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| **Lesson Title : Gravity, Mass and Speed** | **Unit #:1** | **Lesson #:2** | **Activity #:3** |
| **Activity Title: Ramps** |

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| **Estimated Lesson Duration:** | **12 Days** |
| **Estimated Activity Duration:** | **1 day** |

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| **Setting:** | **After lesson on gravity, mass and speed. Classroom** |

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| **Activity Objectives:**  |

**I can explain gravity’s effect on objects.**

**I can describe mass.**

**I can calculate the speed of an object.**

**I can describe a change in motion, speed up or slowing down**

**I can describe the force needed to move object.**

**I can predict the movement of an object based on the force applied and the object’s mass.**

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| **Activity Guiding Questions:** |

1. **Why do all objects fall to the ground?** **Do heavier objects fall faster?**
2. **Does mass have to do with size? Do bigger objects have more mass? Do objects that take up more space have more mass? How do you measure mass?**
3. **How does a speedometer work? How does a radar gun work?**
4. **When a car slows down how do you calculate speed? When a car speeds up how do you calculate speed? What is a car slows down and speeds up when you are calculating speed?**
5. **How much more force is needed to move heavy objects? What if you used more the same force on a lighter object? Can force be applied to move all objects- like buildings?**
6. **How can you measure how speed and mass affect the force of an object?**

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| **Next Generation Science Standards (NGSS)**  |
| **Science and Engineering Practices (Check all that apply)**  | **Crosscutting Concepts (Check all that apply)** |
| ☐ Asking questions (for science) and defining problems (for engineering) | ☐ Patterns |
| X Developing and using models | X Cause and effect |
| ☐ Planning and carrying out investigations | ☐ Scale, proportion, and quantity |
| ☐ Analyzing and interpreting data | ☐ Systems and system models |
| ☐ Using mathematics and computational thinking | ☐ Energy and matter: Flows, cycles, and conservation |
| ☐ Constructing explanations (for science) and designing solutions (for engineering) | ☐ Structure and function.  |
| ☐ Engaging in argument from evidence | ☐ Stability and change.  |
| ☐ Obtaining, evaluating, and communicating information  |  |

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| **Ohio’s New Learning Standards for Science (ONLS)** |
| **Expectations for Learning - Cognitive Demands (Check all that apply)** |
| ☐ Designing Technological/Engineering Solutions Using Science concepts **(T)** |
| X Demonstrating Science Knowledge **(D)** |
| ☐ Interpreting and Communicating Science Concepts **(C)** |
| ☐ Recalling Accurate Science **(R)** |

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| **Common Core State Standards -- Mathematics (CCSS)** |
| **Standards for Mathematical Practice (Check all that apply)** |
| ☐ Make sense of problems and persevere in solving them | ☐ Useappropriate tools strategically |
| ☐ Reason abstractly and quantitatively | ☐ Attendto precision |
| ☐ Construct viable arguments and critique the reasoning of others | ☐ Look for and make use of structure |
| ☐ Model with mathematics | ☐ Look for and express regularity in repeated reasoning |

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| **Unit Academic Standards (NGSS, ONLS and/or CCSS):** |

**OHIO 5 PS 4 The amount of change in movement of an object is based on the mass of the object and the amount of force related.**

**NGSS 3-5 PS2 A Force and Motion**

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| **Materials**:  |

Worksheet for lab

 <https://docs.google.com/viewer?a=v&pid=sites&srcid=c2FzZWFzLm9yZ3xtZWxpc3NhLWEtZG9sbC0yMDE1fGd4OjI1ZGNhYjQxOTVlNTE2Mjc>

3 2 X 4 blocks for each group

1 ramp for each group (cut molding to 12 inch pieces)

1 small ball bearing each group

1 medium ball bearing each group

1 large ball bearing each group

1 ruler each group

1 block each group

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| **Teacher Advance Preparation:**  |

1. Place in bins for each team of students – 3 different mass ball bearings, 3 wood blocks, one ramp, ruler and worksheet
2. Students will work at their tables as a group
3. Demonstrate the set up after passing out the lab worksheet
4. To measure speed the students need to create the steepest incline- all three blocks under the ramp. Using a stop watch time as a class the difference between the different inclines to show the fastest set up.
5. To measure mass weight using a scale in grams each ball bearing.
6. Collect the lab worksheet

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| **Activity Procedures:**  |

Pass out the worksheet and demonstrate the set up for each scenario and complete class demonstration of speed and mass.

Directions for set up –

1. Stack two wood 2 by 4 blocks on top of each other

2. Lean the ramp- piece of wood modeling on the stacked two by fours

3. Place a ruler at the end of the ramp to measure distance

4. Place a wood toy block at end of ramp

5. Roll ball bearing down the ramp

6. Measure the distance the block moves

7. Record in the chart (worksheet for lesson)

Demonstrate incline needed for fastest speed as a class

 Weigh the ball bearings as a class

Student will work in groups of 4 at their tables.

**Formative Assessments:** Link the items in the Activities that will be used as formative assessments.

**Collect the worksheet and take a grade on the follow up questions.**

**When you increased the speed of the marble how far did the block move compared to slower speeds?**

**•When you increased the mass of the marble how far did the block move compared to lower masses?**

**Summative Assessments:** These are optional; there may be summative assessments at the end of a set of Activities or only at the end of the entire Unit.

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| **Differentiation:** Describe how you modified parts of the Lesson to support the needs of different learners.Refer to Activity Template for details. |

Students were supported by working in groups, peer support.

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| **Reflection:** Reflect upon the successes and shortcomings of the lesson. |

The student were able to correctly state that more mass more force. The ball baring weights were drasticallly different from each other so the difference in movement of the block was significant.

The students were able to correctly state the more speed the more force. The students created a steep incline difference for each level so that the speed difference was evident.

The lab lead the students being able to apply what they learned to football. The offensive line compared to running backs. The athletic students found the information very interesting as they looked at their size and speed and what positions they played.