

Background: Temperatures are increasing at a faster rate in polar regions. This temperature rise is causing permafrost to thaw. Infrastructure (roads, buildings, towers) is failing as a result.

Engineering challenge: Design a tower that can stay standing on both solid and thawed permafrost. The tower must be at least 15 cm tall and hold at least 200 grams mass without sinking or tipping. (TEACHER: Change criteria to fit your needs.)

Brainstorm: With partners, share idea about tower design. Sketch ideas on back of this paper. Each person should have at least one sketch.

Build: Build your tower using supplied materials.

Sketch: In your notebook or on additional paper, draw a sketch of the completed tower. Include measurements of height and width. Label materials used.

Test on Solid Permafrost: Place tower on ice. Add mass. Let stand for 20 seconds. Record results on data table. Sketch.

Test on Thawed Permafrost: Place tower on thawed permafrost. Add mass. Let stand for 20 seconds. Observe results. Record results on data table. Sketch results in notebook or on additional paper.

Test	Time Standing Upright (sec)	Mass Used (g)	Briefly describe results here. Sketch the structure in your notebook or on additional paper.
Solid Ice			
Thawed Permafrost			
Additional Tests			

Interpretation:

1. In complete sentences, describe the results of the tests. Include time, mass, and units of measurement.
2. Explain why these results were seen. How did the tower design allow the tower to stay standing on solid ice? If the tower broke or tipped, how did the design contribute to this result?
3. What design changes could be made to your tower to improve performance? If your tower remained standing during the original tests, add more mass to retest. Record results.
4. In our community, what structures might be impacted if the ground beneath them became softer?

Help, Our House is Sinking! Engineering Solutions for Thawing Permafrost
Structure Design and Testing Rubric

Points	9 - 10	7 - 8	5 - 6	0 - 4
Construction	Tower meets assigned criteria.	One design criteria not met.	Two design criteria are not met.	Tower not completed. Tower does not meet any design criteria.
Technical Sketch	Sketch is accurate. Lines drawn with a ruler. Measurements included. Labels included. Extra: Sketch is to scale	Sketch is accurate. One or two requirements missing.	Three or four requirements missing. Sketch not accurate.	No sketch. Person cannot identify structure based on sketch.
Discussion	Test results, explanation of results, and suggestions for improvements all described in detail.	Test results, explanation of results, and suggestions for improvement described, but more detail needed.	One or two required discussion points are missing. Little detail given.	Discussion questions not answered, or answer with no detail.
Teamwork	Work is done cooperatively. Materials used wisely. Work area clean at end of class.	Teamwork could improve or work area could be cleaner at end of class.	Teamwork could improve.	Student did not act cooperatively and/or student misused materials, and/or work area not cleaned.

Comments: