PENDULUM PAINTING

ELEMENTARY SCHOOL LEVEL 3

The first scientific experiments on pendulums were conducted around 1602 A.D. by famous scientist Galileo Galilei. Until the 1900s, the pendulum was known as the world's most reliable timekeeping technology. A pendulum is an object suspended from a point that can swing freely using the force of gravity. By creating a pendulum with a plastic cup, we can make gravitational art! This is a fun way for students to study gravity while getting a bit messy in the process, and what kid doesn't love that?

EDUCATIONAL STANDARDS:

NGSS CONNECTION:
3-PS2-2. Make observations and/or measurements of an object's motion to provide evidence that a pattern can be used to predict future motion.
4-PS3-4. Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.*

COMMON CORE CONNECTION:
ELA/Literacy

W.3.7 Conduct short research projects that build knowledge about a topic.

W.3.8 Recall information from experiences or gather information from print and digital sources; take brief notes on sources and sort evidence into provided categories

SL.4.5 Add audio recordings and visual displays to presentations when appropriate to enhance the development of main ideas or themes.

W.4.7 Conduct short research projects that build knowledge through investigation of different aspects of a topic.

W.4.8 Recall relevant information from experiences or gather relevant information from print and digital sources; take notes and categorize information, and provide a list of sources.

4.OA.A.3 Solve multistep word problems posed with whole numbers and having whole-number answers using the four operations, including problems in which remainders must be interpreted. Represent these problems using equations with a letter standing for the unknown quantity. Assess the reasonableness of answers using mental computation and estimation strategies including rounding.

Mathematics

MP.4 Model with mathematics.

4.G.A.1 Draw points, lines, line segments, rays, angles (right, acute, obtuse), and perpendicular and parallel lines. Identify these in two-dimensional figures.

DOK:
Level 2: Concept
Level 3: Strategic Thinking

MATERIALS NEEDED:

- ❑ Plastic cup or container
- ❑ String
- ❑ Pencil
- ❑ Tape
- ❑ 2 chairs
- ❑ Wooden dowels

DIRECTIONS:

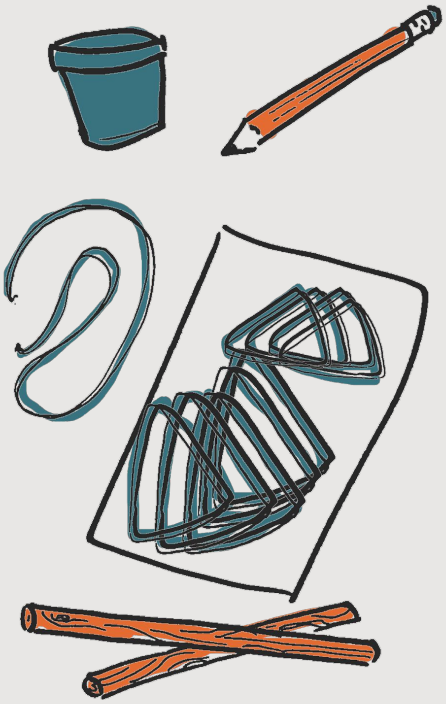
1. Poke a hole in the bottom of your plastic container.
2. Place the dowel across the back of two chairs so it is suspended in air. The chairs should be about 3-4 feet apart, back to back.
3. Hot-glue the string to the top of your plastic container.
4. Tie the string on the dowel to suspend the plastic container a foot above the ground.
5. Cover the hole on the bottom of the container with tape.
6. Fill the cup with water for a test run. Pull off the tape and give it a swing. You should see circular patterns forming on the ground beneath the pendulum.
7. Empty the cup, cover the hole with tape, and fill it with paint.
8. Remove the tape and give the pendulum a swing, observe the patterns that are created on the ground as gravity pulls the pendulum in circular geometric shapes.

OBJECTIVE:

Student wills be able to predict future motion based on patterns from observations.

ESSENTIAL QUESTIONS:

- How might we predict an object's motion?
- What factors affect the motion of an object?



ENGAGE / EXPLORE:

1. Students are given materials to make pendulum art
    a. This can be done in groups, pairs, or individually
2. Ask students to design and conduct a simple test to determine the various motions of the pendulum
    a. Students record observations of patterns of paint as they release the pendulum in different methods
        i. Straight lines
        ii. With curved swing
        iii. Push vs. no push
        iv. Various heights
    b. Students can make use of qualitative and quantitative observations
        i. Time
        ii. Velocity
        iii. Traveled path
3. Evaluate
    a. Identifying task and purpose
    b. Explanation of data they will collect
    c. Planned investigation
    d. Data collection and process

EXPLAIN:

1. Students share what they observed
    a. Identify predictable motion
2. Teacher may choose to do instruction if needed to work with the motion of the pendulum
    a. Identify misconceptions
    b. Clarify observations

ELABORATE:

1. Students use their knowledge of pendulum motion to produce authentic art pieces
    a. Students design their own art
    b. Explain their techniques used
        i. Throws of pendulum for predictable effects.
    c. Students display their art in a class/school art gallery
2. Evaluate
    a. Teachers and students observe and “tastefully critique” students’ techniques
        i. Identify by patterns by what throws they used
        ii. Admire the dazzling arrays of color choices