Matter

Physical Science | Engineering Design Process

Engineering Challenge

Visible Elements in Photo

- Long, thin icicles hanging from an overhang or roof structure
- Brown/tan soil or earth visible at top of frame
- Evergreen trees (conifers) in the blurred background
- Brick building structure visible in the lower background
- Water frozen in vertical formations

Reasonable Inferences

- From icicles + overhang: Water is dripping from a roof edge and freezing in cold temperatures, suggesting a problem of ice buildup or water management in winter conditions.
- From evergreen trees + frozen water: This is a cold climate where persistent freezing occurs; structures and landscapes experience regular ice formation challenges.
- From icicles' length and weight: Accumulated ice can become heavy and potentially hazardous to people or structures below.

Engineering Task

K-2 Challenge:

Make a gutter (a little water slide) that catches dripping water and sends it to a safe place. Use straws, paper towel tubes, or plastic cups to build your water path. How can you stop ice from blocking it?

3-5 Challenge:

Design a roof drainage system that directs water away from a structure while minimizing ice dam formation. Your system must be at least 30 cm long, use only recyclable or natural materials (PVC tubes, gutters made from paper, wood strips, or rigid plastic), and successfully channel water from a source (faucet or pitcher) into a collection container at least 20 cm away. Test how your design handles repeated water flow. Does ice form? Does water back up? Refine your design to reduce both problems.

EDP Phase Targeted

Ask / Define Problem – This phase fits best because the photo clearly shows a real-world winter problem (ice formation and water management) that students can relate to and identify as a challenge worth solving. Students start by observing what happens when water freezes on structures and asking, "How can we stop this?"

Suggested Materials

- PVC pipe or plastic gutters (or rolled paper/poster board as substitutes)

- Straws, paper towel tubes, plastic bottles cut lengthwise
- Tape (duct, masking, or waterproof)
- Wooden blocks or dowels for supports
- Water source (pitcher, faucet, or watering can)

Estimated Time

45–60 minutes (single session for K-2; one 45-minute session for 3-5 planning + build, with optional 20-minute follow-up test/refinement).

Why This Works for Teachers

This task directly addresses NGSS ETS1.A (defining engineering problems) by having students identify a real-world problem visible in their environment—water and ice management—and prototype solutions using constraints and testing, bridging physical science (states of matter, freezing) with practical design.