

Lesson Plan for Joule Website

Grade Level - Upper Elementary

Lesson Title - Designing Earthquake-proof Buildings

Unit - Earth Dynamics

Overview

This lesson is designed as part of a unit where students are learning about Earth's systems, specifically, plate tectonics, weathering and erosion, volcanoes, and earthquakes.

This lesson, and others within the unit, correlate to NGSS Evidence Statement 4-ESS3-2 - Earth and Human Activity. The SEPs (Science and Engineering Practices), DCIs(Disciplinary Core Ideas) and CCs(Crosscutting Concepts) can all be addressed here. The iterative nature of the design process is a key component of the SEPs.

ELA Common Core State Standards connections can be addressed in multiple ways; through gathering information from multiple resources, collaboration and communication reflections, and multimedia presentations throughout the planning, testing and reflecting process, to name a few.

Plan

After observing videos that demonstrate the phenomena of earthquakes and their results, and an introduction to the design process, students are given the task of designing a model of an earthquake-proof building. Constraints include the materials and the height of the building, all of which can be modified for availability, appropriateness for grade level and cost. In Grade 4, we used spaghetti and marshmallows and a completed building height of 25cm. Higher grade levels could add additional constraints involving pricing of materials and time.

Resources - Videos and Websites

Two-minute video from National Geographic with photos and animations of earthquakes: <https://www.youtube.com/watch?v=VSgB1IW6O4>

TED Ed animation of why buildings fail in earthquakes: https://www.youtube.com/watch?v=H4VQuI_SmCg&list=RDQMkBTZoQ5G33c&start_radio=1

Video from The Economist about how engineers test and design earthquake-proof buildings: https://www.youtube.com/watch?v=sxpi9A7_syE

General, kid-friendly information about earthquakes and an aerial video of the 2011 earthquake in Japan: <http://www.weatherwizkids.com/weather-earthquake.htm>

USGS map of recent earthquakes and magnitudes: <https://earthquake.usgs.gov/earthquakes/map/>

USGS link is a short, written overview of why earthquakes happen every day: https://earthquake.usgs.gov/learn/topics/100_chance.php

Interactive page where students can explore how different tectonic plates converge:
<https://cptv.pbslearningmedia.org/resource/ess05.sci.ess.earthsys.shake/mountain-maker-earth-shaker/>

This link has children demonstrating the different types of seismic waves:
<https://www.youtube.com/watch?v=P3zkVAuqu9w>

For students 6-8, 9-12, this site gives lessons and related background material for studying plate tectonics and earthquakes: https://cptv.pbslearningmedia.org/resource/ess05.sci.ess.earthsys.lp_earthquakes/earthquakes/

How to build a shake table and test model buildings: <https://pbskids.org/designsquad/build/seismic-shake-up/>

Planning and Reflection sheets follow

The Design Process - Earthquake-proof structures

Names: _____

1. Find the need -
2. Define the problem -
3. Brainstorm possible solutions (draw on back or on scrap paper) -
4. Select the most promising design -
5. Plan and manage the project -
6. Build - test - refine the design

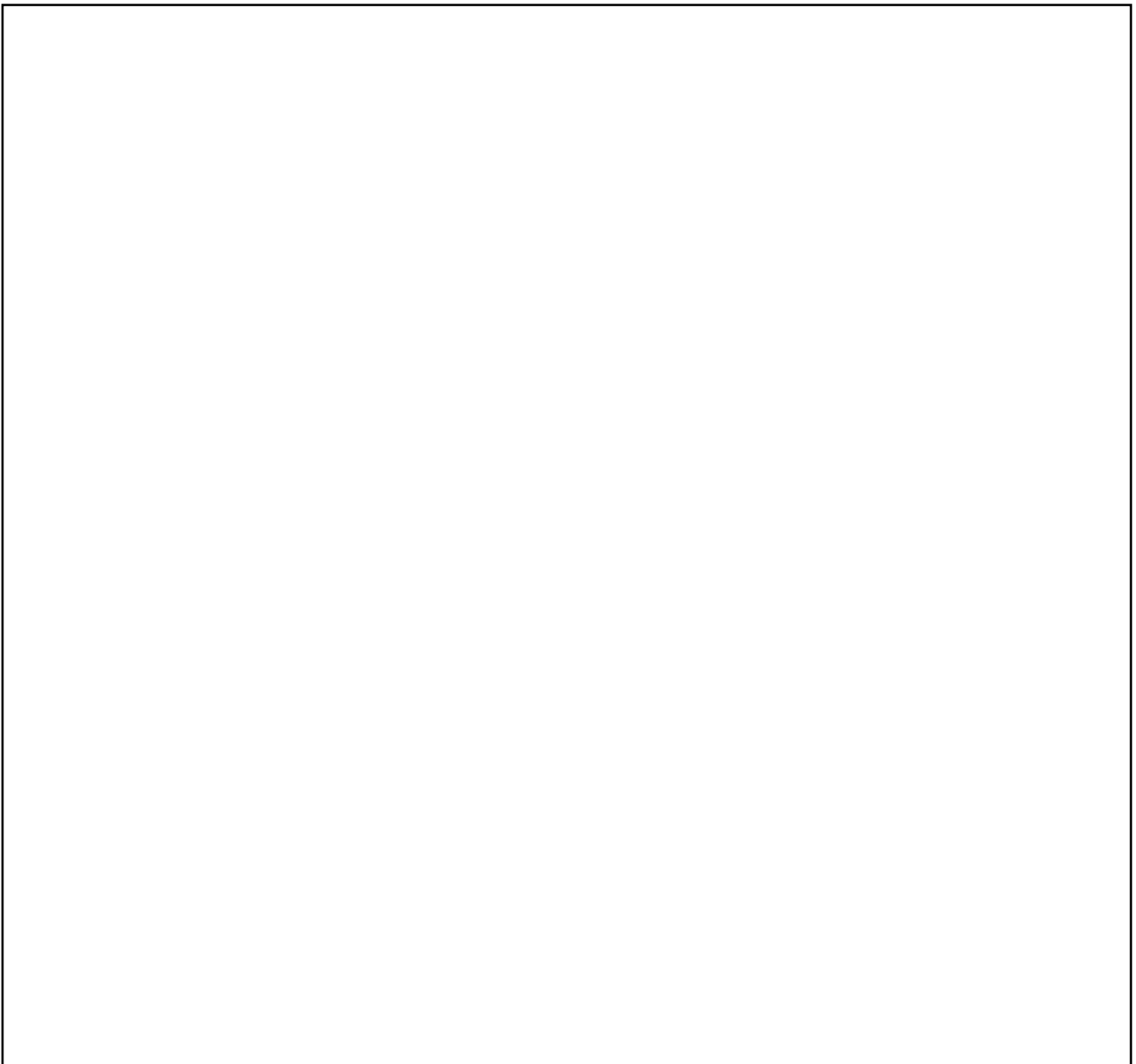
Names: _____

Earthquake Building Designs

Draw a sketch of your Earthquake-proof structure. Be sure to listen to each group member's ideas.

You may only use marshmallows and spaghetti. The structure must be 25 cm. tall and fit on the building pad.

First iteration:



Second iteration:

