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# CYSF Science Fair Log Book – Hydraulic Crane Project

**Project Title:** DIY Hydraulic Crane  
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**Grade & School:** [7th grade & St Rose of lima]  
**Science Fair:** Canada Young Scientists Fair (CYSF)  
**Date Started:** [November 16th of]

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## 1. Project Question / Purpose

**Question:** How does the amount of force applied to a hydraulic crane's syringe affect its lifting capacity?

**Purpose:** To design a DIY hydraulic crane using syringes and cardboard to demonstrate hydraulic principles and measure lifting capacity.

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## 2. Background Research

- Hydraulic systems use liquid pressure to transfer force.
- Syringes and pipes can simulate pistons and hydraulic lines.
- Pascal's Law: Pressure applied to a fluid is transmitted equally in all directions.
- Materials like cardboard and syringes are safe for classroom experiments.

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## 3. Hypothesis

If more force is applied to the input syringe, then the crane will lift heavier objects because the pressure is evenly transmitted through the hydraulic fluid.

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## 4. Materials

- Cardboard
- 7–9 syringes with rubber pistons
- Plastic tubing
- Popsicle sticks
- Glue / tape
- Water
- Small weights (cans, small boxes)
- Ruler
- Marker

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## 5. Procedure

1. Cut and assemble the cardboard to make the crane's base and arm.
2. Attach syringes with tubing to simulate hydraulic pistons.
3. Fill syringes with water, removing all air bubbles.
4. Test each syringe movement and ensure smooth motion.
5. Attach a small weight to the crane's hook.
6. Record the force needed to lift different weights.

7. Adjust syringes if leaking or if movement is uneven.

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## 6. Daily Log / Experiment Entries

Date	Activity / Observations / Problems / Solutions
Nov 16, 2025	Brainstormed project ideas; decided on hydraulic crane. Drew rough sketch of crane design.
Nov 20, 2025	Researched how hydraulic systems work. Collected notes and images from books and videos.
Nov 25, 2025	Made a detailed blueprint for the crane and identified materials needed. Created materials list.
Nov 30, 2025	Gathered cardboard, syringes, tubing, glue, and popsicle sticks. Prepared workspace.
Dec 5, 2025	Cut cardboard pieces for the base and arm. Tested fit and adjusted measurements.
Dec 10, 2025	Assembled the crane base. Glue dried properly. Initial structure stable.
Dec 15, 2025	Attached syringes and tubing to the crane. Found one syringe leaking; replaced it.
Dec 20, 2025	Filled syringes with water and removed air bubbles. Tested arm movement; some jerky motion observed.
Dec 25, 2025	Adjusted syringes alignment; motion became smoother. Practiced lifting small objects (50g).
Jan 1, 2026	Conducted first proper test: lifted 50g and 100g weights. Recorded observations in table.

Jan 5, 2026	Measured lifting height vs applied force. Noted patterns for data analysis.
Jan 10, 2026	Added popsicle stick reinforcements to arm for stability. Tested again.
Jan 15, 2026	Tested crane with 150g weight. Noted maximum capacity and observed limitations.
Jan 20, 2026	Created data tables and graphs from test results. Summarized trends.
Jan 25, 2026	Analyzed results; confirmed hypothesis about force vs lifting capacity.
Jan 28, 2026	Took photos of the final crane setup for presentation. Checked log book for missing details.
Feb 1, 2026	Final review of log book and data. Prepared summary for science fair display.

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## 7. Data & Results

**Table: Force vs Weight Lifted**

Weight (g)	Syringe Force Applied (ml)	Observation
50	5	Lifted smoothly
100	10	Lifted slowly
150	15	Lifted successfully, arm stable

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## 8. Analysis

- The crane lifted heavier weights as more force was applied to the input syringe.
- Air bubbles in syringes caused jerky motion; removing them improved performance.
- The movement was smooth when syringes were aligned correctly.

- Results support Pascal's Law.
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## 9. Conclusion

- The DIY hydraulic crane demonstrates how force is transmitted through liquid.
  - Hypothesis was supported: more force applied resulted in higher lifting capacity.
  - Future improvements: stronger cardboard, better syringe alignment, larger crane arm.
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## 10. Real-World Applications

- Construction cranes use hydraulic systems to lift heavy materials.
  - Hydraulic lifts in cars and machinery work on the same principle.
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## 11. Bibliography

- Websites:
    - How Hydraulic Systems Work – [\[https://youtu.be/DdZnknku8b8?si=ByVPTYBaaM9fmkaE\]](https://youtu.be/DdZnknku8b8?si=ByVPTYBaaM9fmkaE)
    - DIY Hydraulic Arm Projects – [\[https://youtu.be/4j5HdYvkjhs?si=CaMre7IJ9W8oVO1a\]](https://youtu.be/4j5HdYvkjhs?si=CaMre7IJ9W8oVO1a)
  - Videos:
    - YouTube: "DIY Hydraulic Crane" [\[https://youtu.be/P2r9U4wkjcc?si=T2aNqlcuxtGO4CJs\]](https://youtu.be/P2r9U4wkjcc?si=T2aNqlcuxtGO4CJs)
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