**🎮 Station 3: “Trigger the Gate” – Game Mechanism Design**

**NGSS Connection:** *HS-PS3-3 (Designing energy systems and conversions)*
\**Class: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  Partner(s): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*

**🎯 Your Mission:**

You’re designing a **game mechanism** for an escape room challenge! Your goal is to build a creative **switch or trigger** that turns on a **light or buzzer** when solved by a player.

You’ll explore **how mechanical actions (like pressing, tilting, or pulling)** can complete an electrical circuit—and convert **mechanical energy into electrical energy**.

Mechanical-to-Electrical Energy Conversion & Circuit Control Using Switches

**Materials at This Station:**

* Battery (coin cell or 9V)
* Buzzer or LED light
* Wires or copper tape
* Paperclips, magnets, sponges, rubber bands, cardboard
* Aluminum foil, foam, ball bearing, tape, scissors
* Optional: Reed switch or small motor

**Student Directions:**

**STEP 1: Explore Switch Options**

Pick one or more designs to build:

* **Pressure Plate Switch:** Layer foil and sponge so the circuit closes when pressed.
* **Tilt Switch:** Create a simple seesaw or pathway with a metal ball or paperclip that bridges a circuit when tilted.
* **Magnetic Switch:** Use a **magnet** and a **metal paperclip** or **reed switch** to create contact.

 **STEP 2: Build and Test Your Switch**

* Connect your battery, switch, and buzzer/light in a simple circuit.
* When the switch is triggered, your **output device** (light or buzzer) should turn on.
* Troubleshoot as needed: Is the connection tight? Does the circuit close completely?

**STEP 3: Incorporate into a Game Mechanism**

* Imagine this switch is part of an **escape room puzzle.**
* Mount it onto a board or inside a box.
* Think: How does a player *trigger* the circuit? Is it fun and challenging?

**Record Your Results:**

| **Switch Type Tried** | **Did It Work? (Y/N)** | **Easy to Use? (✔/✘)** | **Notes or Observations** |
| --- | --- | --- | --- |
| Pressure Plate |  |  |  |
| Tilt Switch |  |  |  |
| Magnetic Switch |  |  |  |

**Analysis Questions:**

**What kind of energy conversion occurred in your system?**
→ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
→ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**What was the most reliable switch design and why?**
→ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
→ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**💡 Design Tip:**

Think like an engineer! The best switch is not just cool—it’s **reliable**, **reproducible**, and **safe** for others to use in your game setup.

🎮 **Station 3: “Trigger the Gate” – Game Mechanism Design**
🔬 **NGSS Connection:** HS-PS3-3 – Design, build, and refine a device that works within given constraints to convert one form of energy into another.

✅ **ITEEA STEL Standards – High School**

**STEL 1H** – Technological systems include input, processes, output, and feedback.
→ Students construct a functioning system (switch mechanism) that responds to mechanical input with an electrical output (light or buzzer).

**STEL 4J** – The engineering design process involves defining problems, generating ideas, selecting solutions, testing, and evaluating.
→ This activity guides students through engineering steps to design, test, and refine a functional circuit-based switch.

**STEL 5H** – Devices and systems are repaired using troubleshooting and problem-solving.
→ Students actively troubleshoot their circuits and switch designs to improve function and reliability.

**STEL 8H** – Applying science, math, and engineering principles helps solve practical problems.
→ Students apply principles of circuit design and energy conversion to develop real-world, game-based mechanisms.

**STEL 9I** – Invention and innovation are influenced by human wants and needs, and cultural and social priorities.
→ Students design interactive, playful switches with user experience in mind (escape room context).

✅ **Common Core Math Standards – High School**

This activity supports mathematical reasoning through system testing and performance analysis:

**HSN-Q.A.1** – Use units as a way to understand problems and guide the solution of multi-step problems.
→ Students may incorporate resistance, voltage, or current analysis during circuit design.

**HSS-IC.B.6** – Evaluate reports based on data.
→ Students analyze which switch designs performed reliably and justify their design choices based on evidence.

**HSG-MG.A.3** – Apply geometric concepts in modeling situations.
→ Students may use geometry when aligning components, estimating angles in tilt switches, or optimizing contact in physical layouts.

**HSS-ID.A.1** – Represent data with plots on the real number line (dot plots, histograms, box plots).
→ Students may graph trial outcomes for different switch types to find trends or patterns in performance.

💡 **Summary:**
This station combines creative problem-solving and engineering design with real-world math and science applications. Students build a functional game mechanism while exploring energy conversion, system design, and iterative testing—making this activity ideal for cross-disciplinary STEM learning.