# Going Up?

A Learning Activity for Grades 6-8

## Overview

Students, when studying fluids and hydraulics, learn that fluids have special properties such as viscosity, density, buoyancy and compressibility which are useful in industry and in our daily lives. Most people think of liquids when they hear the word “fluids”, but gases are also fluids. These concepts, combined with a basic understanding of Pascal’s law have led to numerous inventions such as hydraulic and pneumatic which are used every day by heavy duty equipment operators and mechanics. Systems that use fluids to transfer forces are called hydraulic systems.

## NB Curricular Connections

| Middle Block Learning Areas |
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| Personal Wellness:<br>○ *Strand:* Career Connected Learning - *Big Idea:* Experiencing Potential Career Pathways - *Skill Descriptor:* Engage in frequent and ongoing career connected experiential learning to learn about preferred career pathways and develop personal competencies. |
| Science:<br>○ *Strand:* Scientific Literacy - *Big Idea:* Investigation |
| Technology:<br>○ *Strand:* Design Thinking Skills - *Big Idea:* Problem Solving |

## What You’ll Need

**Please Note: These materials are for a small group of 2-3 students.**

- Two identical 60 ml (approx.) syringes
- One 10 ml syringe
- Beaker of glass or water
- Plastic tubing approximately 100 cm in length (airline tubing for aquarium filters work well)
- Clamps and retort stands to hold syringes
- Heavy objects or weights (kg)

## Instructions

1. Information Bite

   Ask students the following questions:
   *What is a fluid? Are all fluids, liquids?*
   *What is Viscosity? Density? Buoyancy? Compressibility?*
   *What are some skilled trades that require an understanding of the above concepts?*

   Allow learners to share their thoughts. Then, read/show them the information below:

A fluid is a substance that has no fixed shape and yields to external pressure. Fluids can also be gases not just liquids.

Viscosity is the measure of a fluid's resistance to flow. Density is the measure of how much mass is contained in a given volume of a substance. Buoyancy is the upward force exerted by a fluid that opposes the weight of an object immersed in it. Compressibility is a measure of how much of a substance volume decreases when subjected to pressure.

Industrial Mechanics, Elevator Constructors/Inspectors and Electricians

Industrial mechanics inspect, assemble, install, maintain, fabricate parts and repair machinery/equipment, typically in industrial settings.

Elevator constructors/inspectors train to install, modify, service and repair electrical and hydraulic elevators, hoists, moving walkways, and escalators.

Electricians learn about electrical systems, controls and switches, heating and cooling systems, electronics and lighting.

To be successful in either trade, you will need mechanical aptitude, the ability to do detailed and precise work, the ability to read blueprints, and a willingness to continually upgrade your knowledge and skill levels regarding new innovations in the industry. In terms of numeracy, these trades also involve the use of measurement and calculation math, estimation, and data analysis. Inspectors generally have extensive experience in the trades area and work for government and/or regulator agencies. To be an industrial mechanic, electrician and/or elevator inspector requires a journey person ticket achieved through apprenticeship.

Let your learners know that today, they will design a hydraulic press.

Divide students into small groups of 2-3 learners.

2. Getting Started

   The study of fluids and their various properties such as buoyancy, density, viscosity and compressibility has led to inventions which have helped us to do work or make our lives easier. These systems are called hydraulic systems. In this activity, you will design a hydraulic press.

   This activity should be done over a sink. Students create a hydraulic press using two identical syringes connected by plastic tubing. The experiment can be repeated using one large and one small syringe. In both scenarios, the moving part of the syringe represents a movable piston. Students can use their sense of touch to compare the amount of force required in both.

3. The Activity

A. Connect two identical large syringes (plungers removed) with plastic tubing (100cm in length).
B. Add water to one until both syringes are full.
C. Keeping the two syringes level, place a plunger into one syringe, pushing it all the way in.
D. Place the second plunger into the open syringe, pushing gently until both plungers are halfway down. You now have a closed system with no air in it.
E. The syringes should be level and held carefully or supported on retort stands with clamps. Place a small weighted object on top of one of the syringe plungers and push against the other plunger to make it rise. You will need to compare the force used to raise the object in this activity with the force needed in the activity identified in the next step.
F. Repeat this experiment using one syringe from the previous activity and a second smaller syringe. Compare the force needed to move the same weighted objects (placed on the larger plunger) as in the first activity.

4. Wrap-Up & Discussion: *Which activity required the least amount of force? If someone asked how does viscosity, density, buoyancy & compressibility connect to the trades, what could you tell them after today's experience?*

## Extension Ideas

- Design an experiment to show if the type of liquids used affects the results.
- Test to see if the experiment will work using "air" as your liquid.
- Design posters on elevator safety or handicap lifts to promote safety among younger students at your school.
- Find out how often lift devices in your school are inspected and by whom?

## Reflection Activity

Please see the attached PDF for several choices on how you and your learners can reflect upon today's activity.

## Acknowledgements

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