| Lesson Plan | | |
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| **Title**: Angular Velocity  **Name:** Trek | | **Grades**: 8th, 9th |
| **Overview of Lesson**:   1. Students will examine racing mechanics, describe observations in their effective arcs based on distance from radius, and make predictions about speed based on distance from center of a circle. 2. Students will design an investigation to test their ideas of the radius speed relationship 3. Students will present their findings and revise ideas 4. Students will then examine different river formations, describe observations of their shape, and make predictions about how these formations erode when interacted with by water. | | **Time**: 5 Class Periods |
| **Overview of Content**:  Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes. [Clarification Statement: Emphasis is on mechanical and chemical investigations with water and a variety of solid materials to provide the evidence for connections between the hydrologic cycle and system interactions commonly known as the rock cycle. Examples of mechanical investigations include stream transportation and deposition using a stream table, erosion using variations in soil moisture content, or frost wedging by the expansion of water as it freezes. Examples of chemical investigations include chemical weathering and recrystallization (by testing the solubility of different materials) or melt generation (by examining how water lowers the melting temperature of most solids).] | | **Standards**: HS-ESS2-5 |
| **Key Topics**:  Erosion  Stream Transportation  Deposition  Radius  Arc length  Angular speed | **Misconceptions**:  Rocks do not change  Weathering and erosion are the same thing  Erosion happens quickly  Erosion is bad!  Speed is the only thing that matters when (traveling in a circle)  Objects in lockstep on a circle travel at the same speed, irregardless of distance to center. | **Materials**:  MarioKart Demo (in folder)  [Teachback front](https://drive.google.com/file/d/15Jq-HW72en5XmuVXymJOJG3ruqVbQM40/view?usp=sharing)  [Teachback back](https://docs.google.com/document/d/1e-nc8wEsqh01R2SvOaLpn65csctISFrzUQZIjhq3GZo/edit?usp=sharing)  [Erosion Vocab](https://drive.google.com/file/d/15mBRUBVykLDi7sjwA6ZJ_RhbZye-Oml5/view?usp=sharing)  Ring or torus shaped flow pool  Colored dyes (pink, green, purple, blue, yellow, orange)  Colored Ping Pong balls (pink, green, purple, blue)  [Rubric (WDYS)](https://docs.google.com/document/d/1Dh6F6PMJxLoAJLEerJOgL11phL3CWNOAB3MljE8M3dw/edit?usp=sharing)  [Rubric (Lab)](https://docs.google.com/document/d/1kXDXA8pWfyd2OLcxinMVoA893bkK2jPxPl1-m4dOPak/edit?usp=sharing)  [Rubric (Teachback)](https://docs.google.com/document/d/1_vj-4A0yV6LcriXaJUqdOr74Z-HW56Js9AzNQDxjCm8/edit?usp=sharing) |
| **Learning Goals and Objectives**:  Observable features of the student performance by the end of the lesson:   1. Identifying the phenomenon to be investigated    1. Students describe\* the phenomenon under investigation, which includes the following idea: connection between the properties of water and its effects on Earth materials and surface processes. 2. Planning for the Investigation    1. In their investigation plan, students include a means to indicate or measure the predicted effect of water on Earth’s materials or surface processes.    2. In the plan, students state whether the investigation will be conducted individually or collaboratively. 3. Collecting the data    1. Students collect and record measurements or indications of the predicted effect of a property of water on Earth’s materials or surface. 4. Refining the design    1. Students evaluate the accuracy and precision of the collected data.    2. Students evaluate whether the data can be used to infer the effect of water on processes in the natural world.    3. If necessary, students refine the plan to produce more accurate and precise data. | | |
| Body of Lesson | | |
| **Main Activity (Day 1)**  (5) Do Now - Poll - Which character is best character?   * Mario * Luigi * Toad * Yoshi * Peach * Donkey Kong * Wario * Bowser   (15) Activity   * Play through MarioKart Demo. Open Bizhawk, load “What Do You See.lua” and the MarioKart Rom. Go to character select then push up on the dpad. Select the poll winning character’s appropriate recording. Let the recording play out while miming real play. Discuss how you are staying in the left lane or right lane Afterwards, on the victory screen, give students a WDYS worksheet and turn on the prompt (push left on the dpad)   + Matching colors, students should describe the race using natural language (language baseline diagnostic)   (5) Group discussion - Vocabulary Collection   * Which words did we choose to use to describe the race? Shape? Speed? Put words on board (Inline Diagnostic). Are racers traveling at different speeds? * If two racers travel at different distances from the center of a circle, does one need to go faster to match its opponent? * Which one must go faster?   (21) Investigation design   * Hand out rubric and lab template * Students have rest of class to design an investigation using classroom materials as per rubric * Procedure   + Materials   + Procedure   + Data Collection   (2) Minutes - Exit Ticket   * What was difficult to describe about the race? * Collect WDYS1   **Main Activity (Day 2)**  (3) Do Now - Do you need any teacher support for your investigation?  (5) Opening Announcements/SEL hook  (37) Carrying out investigation/table support  \*(3)Exit Ticket - What went poorly and how can we avoid that challenge next time?  (students submit lab template - assessment #1, rubric)  **Main Activity (Day 3)**  Do Now  (10) Vocabulary Intro   * Give each student a vocabulary sheet. Discuss vocabulary with students pointing to specific phenomena examples. Play kahoot with examples of permeable, porous, and high capillarity materials ([kahoot link](https://create.kahoot.it/share/ppc/9e06e44a-c6f1-47d7-9f77-bd6cae89423c))   (10) Activity   * Set up a station with water flowing in a circle with four colored ping pong balls (pink, green, purple, blue). The station should be yellow themed. The water should be dyed orange. * Give each student a WDYS2 and a vocabulary sheet. * Have students fill out the WDYS2, analyzing the ‘race’ and comparing them in groups   (WDYS2 v WDYS1 - assessment #2, rubric)  (21) Investigation   * Hand out rubric and lab template * Students have rest of class to design **and carry out** an investigation using classroom materials as per rubric   + Materials   + Data Collection   (2) Minutes - Exit Ticket   * How was the river different than the race? Why? * Collect WDYS2 and lab template   (Lab Template 2 - Assessment #4)  **Main Activity (Day 4-5)**  (5) Do Now  Students collect Teachback fliers and rubrics and discuss and choose a type in their groups  (5) Announcements/SEL  (80) Main Activity - Teachback ([front](https://drive.google.com/file/d/15GPJvikIwJdbTSBiIyjJv_n2Quf2h0Qr/view?usp=sharing) - [back](https://docs.google.com/document/d/1cZn5oFtSkUjLobrAtWzRrQeGG7LOg2-J3p4o37E3xqU/edit?usp=sharing))   * Groups work together to produce an artifact discussing and teaching the topic   (Teachback artifact is due Sunday night - assessment #3) | | |
| **Summary of lesson and tie up (~15)**:  Groups may volunteer to share their Teachback | | |