Experiment

Advanced Intermediate

Pneumatic-Hydraulic Device

sead : stem

Subjects

Physics | Engineering | Mathematics | Chemistry

Topics

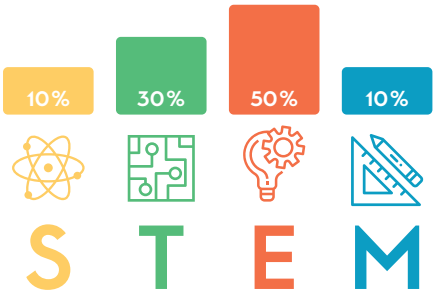
Hydraulics | Pneumatics | Fluids | Gases | Liquids | Mechanics | Technology

Key Words

Hydraulics | Pneumatics | Design | Engineering Process | Fluids | Gases | Liquids | Creative Engineering | Mechanics | Gas Laws | Hydraulic Labyrinth | Hydraulic Maze | Pneumatic Labyrinth | Measurement | Hydraulics Technology | Pneumatics Technology | DIY

Connection to SDG

STEM Chart



Time for Activity

60–90 Minutes

Introduction

Hydraulics and pneumatics are technologies that use chemistry, physics and engineering concepts involving the mechanical properties of liquids and gases respectively. Hydraulics and pneumatics are used for control and generation of power by the use of pressurized liquids and gases. Applications of hydraulics and pneumatics are pipe flow, dam design, fluid control circuitry and many more.

In this activity, the students will design an innovative device which uses hydraulics or pneumatics technology. The efficiency of the device will be determined and tested by the task that the device is able to do.
This project allows us to explore some interesting topics in physics and engineering. It's a great opportunity to learn how to build a device powered by hydraulic and pneumatic principles.

Finally, we can use this project to demonstrate the engineering design process. It is unlikely that you will think of an idea for a device, sit down and build it, and have it work perfectly on the first try. Just encourage students to come up with their own designs, test the designs and modify the designs to improve them.

Professional engineers rarely get things right on the first try!

Key Objectives

1. Fostering creativity by coming up with an innovative design.
2. Practicing sophisticated manipulation in fabrication and assembly of components.
3. Creating an inventive device (based on the innovative design) that could do specific task with the use of hydraulics or pneumatics technology.
4. Understanding the name and the functions of the components in the device.

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5. Knowing how and where to install the device at home.
6. Testing the efficiency of the inventive device powered by hydraulic or pneumatic technology by doing different tasks.

Materials

1. Card board
2. Connecting tubes
3. Food color
4. Glue gun
5. Glue sticks
6. Scissors
7. Sticks
8. Syringe
9. Water

Safety

1. Be careful while using scissors, knifes or handsaws for cutting wood or metal strips.
2. Be careful when using the hot glue– it's really hot!

Guiding Questions

1. How did you design your inventive device?
2. Which tasks could be accomplished by your inventive device?
3. What technology did you use to power up your innovative device? (Pneumatic or hydraulic technology)

Procedure

(Experimental Procedure or How It Works and How to Design)

The objective of this project is to build a gravity-powered irrigation system modeled after the Banaue rice terraces in the Philippines.

Task

1. Gather all the materials needed. The students may or may not use all the materials given.
2. Ask the students to make a draft or design of an innovative device which will use hydraulics or pneumatics technology.
3. Let the students determine the task that should be accomplished by the device.
4. Ask the students to use any or all of the following things such as cardboard, connecting tubes, food color, glue gun, glue sticks, scissors, sticks, syringe, water to implement the inventive design. They may use the cardboard to build the frame of the design. Suggested designs are labyrinth and crane.
5. Test the innovative device by doing a task specified for it.

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Engage (5 minutes)

Introduce the challenge to students. Explain that the main goal is to build a machine that moves thanks to pneumatic or hydraulic principles using only the given materials.

Design

Before you start building anything, it is a good idea to brainstorm different designs. Try sketching your designs on paper. Which designs will work best given the rules and materials you are allowed to use? Which design do you think will be the most reliable? Think about these questions and select a design to move forward with.

Build

Once you have decided on designs, it is time to start building them. You might find out that your designs “on paper” do not work as planned when you try to build them in the real world. That is OK! You do not have to stick to your original plan. You can make modifications to your design, or even start over with something completely new.

Rules for Building a Machine

1. **Only use items listed in the Materials section.**
2. **Build one device. The devices within the class can be different from each other.**
3. **The device must be freestanding. It cannot be taped to the ground or supported by a person.**

Test

Once you have the device, put it on a table and try them out. This is your opportunity to identify weak spots in your designs and things that can be improved. Here are some things to consider:

Assessment

Creativity	25 %
Stability of the device	25 %
Efficiency in doing a specific task	50 %
Total Points	**100 %**

Related Pictures

Fig 1