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)

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

✏️ Sketch / Notes:

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**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?

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* What was hardest to figure out?

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

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

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**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