Beverage Container Crusher: Grade 8

Understanding Structures and Mechanisms - Systems In Action

Introduction: Designers are always designing new structures and mechanisms to meet a need. Some of these needs might be to help us work faster, to make lives more pleasant or perhaps it is to perform a dangerous task. To prevent designing something incorrectly, designers must consider many things. Some of these considerations would be:

1) The forces acting upon the structure;
2) The structures impact on the environment;
3) The materials available;
4) The cost of the finished structure.

Mechanical Advantage is directly related to the efficient operation of any mechanism, and is determined by the relationship between input and output forces.

Prior Knowledge and Skills Students will need to be familiar with in order to complete this activity:

- Understand Mechanical Advantage and know how to calculate it for pulleys, gears, levers, and hydraulic systems
- How to use appropriate techniques and materials for building structures
- How to set up pulleys, gears, levers, and hydraulic systems so that they function
- Knowledge of the Design Process

Scenario: Your School Board is expanding the types of beverage containers that it will be collecting for recycling (including cans, plastic bottles, drinking boxes, milk cartons). Since space to store this material is a major concern, the Board is looking at ways of reducing the volume of this material. The Board has approached you to design and construct a prototype of a device that could be used to safely crush the beverage containers to be recycled. The Board is very environmentally conscious; therefore, the device must use the least energy/force possible to crush the beverage containers. Final proposals, including prototypes, are due at the close of business on _____(date).

Resources/Materials/Equipment: *Scroll saw, drill press, band saw (if working in an Application Centre) *Hand saw (e.g. back saw, hack saw), mitre box, hammer, screwdriver, pliers, *Safety goggles *Nails, screws, wood (1 cm x 1 cm bass wood, dowelling, wood scraps), craft sticks, clothes pins, string, wire, cardboard, tape, glue (including glue gun), gussets *Assorted syringes, plastic tubing, connectors, *Assorted pulleys and gears, springs, elastics.

Design Specifications

The beverage container crusher:

- must be constructed of the materials provided
- must use at least one simple machine and/or hydraulic system
- must have a mechanical advantage (calculated by student)
- must be easily assembled and disassembled so that the component parts can be re-used or recycled

Students will be required to submit:

- prior to the building stage a diagram of their prototype
- at the end of the design process, a written presentation, including diagrams, outlining their solution to members of the Board's Environmental Management Team (judges).

Assessment and Evaluation:

Evidence of Student Learning: design notes and drawings, working model, understanding of Mechanical Advantage, demonstration of knowledge of design process, presentation of design and model

Criteria: safe, appropriate, and effective use of materials and tools, design specification requirements are met, accurate Mechanical Advantage calculations, presentation shows understanding of key learnings, including use of design process.