



# Physics - Unit 1 - Kinematics

## Unit Focus

Students will explore one dimensional motion. Beginning with evaluating the nuances of distance vs displacement and velocity vs speed, students will learn about scalars versus vectors and how they affect signs and acceleration. With this new understanding of vectors and scalars, students will embark on problem solving techniques, experiments, and graphical analysis of motion. As a part of this unit, students will also spend time looking at the importance of units and unit conversions in calculations and understanding of what numbers really mean. Ultimately, students will be using these skills to help them develop their own procedures for an end of unit project.

## Stage 1: Desired Results - Key Understandings

Standard(s)	Transfer	
<p><b>NGSS/NSTA Science &amp; Engineering Practices</b> <i>NGSS Science &amp; Engineering Practices: 9-12</i></p> <ul style="list-style-type: none"> <li>Ask questions to determine relationships, including quantitative relationships, between independent and dependent variables. <i>SE.9-12.1.3</i></li> <li>Evaluate a question to determine if it is testable and relevant. <i>SE.9-12.1.5</i></li> <li>Ask questions that can be investigated within the scope of the school laboratory, research facilities, or field (e.g., outdoor environment) with available resources and, when appropriate, frame a hypothesis based on a model or theory. <i>SE.9-12.1.6</i></li> <li>Select appropriate tools to collect, record, analyze, and evaluate data. <i>SE.9-12.3.4</i></li> <li>Analyze data using tools, technologies, and/or models (e.g., computational, mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution. <i>SE.9-12.4.1</i></li> <li>Consider limitations of data analysis (e.g., measurement error, sample selection) when analyzing and interpreting data. <i>SE.9-12.4.3</i></li> <li>Compare and contrast various types of data sets (e.g., self-generated, archival) to examine consistency of measurements and observations. <i>SE.9-12.4.4</i></li> </ul>	<b>T1</b> Create models to explore complex systems, show mastery of key science concepts, and/or develop solutions through creation of a product open to testing and redesign.	
	<b>Meaning</b>	
	<b>Understanding(s)</b>	<b>Essential Question(s)</b>
	<p><b>U1</b> The motion of objects must be defined by using a frame of reference.</p> <p><b>U2</b> There are two main types of one dimensional motion: motion with constant velocity (at rest is a particular case of this) and accelerated motion (changing velocity).</p> <p><b>U3</b> Motion can be analyzed graphically.</p>	<p><b>Q1</b> How do forces cause and affect motion?</p> <p><b>Q2</b> How do the principles of physics explain natural phenomenon?</p> <p><b>Q3</b> How is it possible for an object to stay in constant motion or constant rest forever?</p> <p><b>Q4</b> If you are travelling in a car, are you at rest or are you moving?</p> <p><b>Q5</b> How can motion be quantified and communicated scientifically?</p>
	<b>Acquisition of Knowledge and Skill</b>	
	<b>Knowledge</b>	<b>Skill(s)</b>
<p><b>K1</b> Speed and velocity are not the same quantity; velocity has direction</p> <p><b>K2</b> Distance and displacement are different quantities; displacement has a direction as well as a magnitude</p> <p><b>K3</b> Velocity is the rate of change of displacement</p>	<p><b>S1</b> Be able to solve problems using the basic definitions of average velocity and acceleration.</p> <p><b>S2</b> Be able to state the proper units for position, velocity and acceleration.</p>	

## Stage 1: Desired Results - Key Understandings

- Use mathematical, computational, and/or algorithmic representations of phenomena or design solutions to describe and/or support claims and/or explanations. *SE.9-12.5.3*
- Apply ratios, rates, percentages, and unit conversions in the context of complicated measurement problems involving quantities with derived or compound units (such as mg/mL, kg/m<sup>3</sup>, acre-feet, etc.). *SE.9-12.5.6*

### Madison Public Schools Profile of a Graduate

#### *Critical Thinking*

- Analyzing: Examining information/data/evidence from multiple sources to identify possible underlying assumptions, patterns, and relationships in order to make inferences. (POG.1.2)

#### *Creative Thinking*

- Design: Engaging in a process to refine a product for an intended audience and purpose. (POG.2.2)

#### *Collaboration/Communication*

- Collective Intelligence: Working respectfully and responsibly with others, exchanging and evaluating ideas to achieve a common objective. (POG.3.1)

**K4** Acceleration is the rate of change of velocity  
**K5** Graphs can be used to describe motion of objects

**S3** Be able to look at a Position vs. Time graph and explain in words the motion of the object that is described by the graph.  
**S4** Determine velocity from a Position vs. Time graph (i.e. find the slope).  
**S5** Solve Free Fall problems using  $d = \frac{1}{2} a * t^2$ .