**Middle School STEM Science Lab/Activity Planner**

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| Name of Lab/Activity: Average Speed graphing and Interpolation of data | | | Grade: 8 |
| California Science Standard(s): (please copy and paste standards taught during this lesson)  **Motion**  1. The velocity of an object is the rate of change of its position. As a basis for understanding this concept:  b. Students know that average speed is the total distance traveled divided by the total time elapsed and that the speed of an object along the path traveled can vary.  c. Students know how to solve problems involving distance, time, and average speed.  f. Students know how to interpret graphs of position versus time and graphs of speed versus time for motion in a single direction. | | | |
| Learning Objective/Goal: Students will be able to collect and graph data on average speed, use their data to extrapolate how an increase in distance would affect average speed. Students will develop an experiment to test their hypothesis on the average speed of the marble for one meter. | | | |
| Strand:  [Strand:LA.6-8.WHST Writing](http://www.curriki.org/ab/en/alignments/view/Coll_mrsenright.MiddleSchoolPhysicalScienceLab-Energy/cc/cc-common-core-state-standards/486/4185)  [LA.6-8. Text Types and Purposes](http://www.curriki.org/ab/en/alignments/view/Coll_mrsenright.MiddleSchoolPhysicalScienceLab-Energy/cc/cc-common-core-state-standards/486/4185)  Anchor Standard:  [Anchor Standard:LA.6-8.W.CCR.1 Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.](http://www.curriki.org/ab/en/alignments/view/Coll_mrsenright.MiddleSchoolPhysicalScienceLab-Energy/cc/cc-common-core-state-standards/486/4185)  Grade Level Standard:  [Grade Level Standard:LA.6-8.WHST.6-8.1 Write arguments focused on discipline-specific content.](http://www.curriki.org/ab/en/alignments/view/Coll_mrsenright.MiddleSchoolPhysicalScienceLab-Energy/cc/cc-common-core-state-standards/486/4185)  [LA.6-8.WHST.6-8.1.a Introduce claim(s) about a topic or issue, acknowledge and distinguish the claim(s) from alternate or opposing claims, and organize the reasons and evidence logically.](http://www.curriki.org/ab/en/alignments/view/Coll_mrsenright.MiddleSchoolPhysicalScienceLab-Energy/cc/cc-common-core-state-standards/486/4185)  [LA.6-8.WHST.6-8.1.b Support claim(s) with logical reasoning and relevant, accurate data and evidence that demonstrate an understanding of the topic or text, using credible sources.](http://www.curriki.org/ab/en/alignments/view/Coll_mrsenright.MiddleSchoolPhysicalScienceLab-Energy/cc/cc-common-core-state-standards/486/4185)  [LA.6-8.WHST.6-8.1.c Use words, phrases, and clauses to create cohesion and clarify the relationships among claim(s), counterclaims, reasons, and evidence.](http://www.curriki.org/ab/en/alignments/view/Coll_mrsenright.MiddleSchoolPhysicalScienceLab-Energy/cc/cc-common-core-state-standards/486/4185)  [LA.6-8.WHST.6-8.1.d Establish and maintain a formal style.](http://www.curriki.org/ab/en/alignments/view/Coll_mrsenright.MiddleSchoolPhysicalScienceLab-Energy/cc/cc-common-core-state-standards/486/4185)  [LA.6-8.WHST.6-8.1.e Provide a concluding statement or section that follows from and supports the argument presented.](http://www.curriki.org/ab/en/alignments/view/Coll_mrsenright.MiddleSchoolPhysicalScienceLab-Energy/cc/cc-common-core-state-standards/486/4185)  [Anchor Standard:LA.6-8.W.CCR.2 Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content.](http://www.curriki.org/ab/en/alignments/view/Coll_mrsenright.MiddleSchoolPhysicalScienceLab-Energy/cc/cc-common-core-state-standards/486/4185)  Grade Level Standard: [Grade Level Standard:LA.6-8.WHST.6-8.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.](http://www.curriki.org/ab/en/alignments/view/Coll_mrsenright.MiddleSchoolPhysicalScienceLab-Energy/cc/cc-common-core-state-standards/486/4185)  [LA.6-8.WHST.6-8.2.a Introduce a topic clearly, previewing what is to follow; organize ideas, concepts, and information into broader categories as appropriate to achieving purpose; include formatting (e.g., headings), graphics (e.g., charts, tables), and multimedia when useful to aiding comprehension.](http://www.curriki.org/ab/en/alignments/view/Coll_mrsenright.MiddleSchoolPhysicalScienceLab-Energy/cc/cc-common-core-state-standards/486/4185)  [LA.6-8.WHST.6-8.2.b Develop the topic with relevant, well-chosen facts, definitions, concrete details, quotations, or other information and examples.](http://www.curriki.org/ab/en/alignments/view/Coll_mrsenright.MiddleSchoolPhysicalScienceLab-Energy/cc/cc-common-core-state-standards/486/4185)  [LA.6-8.WHST.6-8.2.c Use appropriate and varied transitions to create cohesion and clarify the relationships among ideas and concepts.](http://www.curriki.org/ab/en/alignments/view/Coll_mrsenright.MiddleSchoolPhysicalScienceLab-Energy/cc/cc-common-core-state-standards/486/4185)  [LA.6-8.WHST.6-8.2.d Use precise language and domain-specific vocabulary to inform about or explain the topic.](http://www.curriki.org/ab/en/alignments/view/Coll_mrsenright.MiddleSchoolPhysicalScienceLab-Energy/cc/cc-common-core-state-standards/486/4185)  [LA.6-8.WHST.6-8.2.e Establish and maintain a formal style and objective tone.](http://www.curriki.org/ab/en/alignments/view/Coll_mrsenright.MiddleSchoolPhysicalScienceLab-Energy/cc/cc-common-core-state-standards/486/4185)  [LA.6-8.WHST.6-8.2.f Provide a concluding statement or section that follows from and supports the information or explanation presented.](http://www.curriki.org/ab/en/alignments/view/Coll_mrsenright.MiddleSchoolPhysicalScienceLab-Energy/cc/cc-common-core-state-standards/486/4185)  [Anchor Standard:LA.6-8.W.CCR.3 Write narratives to develop real or imagined experiences or events using effective technique, well-chosen details, and well-structured event sequences.](http://www.curriki.org/ab/en/alignments/view/Coll_mrsenright.MiddleSchoolPhysicalScienceLab-Energy/cc/cc-common-core-state-standards/486/4185)  Grade Level Standard: [Grade Level Standard:LA.6-8.WHST.6-8.3 (See note; not applicable as a separate requirement)](http://www.curriki.org/ab/en/alignments/view/Coll_mrsenright.MiddleSchoolPhysicalScienceLab-Energy/cc/cc-common-core-state-standards/486/4185)  [LA.6-8. Production and Distribution of Writing](http://www.curriki.org/ab/en/alignments/view/Coll_mrsenright.MiddleSchoolPhysicalScienceLab-Energy/cc/cc-common-core-state-standards/486/4185)  Anchor Standard: [Anchor Standard:LA.6-8.W.CCR.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.](http://www.curriki.org/ab/en/alignments/view/Coll_mrsenright.MiddleSchoolPhysicalScienceLab-Energy/cc/cc-common-core-state-standards/486/4185)  Grade Level Standard: [Grade Level Standard:LA.6-8.WHST.6-8.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.](http://www.curriki.org/ab/en/alignments/view/Coll_mrsenright.MiddleSchoolPhysicalScienceLab-Energy/cc/cc-common-core-state-standards/486/4185)  Anchor Standard: [Anchor Standard:LA.6-8.W.CCR.5 Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach.](http://www.curriki.org/ab/en/alignments/view/Coll_mrsenright.MiddleSchoolPhysicalScienceLab-Energy/cc/cc-common-core-state-standards/486/4185)  Grade Level Standard: [Grade Level Standard:LA.6-8.WHST.6-8.5 With some guidance and support from peers and adults, develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on how well purpose and audience have been addressed.](http://www.curriki.org/ab/en/alignments/view/Coll_mrsenright.MiddleSchoolPhysicalScienceLab-Energy/cc/cc-common-core-state-standards/486/4185)  Anchor Standard: [Anchor Standard:LA.6-8.W.CCR.6 Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.](http://www.curriki.org/ab/en/alignments/view/Coll_mrsenright.MiddleSchoolPhysicalScienceLab-Energy/cc/cc-common-core-state-standards/486/4185)  Grade Level Standard: [Grade Level Standard:LA.6-8.WHST.6-8.6 Use technology, including the Internet, to produce and publish writing and present the relationships between information and ideas clearly and efficiently.](http://www.curriki.org/ab/en/alignments/view/Coll_mrsenright.MiddleSchoolPhysicalScienceLab-Energy/cc/cc-common-core-state-standards/486/4185)  [LA.6-8. Research to Build and Present Knowledge](http://www.curriki.org/ab/en/alignments/view/Coll_mrsenright.MiddleSchoolPhysicalScienceLab-Energy/cc/cc-common-core-state-standards/486/4185)  Anchor Standard: [Anchor Standard:LA.6-8.W.CCR.7 Conduct short as well as more sustained research projects based on focused questions, demonstrating understanding of the subject under investigation.](http://www.curriki.org/ab/en/alignments/view/Coll_mrsenright.MiddleSchoolPhysicalScienceLab-Energy/cc/cc-common-core-state-standards/486/4185)  Grade Level Standard: [Grade Level Standard:LA.6-8.WHST.6-8.7 Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration.](http://www.curriki.org/ab/en/alignments/view/Coll_mrsenright.MiddleSchoolPhysicalScienceLab-Energy/cc/cc-common-core-state-standards/486/4185)  Anchor Standard: [Anchor Standard:LA.6-8.W.CCR.8 Gather relevant information from multiple print and digital sources, assess the credibility and accuracy of each source, and integrate the information while avoiding plagiarism.](http://www.curriki.org/ab/en/alignments/view/Coll_mrsenright.MiddleSchoolPhysicalScienceLab-Energy/cc/cc-common-core-state-standards/486/4185)  Grade Level Standard:  [Grade Level Standard:LA.6-8.WHST.6-8.8 Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.](http://www.curriki.org/ab/en/alignments/view/Coll_mrsenright.MiddleSchoolPhysicalScienceLab-Energy/cc/cc-common-core-state-standards/486/4185)  Anchor Standard: [Anchor Standard:LA.6-8.W.CCR.9 Draw evidence from literary or informational texts to support analysis, reflection, and research.](http://www.curriki.org/ab/en/alignments/view/Coll_mrsenright.MiddleSchoolPhysicalScienceLab-Energy/cc/cc-common-core-state-standards/486/4185)  Grade Level Standard:  [Grade Level Standard:LA.6-8.WHST.6-8.9 Draw evidence from informational texts to support analysis, reflection, and research.](http://www.curriki.org/ab/en/alignments/view/Coll_mrsenright.MiddleSchoolPhysicalScienceLab-Energy/cc/cc-common-core-state-standards/486/4185)  [LA.6-8. Range of Writing](http://www.curriki.org/ab/en/alignments/view/Coll_mrsenright.MiddleSchoolPhysicalScienceLab-Energy/cc/cc-common-core-state-standards/486/4185)  Anchor Standard: [Anchor Standard:LA.6-8.W.CCR.10 Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of tasks, purposes, and audiences.](http://www.curriki.org/ab/en/alignments/view/Coll_mrsenright.MiddleSchoolPhysicalScienceLab-Energy/cc/cc-common-core-state-standards/486/4185)  Grade Level Standard: Grade Level Standard:LA.6-8.WHST.6-8.10 Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences. Materials & Resources: Meter sticks, marbles, stop watches, masking tape, books.  Open inquiry options – protractors, steely ball, other types of balls | | | |
| Procedure: See attached lab for part I.  Students will create their own version of part II to test for  average speed of a marble on a one meter ramp. | | Teaching Notes: (include timing)  2-3 days  Part 1 = day one  Part II = days 2 and 3 | |
| Math Connection: Graphing, average speed formula, interpolate, extrapolate. | | Teaching Notes: Be sure to include information on how to graph properly. | |
| Technology Extension of Learning:  **Rad chair – you tube video**  Glencoe lab video  PhET simulation on skate boards  http://phet.colorado.edu/en/simulation/energy-skate-park-basics | | Teaching Notes: Use video to engage students. If not available shoot a rubber band gun at two different targets or use a matchbox car and demo it going 2 distances… | |
| Formative Assessment: (please attach a copy)  Go Cart Test Run- formative Assessment | | Teaching Notes: Use the Keeley formative assessment as a pre and post assessment. You can wait until the end of the motion and forces unit to give the assessment again. The lab write-up should give you some immediate assessment of graphing skills and ability to read a graph. | |
| Strategies for EL and Special Needs Students:   1. Use an engage activity showing motion with a video or roll a car or shoot a rubber band at two targets. 2. Students should be grouped heterogeneously in groups of 4. 3. Use a word wall with diagrams to support the vocabulary. 4. This lab leads to NEW words such as friction, momentum and acceleration. 5. Give the students sentence frames for their analysis and conclusion. Also for group discussions on evidence and claim. | | Vocabulary:  Speed, average speed, extrapolate, interpolate, graph,  best fit line, distance, time, slope  *Students will begin to see acceleration, momentum and friction…*  *Make sentence frames for group discussions on evidence and claim.* | |
| Alignment in science unit: (Brief description of lessons taught **prior to & after** this lab/activity)  This lab falls in the middle of the unit on motion and forces. After reference point and most of motion, but prior to acceleration. The concept of acceleration and momentum naturally follow as the next lab. Newton’s laws should be taught prior to this lab and the Newtonian demonstrator is great to use. | | | |
| Brief description of lessons taught **after** this lab/activity: This lab leads to a lab on acceleration and then some data collection on friction. | | | |
| Lab/Activity adapted from: (website, textbook, etc.)  My own lab using a 1.5 meter ramp and multiple balls to find average speed. | Formative Assessment adapted from:  Uncovering Students Ideas in Physical Science – 45 NEW Force and Motion Assessment Probes by Page Keeley and Rand Harrington  (# 5- page 31- Go-Cart Test Run) | | |
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| This lesson was developed by: | | | |
| Teacher’s Name | Currently Teaching at: (School & District) | | |
| Carol Hagen | Sheppard Middle School ARUSD | | |
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