Pitsco Can Crusher Test

Mid-Valley
STEM-CTE HUB

www.midvalleystem.org
midvalleystemctehub@linnbenton.edu
Linn-Benton Community College
Albany Campus - CC-212

Mid-Valley
STEM-CTE HUB

Pitsco Crusher Stress Test

Take hydraulics to the next level in your classroom. Using a system of syringes, tubing, and three-way valves, you can build the Can Crusher, a mini version of a four-post hydraulic press similar to those found in manufacturing and testing facilities around the world.

Creating a mechanical advantage of 14:1 with fluid running through tubing and syringes, it easily crushes aluminum cans, paper cups, and other items. Two tubes – one to take up the water and the other to return it – rest in a cup of water. Pumping the small syringe forces fluid through the tubes and to the four larger syringes, creating a lot of force from a little input.

-

Grade Level

6th - 12th

Group Size

2 - 4 Students Per Kit

Time Duration

45 - 90 minutes

Content of Kits

Components

- Pieces for two can crusher structures
- 8 large syringes
- 2 small syringes
- Tubing

Mid-Valley
STEM-CTE HUB

Usage

Getting Started

1. Set up the system: Lay out all components—syringes (large and small), tubing, three-way valves, and base parts—and attach the tubing securely to the syringes and valves.

2. Prime the system: Place the intake and return tubes into a cup of clean water. Draw water into the system by gently pulling the small syringe, then cycle the water by slowly pushing and pulling the syringe to remove air.

3. Check for leaks: Ensure all connections are tight to prevent leaks and backflow before starting the test.

4. Test the crusher: Place a lightweight item on the press base, then gently press the small syringe to amplify the force and crush the object. Observe and take notes on the results.

5. Clean and store: After testing, release the pressure created by pulling back the small syringe, empty the tubing into a container, dry the components, and store them for future use.

Storage

- Rinse and dry all tubing and syringes after use to prevent mold or residue buildup.
- Store syringes with plungers slightly pulled out to prevent sticking.
- Keep tubing coiled loosely to avoid kinks and cracks.

Troubleshooting

- If the system isn't building pressure, check for loose or disconnected tubing.
- Bubbles in the tubing? Prime the system again slowly to remove trapped air.
- If the syringes are hard to push, check for blockages or over-tightened tubing.
- Leaking water? Dry and reseat all connections firmly, especially at valves.
- Crushing power seems weak? Add more water or double-check for hidden air pockets.

Mid-Valley
STEM-CTE HUB

Activity Guide

Beginner

Assemble a basic syringe-and-tube system to move water between two syringes. Observe how pressure in one syringe causes motion in the other, introducing the concept of hydraulic force. Record your observations and sketch how the system transfers energy.

Intermediate

Follow the instructions to assemble the Can Crusher and test it on a paper cup or empty soda can. Use the syringe pump to observe how a small input creates a large output force. Record the force required to crush different materials and hypothesize why some are harder to crush.

Advanced

Design a controlled experiment to test how different variables (water volume, tubing length, syringe size) affect the crushing power of your device. Adjust components and measure how quickly and completely the Can Crusher flattens each object. Create a graph or chart of your findings and propose design improvements.

Extension Activities:

After mastering the Can Crusher, students will explore how similar hydraulic systems are used in construction equipment, airplane brakes, and industrial presses. In small teams, students will research a real-world hydraulic machine, then modify their Can Crusher setup to replicate that motion (e.g., vertical lift, clamp, or press). Each team will demonstrate their adaptation and explain how fluid mechanics enables the work. Students will reflect on what makes hydraulics powerful and how this technology can be used in fields such as manufacturing, medical devices, and robotics.

Mid-Valley
STEM-CTE HUB

Learning Extensions

STEAM Connections: Engineering - Math - Science

Learning Objectives:

- **Understand Hydraulic Systems:** Explain how pressure and fluid transfer force in a closed hydraulic system.
- **Explore Mechanical Advantage:** Calculate and observe how input force is multiplied using simple machines and fluid mechanics.
- **Apply the Engineering Design Process:** Build, test, and revise a working hydraulic device to perform a mechanical task.

Career Connections:

- **Mechanical Engineer –** Designs machines that use hydraulics in manufacturing, robotics, and aerospace systems.
- **Industrial Designer –** Develops consumer products and tools using efficient mechanical systems.
- **Construction Equipment Operator –** Uses hydraulic-powered machines like backhoes, cranes, and bulldozers on job sites.
- **Biomedical Engineer –** Designs prosthetics and assistive devices using miniature hydraulic systems.
- **Automotive Technician –** Works with brake systems, lifts, and power steering—many of which use fluid-based technology.

Essential Employability Skills:

- **Problem Solving**
- **Critical Thinking**
- **Collaboration & Teamwork**
- **Communication**
- **Observation**

Mid-Valley
STEM-CTE HUB

Resources and Accessibility

Safety Guidelines

- **Supervised Use:** Always use under adult supervision, especially when crushing items like aluminum cans, which may have sharp edges after compression.
- **Water Safety:** Use clean water only—avoid sticky or sugary liquids that can clog tubing or grow bacteria. Keep workspaces dry to prevent slipping hazards.
- **Crushing Precautions:** Only crush approved materials like empty cans, paper cups, or lightweight plastic. Never attempt to crush batteries, glass, or dense materials.

Accessibility

- **Visual Diagrams & Instructions:** Use step-by-step visual assembly guides to support diverse learners and multilingual students.
- **Adaptable Syringe Sizes:** Larger syringes and valves can be swapped in for an easier grip by students with fine motor challenges.
- **Collaborative Design:** Roles like recorder, builder, tester, and observer allow students of varying abilities to contribute meaningfully.
- **Hands-On Engagement:** Provides tactile, kinesthetic learning for students who thrive with physical manipulation and real-world analogies.
- **Flexible Workspace:** Can be assembled on any tabletop—low-profile design supports use in wheelchairs or by students with mobility devices.

Library Catalog

Library Resources

Feedback

QR to feedback survey