STEM 101
Powered by THE STEM ACADEMY

Name: _____
Period: _____

UNIT: MEASUREMENT

FINAL CHALLENGE: BUILD & TEST THE ARM

GOAL:

Use what you've learned from the other stations to design, build, and test a functional arm or ramp system that can move, measure, and signal success—just like a real prosthetic or rover tool.

CHALLENGE OVERVIEW:

Use the **best materials or designs** from each station to build a mechanical **arm, grabber, or launcher system** that:

- ✓ **Moves** (using elastic bands, springs, or magnets)
- ✓ **Measures** something (like distance, angle, or height)
- ✓ **Signals** when the task is complete (with an LED or buzzer)

MATERIALS:

- ✓ Rubber bands, springs, dowels, straws, craft sticks
- ✓ Paperclips, magnets, aluminum foil
- ✓ LED light, buzzer, coin battery
- ✓ Ruler, protractor (for measuring distance or angle)
- ✓ Cardboard, scissors, tape, string, paper towel tubes
- ✓ Multimeter (optional for testing current or voltage)

STUDENT DIRECTIONS:

Step 1: Plan Your Design

Before building, sketch or write out your idea:

- **What will your arm or ramp do?** (grab, push, launch, lift, etc.)
- **How will it move?** (rubber band, magnet, spring)
- **How will it measure something?** (ruler, angle, stretch length)
- **How will you signal success?** (LED lights up, buzzer sounds)

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Use this space to draw your blueprint or describe your idea:

✏️ Sketch / Notes:

_____
_____
_____

Step 2: Build Your System

- Start with the **main structure** (ramp, base, arm, etc.).
- Add your **motion system** (rubber band, magnet, etc.).
- Attach any **measurement tools** (ruler for distance, protractor for angle).
- Connect a **simple circuit** to trigger your **signal** (LED or buzzer).

Be safe when using batteries or scissors. Ask for help if needed!

Step 3: Test & Improve

- Try your build at least **3 times**.
- Does it work every time?
- Make changes if needed. Engineers test and improve constantly!

Did your arm or ramp:

- Move with energy from a spring, magnet, or elastic?
- Measure something accurately?
- Light up or signal success?

Final Reflection & Team Check-In

- What worked best in your design?

  _____
  _____

- What was hardest to figure out?

  _____
  _____

- How did your knowledge of energy, materials, and circuits help?

  _____
  _____

- If you had one more hour, what would you upgrade?

  _____

  _____

Wrap-Up Prompts (Student Reflection):

- How did precision measurement help in choosing the best materials?
- What was the most challenging part of working with small forces or currents?
- How do you see measurement and energy transfer working together in real-world tech?

STANDARDS ALIGNMENT

NGSS: HS-PS3-3, HS-ETS1-1, HS-ETS1-2, HS-ETS1-3 **STEL:** STEL 1E, STEL 2E, STEL 7F, STEL 8F, STEL 10F, STEL 11F **CCSS:** CCSS.MATH.CONTENT.HSN.Q.A.1, CCSS.MATH.CONTENT.HSN.Q.A.3, CCSS.MATH.CONTENT.HSG.MG.A.3, CCSS.MATH.PRACTICE.MP4, CCSS.MATH.PRACTICE.MP5