroom has a window that opens, the activity can be done in the classroom.
 - Students will take turns standing next to the exterior door or window and slightly open it. Students will hold a piece of Kleenex near the opening to help detect airflow. If they see the Kleenex moving from the air, they should conclude that there is a negative air pressure.
 - Each student will record on a piece of paper whether there is negative pressure. They will hand this paper to the teacher. The teacher will use this as a formative assessment tool.
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DIFFERENTIATION

CONTENT

Some students may struggle to keep up with the video and reading the questions on their handouts. The teacher can turn on the subtitles for the video to help students follow along.

PRACTICE

Some students may struggle to watch the video and answer questions at the same time. If there is enough technology available in the school, the teacher could provide the option for students to watch the video individually so they can pause the video.

PRODUCT

Some students may not be able to answer all fifteen questions in the time given. Therefore, the teacher can assign half the questions if needed.

EXTENSION

The teacher can bring in a guest speaker from the community who works in the HVAC industry. The guest speaker can discuss the installation of HVAC within a home, how it works, the benefits, and any cons that may exist. Or, a guest speaker who works in the energy business could discuss ways that a home can become more efficient regarding airflow.

GRADE 8 VIDEO QUESTIONS FOR *FLUIDS: WATER AND AIR FLOW*

Name: _____ Class: _____ Date: _____

DIRECTIONS

- Answer the pre-video question first.
- While watching *The House That STEM Built: Fluids: Water and Air Flow* video, answer the video questions.
- Hand this sheet into the teacher at the end of class.

PRE-VIDEO QUESTION

Formulate one question you have about water and air flow in a home.

VIDEO QUESTIONS

1. What is HVAC an acronym for?
2. What is an HVAC system?
3. How does an HVAC system work?
4. What is an air exchanger?
5. How does an air exchanger work?
6. What are two things construction workers can do to help maintain proper air pressure in a home?

7. How does the negative air pressure in your home happen?
8. True or false: Do vents such as range hoods, bath vents, and dryer vents help remove stale air from the home?
9. Why do we get dry skin and chapped lips, and see an increase in static electricity in our homes during the winter months?
10. How can we solve negative air pressure?
11. How does an HRV work?
12. What causes water to flow within the plumbing system of a home?
13. How does the water pressure within a house work in rural communities?
14. How does water pressure within houses work in cities?
15. Where do the hot water and cold water lines run in a house?
16. Was your pre-video question answered? If not, please research an answer.

GRADE 8 VIDEO QUESTIONS FOR *FLUIDS: WATER AND AIR FLOW*

ANSWER KEY

1. What is HVAC an acronym for?

Heating, Ventilation, and Air Conditioning.

2. What is an HVAC?

It is a system that heats and cools the air within a home and moves the air to and from the rooms of a house through ducts.

3. How does an HVAC system work?

An HVAC system takes the heated or cooled air and moves it through the ducts of the home to all the rooms. When the new air enters the room, it pushes the existing air out of the room through the return ducts where it will return to the main HVAC system to begin the cycle again.

4. What is an air exchanger?

An air exchanger is a device that moves fresh air into the house and removes the stale air.

5. How does an air exchanger work?

An air exchanger uses fans and vents to move the indoor air out and bring the fresh outdoor air into the home.

6. What are two things construction workers can do to help maintain proper air pressure in a home?

They can install an HVAC system and an air exchanger to help to maintain proper air pressure in a home.

7. How does the negative air pressure in your home happen?

Negative air pressure happens when the air in the home is at a lower pressure than the air outside the home. This can happen when stale air is pushed out of the house without adequate fresh air being brought in to replace it.

8. True or false: Do vents such as range hoods, bath vents, and

dryer vents help remove stale air from the home?

True.

9. Why do we get dry skin, and chapped lips, and see an increase in static electricity in our homes during the winter months?

Negative air pressure during the winter months brings the cold air in. The cold air entering the home causes the air to become dry which results in dry skin, chapped lips, and an increase in static electricity.

10. How can we solve negative air pressure?

Bringing air from outdoors inside to make up for the large volume of air leaving the home using an HRV (heat recovery ventilation) system can help solve negative air pressure.

11. How does an HRV work?

An HRV is part of the HVAC system. An air intake duct is added to the system to bring in fresh air from the outdoors.

12. What causes water to flow within a home?

The pressure in the pipes causes water to flow in the plumbing system of a home.

13. How does the water pressure work in rural communities?

There is a water pressure tank connected to the home's underground water well. The pressure tank uses compressed air to push water out of the tank through the pipes.

14. How does water pressure work in cities?

The water supply is pumped to facilities for cleaning and purification. Then, the supply is pumped to pressure tanks throughout the city. The higher the tank above ground, the higher the pressure. Water will leave the tank and move through underground pipes to homes. Once the water reaches the home, it enters through the supply line attached to the home.

15. Where do the hot water and cold water lines run?

The hot water line runs into the water heater where the water will be heated for baths, showers, and washing dishes. The cold water line bypasses the water heater and branches to every water appliance in the home.

LESSON TITLE: FLUIDS: WATER AND AIR FLOW (PART 2)

TOTAL TIME: TWO 50-MINUTE PERIODS

BRIEF DESCRIPTION

In this second lesson associated with *The House That STEM Built: Fluids: Water and Air Flow* video, students will conduct experiments to demonstrate air pressure. There will be multiple different experiments set up around the classroom. Students will work in groups to put together the experiment. After students have had time to practice the experiment, they will demonstrate it to the rest of the class. Students will complete an exit slip at the end of class that teachers can use as a formative assessment tool.

CURRICULUM OUTCOMES

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GENERAL CURRICULUM OUTCOMES

Forces in fluids.

SPECIFIC CURRICULUM OUTCOMES

309-2: Describe the movement of objects in terms of balanced forces and unbalanced forces.

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NEW BRUNSWICK GLOBAL COMPETENCIES ACHIEVED²

- Critical Thinking and Problem-Solving
 - Learners formulate and express questions to further their understanding, thinking, and problem-solving.
 - Learners formulate and express questions to further their understanding, thinking, and problem-solving.
- Innovation, Creativity, and Entrepreneurship
 - Learners formulate and express insightful questions and opinions to generate novel ideas.
 - Learners enhance concepts, ideas, or products through a creative process.
- Collaboration
 - Learners assume various roles on the team, respect a diversity of perspectives, and address disagreements and manage conflict in a sensitive and constructive manner.
 - Learners create and maintain positive relationships with a diverse group of people.
 - Learners learn from and contribute to the learning of others by coconstructing knowledge, meaning, and content.

LEARNING OBJECTIVES

The learner will be able to

- explain the concept of air pressure including high and low pressure areas, and
- explain negative air pressure.

² https://www2.gnb.ca/content/dam/gnb/Departments/ed/pdf/K12/curric/competencies/NBCompetencies.pdf?fbclid=IwAR1ldrZs1gFgiNm8rC4oz7Fmx6mSn-6t_QJkenev0eD33rZ-foYYn6bmdmc also available at <https://tinyurl.com/nb-competencies>

MATERIALS

- Handout titled *Air Pressure Experiments Exit Slip*.
 - Electronic device.
 - Pencil or pen.
 - Loose leaf.
 - Two latex balloons.
 - String.
 - One funnel.
 - One ping pong ball.
 - One 2 L plastic bottle.
 - Water.
 - One straw.
 - Clay.
 - One cup.
 - One index card big enough to cover the top of the cup.
 - A bucket.
 - One pop bottle.
 - One piece of paper.
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BEFORE CLASS

- The teacher should rearrange desks so every group has a large

enough workstation.

- The teacher should have all materials for the experiments laid out in the groups.
- Print one copy of the handout titled *Air Pressure Experiments Exit Slip* for each student.
- Print one copy of each of the experiment guides attached at the end of this lesson plan.

WARM-UP: 5 MINUTES

Students will watch *The House That STEM Built: Fluids: Water and Air Flow* video from 1:00 to 5:24. This section of the video discusses the concept of air flow and air pressure. This will serve as a good reminder for the students before completing the experiments.

ACTIVITY: 40 MINUTES

There will be five different experiment stations set up around the room. The directions and material list for all the experiments can be found at the end of this lesson plan.

- Students will assemble into groups of 4–5.
 - The teacher can create the groups or students can pick their own groups. This decision is up to the teacher.
- Groups will be assigned one experiment that demonstrates the concept of air pressure.
- Students will work in their groups to conduct the experiment.
- Students will come up with an explanation of how air pressure is used in their experiment. This may involve some research needing to be done.
- Once all groups have developed an explanation for their experiment, they will demonstrate their experiment to the whole class and explain how air pressure was used.

CONCLUSION: 5 MINUTES

After all groups have demonstrated their experiment, the teacher should hand out one exit slip to each student. Exit slip details:

- Students watched a variety of different experiments demonstrating air pressure.
- Students need to write a minimum of one paragraph explaining which experiment was their favourite and why.

Students will hand in their completed exit slip to the teacher.

DIFFERENTIATION

CONTENT

Instead of the teacher sending groups to a random experiment station, the teacher can assign students an experiment that they feel the student would be more interested in.

PRACTICE

Instead of having students only complete one experiment station and showing the class, the teacher can have students rotate experiment stations so they are able to complete each one.

PRODUCT

The teacher can select only a few experiments to be shown to the class instead of all five.

EXTENSION

After the students have seen all the experiments, the teacher can have students select their favourite and write a report on the experiment.

The report can include sections like

- materials,
- methods,
- results,
- discussion, and
- conclusion.

AIR PRESSURE EXPERIMENTS EXIT SLIP

Name: _____ Class: _____ Date: _____

DIRECTIONS

- Answer the following questions with a minimum of one paragraph.
- Hand in the exit slip to the teacher at the end of class.

QUESTIONS

What was your favourite experiment demonstrated in today's class?
Why? How did that experiment help you understand the concept of air pressure?

EXPERIMENT ONE: PING PONG FUNNEL

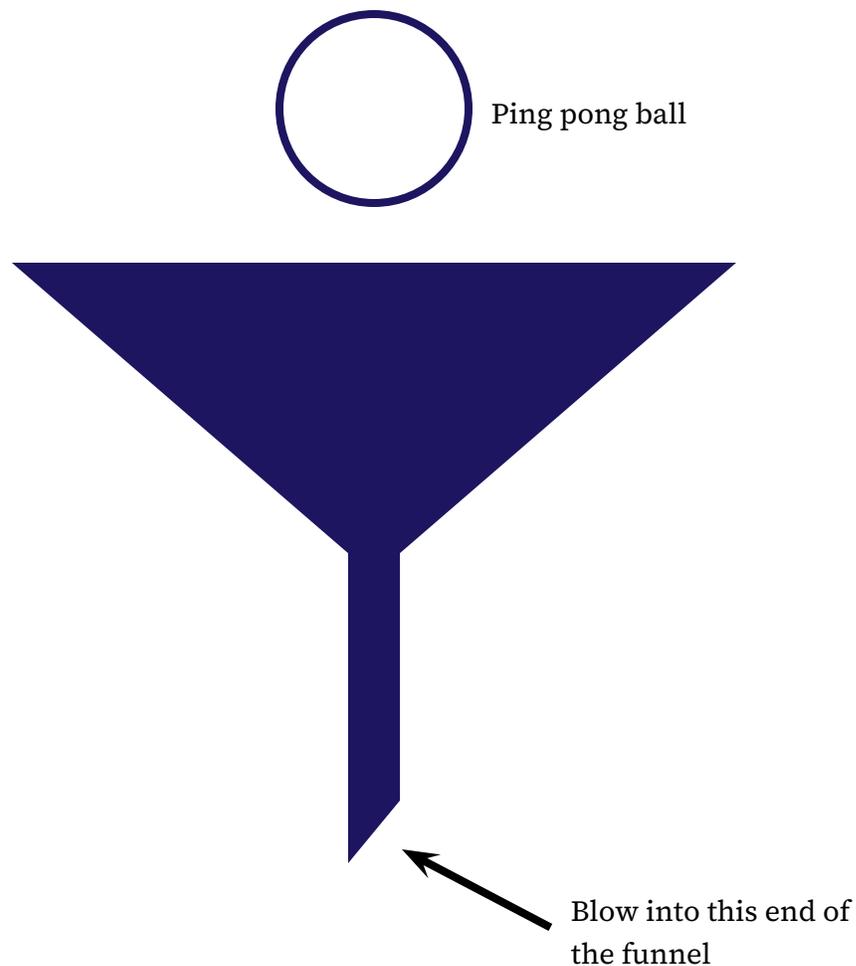
Taken from asme.org

MATERIALS

- One funnel
- One ping pong ball

DIRECTIONS

- Place the ping pong ball into the wide part of the funnel while holding the funnel upright as shown below.
- Try blowing in the small part of the funnel.
- Does the ball fall out? Why or why not?



EXPERIMENT TWO: KISSING BALLOONS

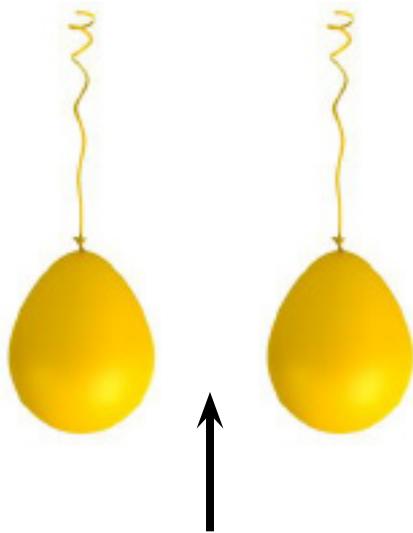
Taken from asme.org

MATERIALS

- Two latex balloons
- String

DIRECTIONS

- Blow both balloons up and tie them.
- Attach one piece of string to each balloon.
- Hold each string so the balloons are roughly at nose level.
- The balloons should be approximately 6 inches apart from each other.
- Take a deep breath and blow in between the two balloons.
- Do the balloons move away from each other? Do the balloons move toward each other? Why or why not?



Blow in between the balloons

EXPERIMENT THREE: FOUNTAIN BOTTLE

Taken from asme.org

MATERIALS

- One 2 L plastic bottle
- Water
- One straw
- Modelling clay

DIRECTIONS

- Fill the bottle half full with water.
- Take the straw and insert it into the opening of the bottle.
- The end of the straw should be in the water.
- Wrap the modelling clay around the straw so it forms a seal.
- Take a deep breath and blow hard into the straw.
- What happens? Explain how air pressure is involved.



Image taken from <https://www.experimentarchive.com/experiments/water-thermometer/>

EXPERIMENT FOUR: WATER GLASS TRICK

Taken from asme.org

MATERIALS

- One cup
- One index card big enough to cover the top of the cup
- A bucket

DIRECTIONS

- Fill the cup approximately $\frac{1}{3}$ of the way with water.
- Place the index card on the top of the cup so it is completely covered.
- Place your hand on top of the index card so it does not move.
- Pick the cup up and turn it upside down over the bucket while keeping your hand pressing on the index card.
- Remove your hand from the index card.
- What happens? Explain how air pressure plays a role.



Image taken from Upside Down Glass of Water Science Experiment (coolscienceexperimentshq.com)

EXPERIMENT FIVE: THE MILLION DOLLAR BET

Taken from scienceexplorers.com

MATERIALS

- One empty pop bottle
- One piece of paper

DIRECTIONS

- Place the pop bottle on its side on the table.
- Rip a small piece of paper and crumple it up so it is approximately half the size of the opening of the pop bottle.
- Place the crumpled piece of paper in the bottle's mouth.
- Try to blow the paper into the opening of the pop bottle.
- It is going to be very difficult. Explain how air pressure is preventing the paper from entering the pop bottle.

