

Visible Elements in Photo



- Frost or ice crystals covering a flat surface (likely a car hood or roof)
- Low-angle sunlight creating glare and shadows across the crystalline texture
- Bare trees in the background suggesting winter or cold season
- A building structure visible on the right side
- Clear sky with golden-hour lighting

Reasonable Inferences

- From frost crystals: Water vapor in the air has frozen solid on a cold surface, meaning the air temperature dropped below freezing and the surface was even colder than the surrounding air.
- From bare trees and frost presence: This is winter or early spring in a climate with freezing temperatures; outdoor structures and exposed surfaces face repeated freeze-thaw cycles.
- From sunlight angle and crystal visibility: The frost layer is fragile and will melt or sublimate as temperature rises, suggesting any protective structure built in this environment must account for seasonal temperature changes.

Engineering Task

K-2 Challenge:

Make a tiny roof or cover for things outside so frost doesn't stick to them. What shape works best? Use straws, paper, and tape to build a small shield. Test it by sprinkling water on it and putting it in a cold place overnight. Does the frost stick less to the covered side?

3-5 Challenge:

Design a protective coating or covering system that reduces frost accumulation on outdoor metal surfaces. Your solution must (1) cover at least 100 square centimeters, (2) allow airflow so it doesn't trap moisture, (3) be removable or reusable, and (4) remain intact through at least 3 freeze-thaw cycles. Test your design by comparing frost buildup on a coated metal sheet versus an uncoated control in a freezer. Measure frost thickness in millimeters.

EDP Phase Targeted

Ask / Define Problem

This photo shows a real problem: frost buildup on outdoor surfaces causes visibility loss, equipment damage, and safety hazards. Students can see the problem directly and brainstorm solutions before testing. The winter setting and visible frost create authentic context for asking Why does frost form? and How can we stop it?

Suggested Materials

- Metal or aluminum sheets or trays (test surfaces)
- Wax paper, fabric, or bubble wrap (potential coatings)
- Clear tape or duct tape

- Spray bottle (to add water for freeze cycles)
- Freezer or cold outdoor location
- Ruler (to measure frost thickness)

Estimated Time

K-2: One 45-minute session + overnight freezing

3-5: Two 40-minute sessions (design/build first session; test and measure second session) + overnight freezing between sessions

Why This Works for Teachers

This task aligns with NGSS K.ETS1.1 and 3-5.ETS1.1 (Ask questions, make observations, and gather information) by anchoring the engineering challenge in observable natural phenomena and a tangible real-world need—protecting outdoor surfaces from frost damage—which motivates students to ask good questions before they design.