Spintronics Act 2 and Power Pack Expansion Kit

Mid-Valley
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Spintronics Expansion Pack

The Spintronics Act 2 and Power Pack Extension Kit expands on mechanical circuit exploration with even more components, complexity, and creativity. Students dive deeper into the world of analog electronics, building intricate spin-based systems that include switches, timers, and amplifiers—all powered by hands-on energy from the Power Pack. This advanced kit transforms abstract concepts like resistance, current, and logic into tactile, engaging challenges that build real engineering insight.

Note: This kit is designed to be used with a Spintronics Act 1 classroom kit.

Grade Level

6th - 12th

Group Size

2 - 3 students per group

Time Duration

60 - 90 minutes

Content of Kits

Components

- 2 Spintronics Act 2 sets
- 2 Spintronics Power Pack sets

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Usage

Getting Started

1. **Review Act 1 Concepts -** Before diving into the new components, have students review key principles from Act 1—such as torque, current, resistance, and how spintronic circuits function. A quick recap sets the foundation for more complex builds.

2. **Explore New Components** - Introduce students to the new parts in Act 2 (like logic gates, timers, and junctions) and the Power Pack (which adds more power sources). Allow time for free exploration or guided mini-challenges to understand their unique functions.

3. **Use the Puzzle Booklets** - Begin with the first few puzzles in Act 2's booklet to gradually build confidence with advanced components and mechanical logic concepts. Encourage students to work in pairs to collaborate on problem-solving.

4. **Create a Multi-Powered Circuit** - Challenge students to modify a previous circuit to incorporate multiple power packs, helping them understand how combining power sources affects circuit behavior. This helps bridge Act 1 learning with the capabilities of the Power Pack.

Storage

Return the set components to their designated spots within the set's box to ensure the sets fit together. This will help prevent damage to the small parts during travel.

Troubleshooting

- **Timer or Logic Gates Not Working Properly**
  Ensure that all gears are engaged correctly and that chains are tensioned properly; loose chains or misaligned gears can interrupt function.
- **Power Source Feels Too Weak**
  Make sure the spring motor in the Power Pack is fully wound and that the chain is tight and not slipping. Add a second Power Pack if the design requires more torque.
- **Chains Slipping or Popping Off**
  Check that all sprockets are aligned on the same plane and that the chain isn't too tight or too loose. Adjust as needed to maintain smooth movement.
- **Puzzle Solutions Not Matching Output**
  Revisit the puzzle prompt—many puzzles in Act 2 introduce logic-based challenges, and even small misconfiguration can lead to incorrect results

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Activity Guide

Beginner

Power Up and Test
Students will build a basic Spintronics circuit (e.g., switch → resistor → ammeter) and test how the system changes when powered by one vs. two Power Packs. They'll observe speed, torque, and current levels and record their results. This reinforces understanding of energy sources and mechanical-electric relationships.

Intermediate

Logic Gate Explorations
Students will use the Act 2 components to build simple mechanical logic gates (AND, OR, NOT). After testing how each gate functions individually, they'll combine them into a short decision-making chain. This builds foundational knowledge of computing systems and control logic.

Advanced

Multi-Function Circuit Challenge
Working in teams, students will create a system with at least two powered branches (e.g., one controlling a timer, the other using a logic gate to control a switch). They'll plan, build, test, and revise their design to ensure synchronized, functional movement across all outputs. This promotes complex systems thinking and mechanical troubleshooting.

Extension Activity:

Mechanical Coding Maze
Students will design a 'logic maze' puzzle using logic gates and switches, where users must input a correct physical sequence (e.g., flip switch A, then B) to complete tasks like moving a chain or triggering a timer. Teams will swap puzzles and attempt to solve each other's builds. This fosters computational thinking, creativity, and mechanical design.

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Learning Extensions

STEAM Connections: Engineering - Technology

Learning Objectives:

- Understand and apply advanced mechanical circuit concepts, including logic gates, timers, and multi-branch systems.
- Analyze the impact of power input on circuit behavior using the Spintronics Power Pack.
- Strengthen problem-solving and systems thinking through hands-on circuit design and troubleshooting.
- Use mechanical logic to simulate basic computing processes and decision-making systems.

Career Connections:

- **Electrical & Mechanical Engineer –** Applies knowledge of circuits, torque, resistance, and system design to real-world machines and infrastructure.
- **Computer Hardware Designer –** Builds and tests logic systems foundational to computing hardware.
- **Robotics Engineer –** Combines mechanics and logic to create functional machines with purposeful behavior.
- **Product Prototyper –** Designs and iterates physical systems to solve challenges in early-stage product development.

Essential Employability Skills:

- Critical Thinking
- Problem-Solving
- Collaboration
- Adaptability
- Attention to Detail

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Resources and Accessibility

Safety Guidelines

- **Use Components as Intended** – Avoid forcing parts together; ensure students understand how to properly attach and remove components to prevent damage or injury.
- **Secure Work Area** – Work on flat, stable surfaces to prevent components from shifting or falling during operation.
- **Wind Power Packs Carefully** – Remind students not to overwind the spring motors in the Power Pack to avoid mechanical strain.
- **Store Parts Safely** – Keep small components organized in bins to prevent choking hazards or accidental loss.

Accessibility

- **Provide Adapted Tools** – Offer rubber grips or larger knobs to assist students with limited hand strength or dexterity.
- **Use Visual Instructions** – Include large-print diagrams or visual guides to support students with learning or visual disabilities.
- **Adjust Table Height** – Ensure workspace tables are accessible to students who use wheelchairs or other mobility devices.
- **Flexible Participation Roles** – Allow students to take on different roles (planner, builder, tester, recorder) based on comfort and ability.

Library Catalog

Library Resources

Feedback

QR to feedback survey