

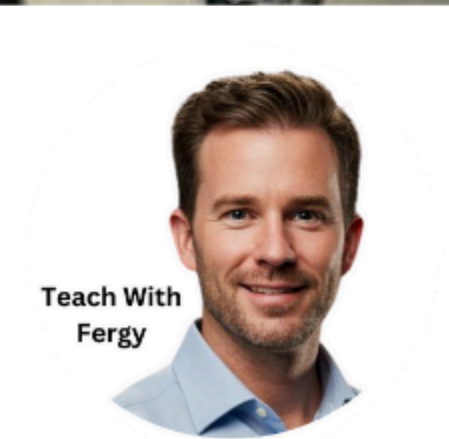
STEM Engineering Challenge Bundle - High School

Print and go
STEM
Engineering
Challenges



- ✓ 20 Hands-On STEM Challenges
- ✓ Aligned with NGSS Standards
- ✓ Complete Student Resources
- ✓ Perfect for Class or STEM Club

SCROLL
to take a look inside!



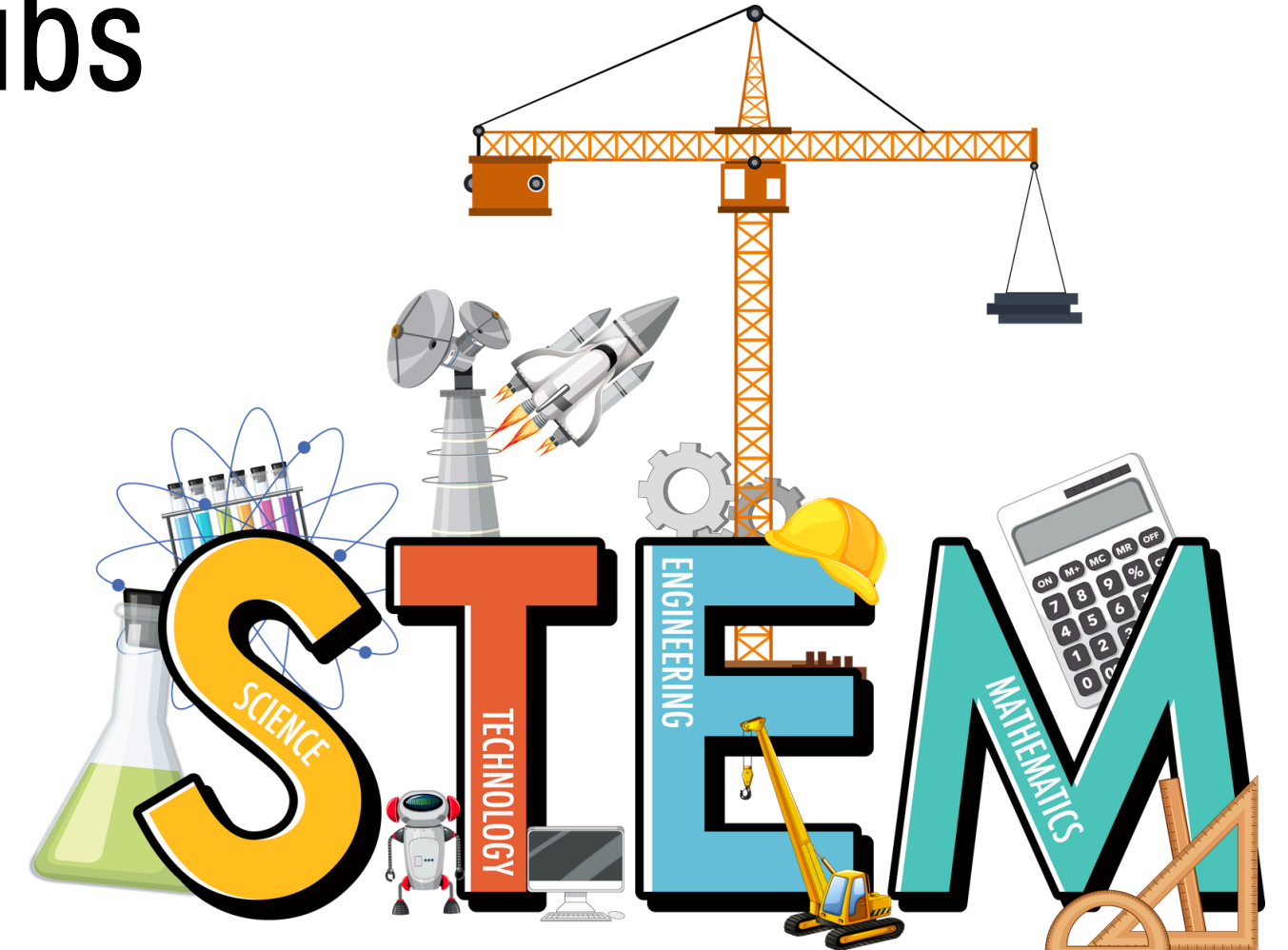
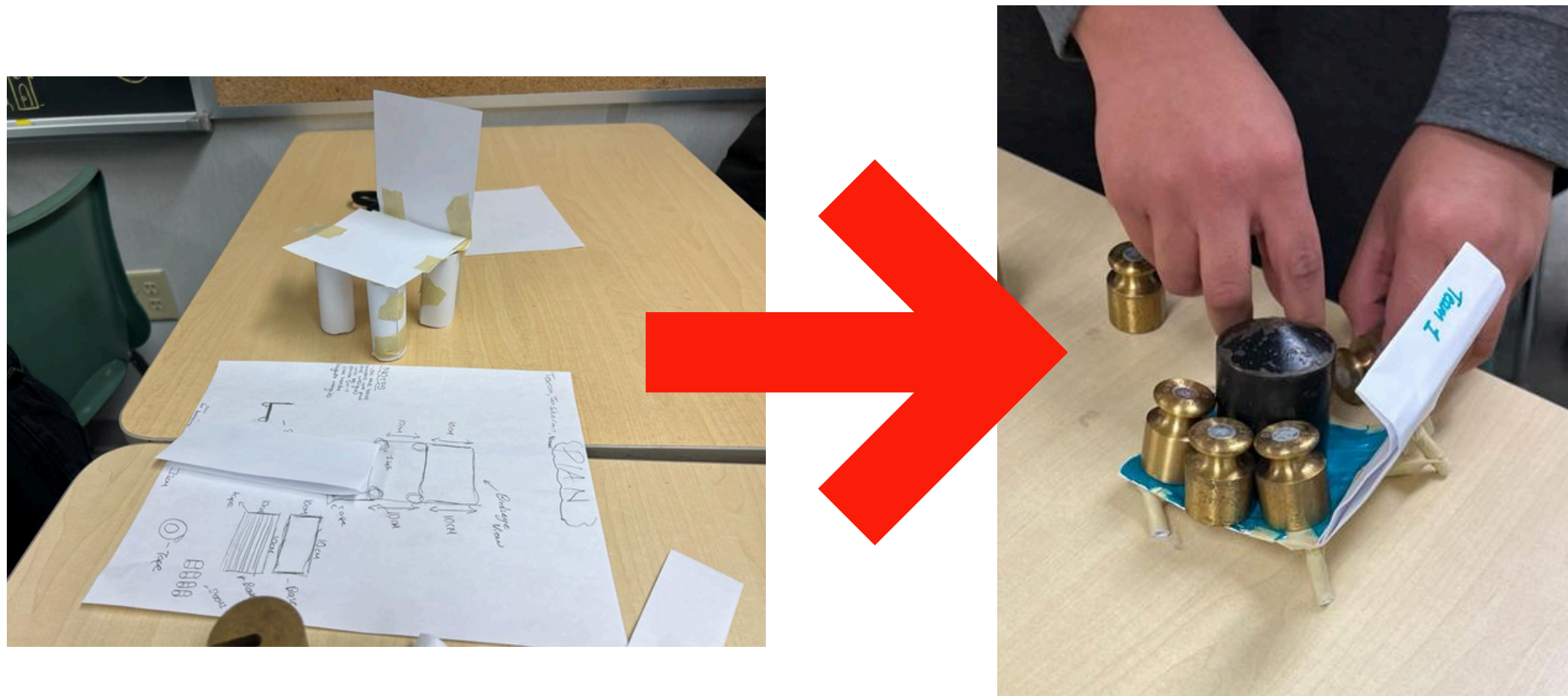
Ways to Use this Resource

★ Introduce the Scientific Method

★ Teach STEM Concepts

★ Engineering Lessons/Activities

★ STEM and/or Engineering Clubs



Classroom Fit Guarantee

I want you to feel confident when you purchase from Teach With Fergy. If a resource is not the right fit for your students, simply contact me and I'll provide double your purchase amount in store credit toward another resource in my store.



HOW THESE CHALLENGES WILL HELP YOU



- Eliminates prep stress with ready-to-use, fully editable challenges - just print/upload and assign with almost no materials.
- Engages every learner through hands-on, high-interest engineering challenges that boost motivation and participation.
- Strengthens instruction by aligning directly with NGSS HS-ETS1 standards.
- Builds essential skills such as problem-solving, teamwork, creativity, and communication—core competencies for high school STEM.

What's Inside Each Challenge

Detailed Challenge Guide: A step-by-step process to introduce the challenge objectives and guide the design process.

Construction Strategy: Instructions to aid students in planning and constructing promoting an understanding of engineering concepts.

Reflective Questions: Thought-provoking questions designed to stimulate reflection after the challenge.

Extension Research Questions: Additional questions that promote further inquiry that push students to investigate modern engineering feats.

The Science Behind the Challenge: An explanation of the science behind the challenge for your students.

Paper Chair Challenge

Objective:
To construct a chair solely from four standard sheets of paper and three feet of tape that can support a weight for at least 5 seconds. Additional weight will be added until your chair collapses.

Materials:

- Four sheets of standard 8.5" x 11" paper
- Three feet of masking tape
- Scissors

Challenge Rules:

1. Each group of students should only use the materials provided for the construction of the chair.
2. The chair must be free-standing, without any additional support or leaning against any surface for stability.
3. No other materials (like pencils, staples, or glue) are allowed to support the structure.
4. The chair must have at least three distinct parts: a seat, a back, and legs/support.
5. The 'sitting area' must be at least 4" x 4" (10 cm x 10 cm).
6. Your chair must only have 4 legs.
7. Each team must complete their chair within the given time frame (suggested: one class period). If desired, tell your students about the project the day before and give them time to complete the drawing phase.

Instructions:

Step 1: Planning

- Students discuss how to design the chair.

Step 2: Construction

- Students cut the paper, lay out the roll, lay the tape.

Step 3: Testing

- Each group adds weight at least until the chair collapses.

Reflection: Students

Paper Chair Challenge Reflection Questions

1. What shapes did you use in your chair design and why? Think about the strength of shapes like triangles and cylinders.
2. How did you make sure your chair would be stable? Consider weight distribution and the center of gravity.
3. What was the most challenging part of building your paper chair and how did you overcome it?
4. Did your chair hold as much weight as you hoped? If not, what do you think went wrong?
5. If you had more paper and tape, what would you do differently in your design?
6. How did working in a team help during this challenge?

Paper Chair Challenge: The Science Behind It

Strength in Shapes:
Even though paper is thin and flimsy, when you fold it into certain shapes, it becomes much stronger! Here's why:

- **Triangles:** These are superheroes of shapes! They don't change shape easily, which makes them great at spreading out weight. When you push down on the point of a triangle, the sides push outward but don't collapse.
- **Cylinders (Tubes):** Rolling your paper into a tube makes it way tougher. This is because when you try to squeeze a tube, each part of the paper helps to hold the other parts up. Think of it like a bunch of friends holding hands in a circle – it's harder to push them over when they're working together!

Weight Distribution:
This is about how the weight of something (like your stuffed animal) is spread out. If you put all the weight in one spot, the paper chair will probably crumple. But if you spread the weight over a wider area, the chair can hold up much better. This is because the pressure is shared over more paper, not just one spot.

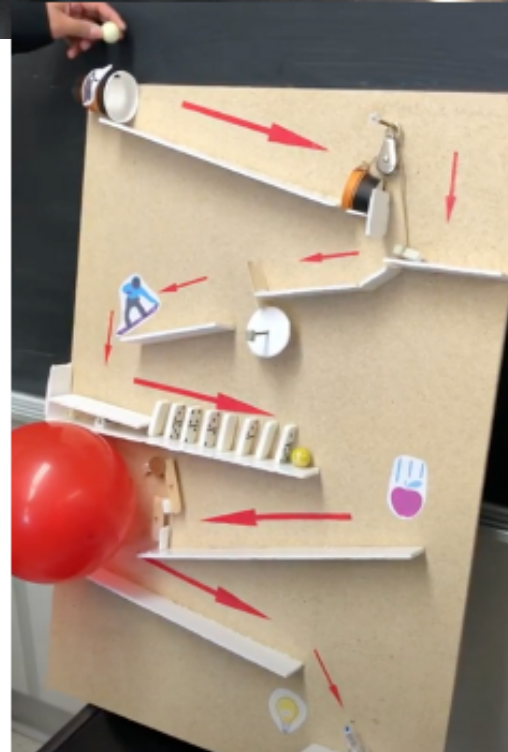
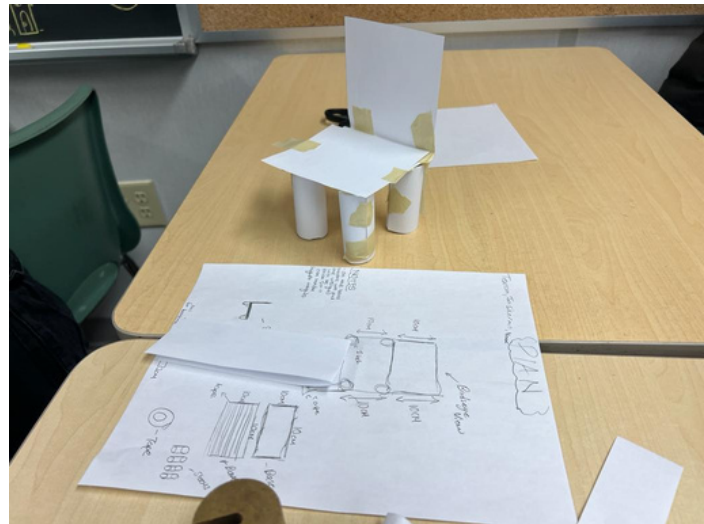
Center of Gravity:
Everything has a center of gravity – it's like the place where it balances perfectly. If the center of gravity isn't right over the middle of the chair, it might tip over. When you're building your chair, try to make sure the middle of the chair is ready to hold the textbook right at its center.

Science Tips:
Here are some shapes students can consider incorporating into their paper chair designs, along with a brief explanation of why these shapes might be useful:

Shapes for Paper Chair Design

- **Triangles:** Triangles are one of the strongest shapes in engineering. They distribute weight evenly and resist bending and flexing better than rectangles. Use them for the chair's legs or back support.
- **Cylinders:** Rolling paper into cylinders can create strong columns that can support a lot of weight relative to their size. They're great for legs or for a structural support system under the seat.
- **Rectangles/Squares:** While not as strong as triangles, rectangles and squares can be useful, especially if folded into corrugated layers or combined with triangles for stability. They can be used for the seat and backrest.
- **Arches:** An arch shape can be strong for supporting weight as well when force is applied from above. This might be a bit complex to implement but could be a fun challenge for a seat design.

Skills Your Students Will Learn/Improve



- ✓ Problem-Solving and Critical Thinking & Innovation
- ✓ Collaboration & Communication
- ✓ Engineering Design Process
- ✓ Data Collection & Analysis
- ✓ Resilience & Perseverance
- ✓ STEM Content Knowledge
- ✓ Time Management & Organization

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