Marble Genius Super Set

Mid-Valley
STEM-CTE HUB

www.midvalleystem.org
midvalleystemctehub@linnbenton.edu
Linn-Benton Community College
Albany Campus - CC-212

Mid-Valley
STEM-CTE HUB

Marble Genius Super Set

The Marble Genius Super Set challenges students to explore engineering, physics, and problem-solving through the design and construction of marble runs. Using a variety of track pieces, connectors, and marbles, students investigate concepts such as gravity, force, motion, energy transfer, and cause-and-effect while designing, testing, and improving their creations. Designed for collaborative learning, this kit encourages creativity, perseverance, and the engineering design process as students build increasingly complex marble runs and evaluate how design choices affect performance.

Grade Level

2nd - 8th

Group Size

Up to 10 students

Time Duration

15 - 60 minutes per activity

Content of Kits

Components

- 3 Marble Genius Super sets
- Graph Paper

Mid-Valley
STEM-CTE HUB

Usage

Getting Started

1. **Inventory and Sort the Pieces**
Begin by unpacking the three Marble Genius sets and organizing the pieces by type, such as bases, columns, tracks, connectors, and special elements. Sorting components before building makes it easier for student teams to locate materials and collaborate effectively.

2. **Explore How the Pieces Connect**
Allow students time to examine the different track pieces and practice connecting them securely. Encourage them to experiment with simple designs to understand how height, support, and track alignment affect the movement of the marbles.

3. **Build a Simple Marble Run**
Start with a basic marble run before attempting more complex designs. Test the run several times and encourage students to identify any areas where the marble slows down, stops, or leaves the track.

4. **Introduce the Engineering Design Process**
Challenge students to plan, build, test, and improve their marble runs. Encourage teams to record observations, identify problems, and make design modifications based on the results of each test, reinforcing that iteration is an important part of engineering.

Storage

- **Sort and Store Components by Type**

Keeping similar pieces together makes inventory and future setup quicker and easier.

- **Check for Missing Pieces Before Packing**

Before returning the kit, count the marbles and verify that all components have been collected from the classroom or activity area. Storing a complete kit ensures it is ready for the next group of learners.

Troubleshooting

- **Marbles Stop or Fall Off the Track**

If marbles slow down, stop, or leave the track, check that all connections are secure and the track sections are aligned properly. Increasing the starting height or smoothing uneven transitions can help maintain momentum.

- **The Structure Is Unstable**

If the marble run wobbles or collapses, add additional support columns or widen the base of the structure. Building in sections and testing frequently can help identify weak points before continuing construction.

Mid-Valley
STEM-CTE HUB

Activity Guide

Beginner

Marble Motion Challenge
Students build a simple marble run and investigate how height affects the speed and distance a marble travels. Students make predictions, test their designs, and record observations.

Oregon Science Standards Alignment
3-PS2-1 & MS-PS2-2

Procedure
1. Working in teams, build a simple marble run with one starting point.
2. Predict what will happen when the starting height is changed.
3. Test the marble from different heights.
4. Record observations about the marble's speed and how smoothly it travels.
5. Discuss how gravity influences the marble's motion.

Intermediate

Engineering Design Challenge
Student teams design and build a marble run that meets a specific engineering challenge, such as the longest run, the slowest marble, or the greatest number of turns. Teams test, evaluate, and redesign their structures using the engineering design process.

Oregon Science Standards Alignment
3-5-ETS1-1, 3-5-ETS1-2, & MS-ETS1-2

Procedure
1. Assign each team an engineering challenge.
2. Plan the design before building.
3. Construct and test the marble run.
4. Identify any problems and redesign as needed.
5. Present the final design and explain how it meets the challenge.

Advanced

Collect, Graph, and Improve
Students investigate how different design features affect marble run performance. Teams collect quantitative data, create graphs, and use the results to improve their designs.

Oregon Science Standards Alignment
MS-ETS1-3 & Science and Engineering Practice

Procedure
1. Build several marble runs with different features (height, turns, or track length).
2. Measure the time required for the marble to complete each run.
3. Record results and repeat multiple trials.
4. Create a graph comparing the performance of each design.
5. Use the data to redesign the marble run for improved performance.

Mid-Valley
STEM-CTE HUB

Learning Extensions

STEAM Connections: Engineering - Math - Science

Learning Objectives:

- Investigate how gravity, force, motion, and energy affect the movement of objects.
- Apply the engineering design process to plan, build, test, and improve marble run designs.
- Collect, record, and analyze data to evaluate the performance of different designs.
- Use measurement and mathematical reasoning to compare heights, distances, angles, and travel times.
- Identify how changes to a design influence the speed, direction, and success of a marble run.
- Collaborate to solve engineering challenges through creativity, experimentation, and evidence-based decision-making.

Career Connections:

- **Mechanical Engineer –** Designs machines and systems that use motion and force.
- **Civil Engineer –** Plans and builds safe, efficient structures and transportation systems.
- **Structural Engineer –** Designs structures that are stable and can withstand forces.
- **Product Designer –** Creates and tests products to improve function and user experience.
- **Architect –** Designs buildings and structures using principles of engineering and mathematics.
- **Physics Teacher or Research Scientist –** Studies and teaches the principles of motion, energy, and forces.
- **Construction Manager –** Oversees building projects and coordinates teams to complete complex designs.

Essential Employability Skills:

- Critical Thinking
- Problem Solving
- Collaboration
- Communication
- Creativity and Innovation
- Observation and Attention to Detail

Mid-Valley
STEM-CTE HUB

Resources and Accessibility

Safety Guidelines

- **Build on a Stable Surface**

Construct marble runs on a flat, stable surface and keep the surrounding area clear of backpacks, chairs, and other obstacles. This helps prevent structures from tipping over and reduces tripping hazards during testing.

- **Handle Small Pieces Responsibly**

Marbles and small construction pieces can present a choking hazard for young children and may roll across the floor if dropped. Encourage students to keep pieces contained within their work area and collect all components before moving to another activity.

Accessibility

- **Provide Multiple Ways to Participate**

Students can contribute by planning designs, assembling structures, testing marble runs, measuring distances, recording data, or presenting results. Offering a variety of roles allows all learners to participate based on their strengths and abilities.

- **Support Learning with Visual and Hands-On Strategies**

Use diagrams, example marble runs, verbal instructions, and hands-on demonstrations to introduce engineering concepts. Encourage students to sketch designs, discuss ideas with teammates, and learn through iterative testing to support a variety of learning styles.

Library Catalog

Library Resources

Feedback

QR to feedback survey