

Volume 5: Motion, Instructor Materials Table of Contents

Contents	Page No.
I. Introduction	
A. Overview of the Unit	1
B. Acknowledgments and Origin of Ideas	2
C. Safety Considerations	3
II. Student Notions About Motion	
A. The Students' Prior Beliefs as Described in the Research on Student Conceptions	4
B. Conceptions that Students Can Develop in this Unit	6
III. Cognitive Rationale	
General Comments	12
Specific Comments	13
IV. The Motion Unit	
A. Suggestions for Implementation in the Larger Group Setting with Separate Laboratory Class	18
B. Materials and Equipment	18
V. Sample Assessment Materials	20
VI. Selected Bibliography/References	26
VII. Student Investigations with Embedded Instructor Notes	
<i>Investigation 1: Constant Motion and the first type of graph</i>	
Activity M1.1: Exploring the First Type of Graph	27
Activity M1.2: What difference would it make if you walked slowly, but steadily, away from the detector compared to walking faster, but steadily, away from the detector? What about motion toward the detector?	32
Activity M1.3: What would a position-time graph of the following motion look like?	37
Activity M1.4: How would you move to exactly match the graph below?	40
<i>Investigation 2: More Constant Motion and the second type of motion graph</i>	
Activity M2.1: Exploring the Second Type of Graph	44
Activity M2.2: What difference would it make on this new type of graph, if you walked slowly, but steadily, away from the detector compared to walking faster, but steadily, away from the detector?	48
Activity M2.3: What would a velocity-time graph of the following motion look like?	54
Activity M2.4: How would you move to exactly match the graph below?	57
Activity M2.5: What do you think the position-time graph might look like for a motion that made the velocity-time graph shown?	62
Activity M2.6: What do you think the velocity-time graph would look like for a motion that made the position-time graph shown?	65

<i>Investigation 3: Changing Motion and the third graph type</i>	
Activity M3.1: If we were to move away first constantly speeding up and then constantly slowing down, what would the graphs look like?	68
Activity M3.2: Exploring the third type of graph	76
Activity M3.3: What does it appear the signs (+ and -) mean in this third type of graph?	81
Activity M3.4: If we were to move toward the detector first constantly speeding up and then constantly slowing down, what would the graphs look like?	83
Activity M3.5: Focus on Physical Science -- Words Used to Describe Ideas About Motion	89
<i>Investigation 4: More Changing Motion -- A Closer Look</i>	
Activity M4.1: If we were to allow a cart to roll down an inclined ramp, what would its velocity and acceleration graphs look like?	91
Activity M4.2: If we were to allow a cart to roll down an <u>even steeper</u> inclined ramp, what would its velocity and acceleration graphs look like?	100
Activity M4.3: Using an example to explore what we think is meant by the words "acceleration" and "velocity"	104
Activity M4.4: If we were to give a cart a quick shove and allow it to coast up and then back down an incline before it is stopped, what would its velocity and acceleration graphs look like?	107
Activity M4.5: What is apparently meant by "acceleration" and "velocity" in these graphs?	111
Activity M4.6: Does acceleration have direction?	115
Activity M4.7: Focus on Physical Science—Issues to confront concerning velocity and acceleration and the graphs of velocity and acceleration	117