Fountain

Physical Science | Engineering Design Process

Engineering Challenge

Visible Elements in Photo

- A tiered outdoor fountain with three basin levels covered in ice and frost
- Water flow channels/pathways visible in the fountain's structural tiers
- Surrounding brick building with windows and architectural features
- Ornamental landscaping with flowering plants (yellow flowers visible) and shrubs around the fountain's base
- A street lamp and commercial signage nearby indicating a public courtyard space

---

Reasonable Inferences

- From ice/frost coverage !' The fountain operates in cold climates and water movement/circulation is affected by freezing temperatures, which may block or slow water flow.
- From tiered basin design !' The fountain is engineered to move water from top to bottom through gravity; the multiple levels suggest intentional water pathway design.
- From public courtyard setting !' The fountain serves both aesthetic and functional purposes (water circulation, drainage) and must withstand environmental exposure and regular use.

Engineering Task

K-2 Challenge:

Build a tall tower with three cups stacked on top of each other. Poke a small hole in the bottom of the top cup and fill it with water. Watch the water drip down into the second cup, then the third cup. Can you make the water flow slowly or quickly? What happens when it gets cold?

3-5: Design a Freeze-Resistant Water Feature

Design a small fountain or water circulation system that:
- Must have at least 2 levels where water flows downward
- Can function in freezing temperatures without ice blocking the water pathways
- Uses materials that won't crack or break when exposed to freeze-thaw cycles
- Must be tested to show water moving through all levels

Success criteria: Water flows from top to bottom for at least 3 consecutive cycles without ice buildup blocking flow.

3-5 Challenge:

Design a small fountain or water circulation system that:
- Must have at least 2 levels where water flows downward
- Can function in freezing temperatures without ice blocking the water pathways
- Uses materials that won't crack or break when exposed to freeze-thaw cycles
- Must be tested to show water moving through all levels

Success criteria: Water flows from top to bottom for at least 3 consecutive cycles without ice buildup blocking flow.

EDP Phase Targeted

Ask / Define Problem

This phase fits because the photo shows a real-world structure (a frozen fountain) where water flow is disrupted by environmental conditions. Students observe the problem (ice blocking water pathways in cold weather) and must define what a working solution needs to do. The visible ice and the fountain's design prompt students to ask: "How do we keep water moving when it freezes?" rather than jumping to a predetermined solution.

Suggested Materials

- Small clear plastic cups or containers (3-4 per team)
- Aluminum foil or copper tubing (to represent heat-conductive pathways)
- Warm water and ice (to simulate temperature changes)
- Hole punch or thumbtack (for making drainage holes)
- Sand, gravel, or insulating foam scraps (for thermal protection)
- Measuring cup or spray bottle (to test water flow rate)

Estimated Time

Single 45-minute session (K-2) for building and testing water flow; Two 40-minute sessions (3-5) to design, build, test with freezing conditions, and redesign based on results.

Why This Works for Teachers

This task directly addresses NGSS 3-5-ETS1-2 (Generate and compare multiple solutions using design criteria and constraints) by requiring students to develop a structure that balances water flow, material durability, and environmental resilience—all observable needs from the fountain photo.