Car Crashes

STEM Road Map for High School

Grade 12

Edited by Carla C. Johnson, Janet B. Walton, and Erin Peters-Burton

NSTA press
National Science Teachers Association

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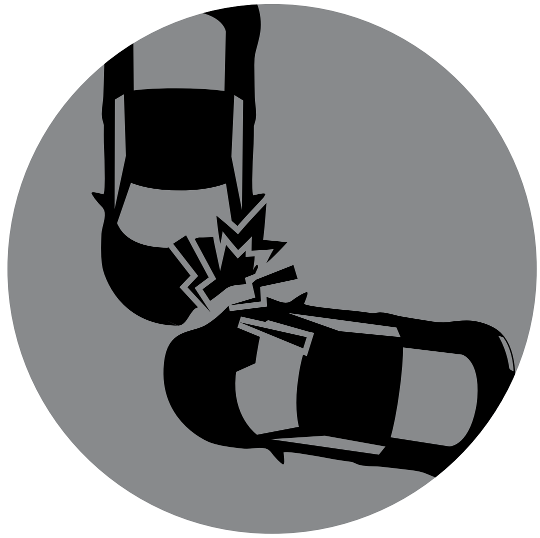

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National Science Teachers Association
Arlington, Virginia

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CONTENTS

About the Editors and Authors vii

Acknowledgments ix

Part 1: The STEM Road Map: Background, Theory, and Practice

1 **Overview of the *STEM Road Map Curriculum Series*** **1**

Standards-Based Approach 2

Themes in the *STEM Road Map Curriculum Series* 2

The Need for an Integrated STEM Approach 5

Framework for STEM Integration in the Classroom 6

The Need for the *STEM Road Map Curriculum Series* 7

References 7

2 **Strategies Used in the *STEM Road Map Curriculum Series*** **9**

Project- and Problem-Based Learning 9

Engineering Design Process 9

Learning Cycle 11

STEM Research Notebook 12

The Role of Assessment in the *STEM Road Map Curriculum Series* 13

Self-Regulated Learning Theory in the STEM Road Map Modules 16

Safety in STEM 18

References 19

Part 2: Car Crashes: STEM Road Map Module

3 **Car Crashes Module Overview** **23**

Module Summary 23

Established Goals and Objectives 24

Challenge or Problem for Students to Solve: "Expert Witness" Presentations 24

CONTENTS

Content Standards Addressed in This STEM Road Map Module 24

STEM Research Notebook 24

Module Launch 27

Prerequisite Skills for the Module 27

Potential STEM Misconceptions 28

SRL Process Components 29

Strategies for Differentiating Instruction Within This Module 30

Strategies for English Language Learners 31

Safety Considerations for the Activities in This Module 32

Desired Outcomes and Monitoring Success 32

Assessment Plan Overview and Map 33

Module Timeline 36

Resources 40

References 40

4 Car Crashes Lesson Plans 41

Lesson Plan 1: Technological Advances in Automobiles 41

Lesson Plan 2: Reconstructing Collisions 68

Lesson Plan 3: Crash Forensics 94

5 Transforming Learning With Car Crashes and the *STEM Road Map Curriculum Series* 117

Appendix: Content Standards Addressed in This Module 121

Index 133

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See *www.routledge.com/products/9781138804234* for more information about *STEM Road Map: A Framework for Integrated STEM Education.*

CAR CRASHES MODULE OVERVIEW

Erin Peters-Burton, Jennifer Drake Patrick, Anthony Pellegrino, Bradley D. Rankin, Janet B. Walton, and Carla C. Johnson

THEME: The Represented World

LEAD DISCIPLINES: Science and Mathematics

MODULE SUMMARY

As technologies become more powerful, limits may be tested, and sometimes human lives are compromised. For example, automobiles have allowed humans to travel greater distances more rapidly. However, traveling at such high speeds puts humans at risk of injury or death because of potential loss of control of the automobile, leading to dangerous impact forces on the human body. Manufacturers have a responsibility to maintain safety standards but cannot test their products on humans because it is too dangerous. Therefore, car manufacturers must use modeling to test dangerous impact forces on humans. To protect people from the potential dangers caused by advances in technologies, governments often need to impose safety rules on individuals, such as the federal seat belt law instituted in the United States in 1968 requiring passenger cars to incorporate seat belts for all designated seating.

This module has four main focuses. Students learn about the industry of car safety and how technological advances may not be all positive, gain a deep understanding of how forces and velocity act at different angles to produce momentum and impact, explore the history of safety features in cars and the impacts these features have on society in terms of governmental rules and individual rights, and reverse engineer car crash scenarios to explain the factors that led to the collisions for the sake of informing law enforcement officials. In science and mathematics classes, students explore forces, velocity, and their impact on human safety in automobiles and use these principles to determine the actual speed of cars in accidents. They use modeling throughout this module to describe the physics of car crashes. Simultaneously, in ELA and social studies connections, students investigate the tension between mandatory governmental rules and individual rights (adapted from Peters-Burton et al. 2015).

ESTABLISHED GOALS AND OBJECTIVES

At the conclusion of this module, students will be able to do the following:

- Identify technological advances in automobiles and explain the trade-offs due to the technology
- Describe how the automobile industry determines factors in a car crash
- Analyze factors after a collision to determine the forces, speeds, momentum, and impact during the collision
- Evaluate arguments made both for governmental restrictions for the sake of safety and for individual rights
- Use analysis of momentum and forces to develop models and mathematical representations of car crash scenarios to determine how crashes occurred

CHALLENGE OR PROBLEM FOR STUDENTS TO SOLVE: "EXPERT WITNESS" PRESENTATIONS

As the culminating activity for the module, student teams create courtroom "expert witness" presentations in which they use models and mathematical representations of different car crash scenarios to show how analysis of momentum and forces can inform law enforcement about how the crashes occurred.

CONTENT STANDARDS ADDRESSED IN THIS STEM ROAD MAP MODULE

A full listing with descriptions of the standards this module addresses can be found in the appendix. Listings of the particular standards addressed within lessons are provided in a table for each lesson in Chapter 4.

STEM RESEARCH NOTEBOOK

Each student should maintain a STEM Research Notebook, which will serve as a place for students to organize their work throughout this module (see p. 12 for more general discussion on setup and use of this notebook). All written work in the module should be included in the notebook, including records of students' thoughts and ideas, fictional accounts based on the concepts in the module, and records of student progress through the engineering design process (EDP). The notebooks may be maintained across subject areas, giving students the opportunity to see that although their classes may be separated during the school day, the knowledge they gain is connected.

Each lesson in this module includes student handouts that should be kept in the STEM Research Notebooks after completion, as well as a prompt to which students should respond in their notebooks. You may also wish to have students include the STEM Research Notebook Guidelines student handout on page 26 in their notebooks.

Emphasize to students the importance of organizing all information in a Research Notebook. Explain to them that scientists and other researchers maintain detailed Research Notebooks in their work. These notebooks, which are crucial to researchers' work because they contain critical information and track the researchers' progress, are often considered legal documents for scientists who are pursuing patents or wish to provide proof of their discovery process.

STUDENT HANDOUT

STEM RESEARCH NOTEBOOK GUIDELINES

STEM professionals record their ideas, inventions, experiments, questions, observations, and other work details in notebooks so that they can use these notebooks to help them think about their projects and the problems they are trying to solve. You will each keep a STEM Research Notebook during this module that is like the notebooks that STEM professionals use. In this notebook, you will include all your work and notes about ideas you have. The notebook will help you connect your daily work with the big problem or challenge you are working to solve.

It is important that you organize your notebook entries under the following headings:

1. **Chapter Topic or Title of Problem or Challenge:** You will start a new chapter in your STEM Research Notebook for each new module. This heading is the topic or title of the big problem or challenge that your team is working to solve in this module.
2. **Date and Topic of Lesson Activity for the Day:** Each day, you will begin your daily entry by writing the date and the day's lesson topic at the top of a new page. Write the page number both on the page and in the table of contents.
3. **Information Gathered From Research:** This is information you find from outside resources such as websites or books.
4. **Information Gained From Class or Discussions With Team Members:** This information includes any notes you take in class and notes about things your team discusses. You can include drawings of your ideas here, too.
5. **New Data Collected From Investigations:** This includes data gathered from experiments, investigations, and activities in class.
6. **Documents:** These are handouts and other resources you may receive in class that will help you solve your big problem or challenge. Paste or staple these documents in your STEM Research Notebook for safekeeping and easy access later.
7. **Personal Reflections:** Here, you record your own thoughts and ideas on what you are learning.
8. **Lesson Prompts:** These are questions or statements that your teacher assigns you within each lesson to help you solve your big problem or challenge. You will respond to the prompts in your notebook.
9. **Other Items:** This section includes any other items your teacher gives you or other ideas or questions you may have.

MODULE LAUNCH

To prepare students to successfully compete this module, students should have an overall understanding of the activities they will accomplish as they build their knowledge for the challenge. This module has three parts: an exploration of technological improvements in cars including safety features, investigations into the momentum involved in car crashes, and activities involved in meeting the "expert witness" challenge. To begin to give an overview of the three sections and to launch the challenge, ask students, What are the basic parts of a car that make it move forward? What technologies have helped to make cars faster over the past 100 years? What might be the implications of making cars faster and faster? Hold a brief class discussion. Then, have students build mousetrap cars to become familiar with the basic idea of how the wheels move the car forward. Next, introduce students to the physical and mathematical issues related to a car crash, as well as the governmental regulations associated with cars because of the dangerous nature of getting from place to place quickly. Tell students that for their challenge in this module, they will work in teams to create courtroom "expert witness" presentations in which they use models and mathematical representations of different car crash scenarios to illustrate how analysis of momentum and forces can inform law enforcement about how the crashes occurred. Have students begin to think about what they might need to know to accomplish the "expert witness" challenge.

PREREQUISITE SKILLS FOR THE MODULE

Students enter this module with a wide range of preexisting skills, information, and knowledge. Table 3.1 (p. 28) provides an overview of prerequisite skills and knowledge that students are expected to apply in this module, along with examples of how they apply this knowledge throughout the module. Differentiation strategies are also provided for students who may need additional support in acquiring or applying this knowledge.

Table 3.1. Prerequisite Key Knowledge and Examples of Applications and Differentiation Strategies

Prerequisite Key Knowledge	Application of Knowledge	Differentiation for Students Needing Knowledge
Understand that speed is when an object moves a distance over a period of time.	Use speed and velocity to determine impact force.	Provide an overview of the concept by showing a video such as "Instantaneous Speed and Velocity: One-Dimensional Motion" at *www.youtube.com/watch?v=pfTTHx9kCHk.*
Understand that forces act on an object to move it.	Use understanding of forces to analyze crash situations.	Provide an overview of the concept by showing a video such as "More on Newton's First Law of Motion" at *www.youtube.com/watch?v=CQYELiTtUs8.*

POTENTIAL STEM MISCONCEPTIONS

Students enter the classroom with a wide variety of prior knowledge and ideas, so it is important to be alert to misconceptions, or inappropriate understandings of foundational knowledge. These misconceptions can be classified as one of several types: "preconceived notions," opinions based on popular beliefs or understandings; "nonscientific beliefs," knowledge students have gained about science from sources outside the scientific community; "conceptual misunderstandings," incorrect conceptual models based on incomplete understanding of concepts; "vernacular misconceptions," misunderstandings of words based on their common use versus their scientific use; and "factual misconceptions," incorrect or imprecise knowledge learned in early life that remains unchallenged (NRC 1997, p. 28). Misconceptions must be addressed and dismantled in order for students to reconstruct their knowledge, and therefore teachers should be prepared to take the following steps:

- Identify students' misconceptions.
- Provide a forum for students to confront their misconceptions.
- Help students reconstruct and internalize their knowledge, based on scientific models. (NRC 1997, p. 29)

Keeley and Harrington (2010) recommend using diagnostic tools such as probes and formative assessment to identify and confront student misconceptions and begin the process of reconstructing student knowledge. Keeley and Harrington's *Uncovering*

Student Ideas in Science series contains probes targeted toward uncovering student misconceptions in a variety of areas. In particular, *Uncovering Student Ideas in Physical Science, Volume 1: 45 New Force and Motion Assessment Probes* (Keeley and Harrington 2010) may be useful resources for addressing student misconceptions in this module.

Some commonly held misconceptions specific to lesson content are provided with each lesson so that you can be alert for student misunderstanding of the science concepts presented and used during this module. The American Association for the Advancement of Science has also identified misconceptions that students frequently hold regarding various science concepts (see the links at *http://assessment.aaas.org/topics*).

SRL PROCESS COMPONENTS

Table 3.2 illustrates some of the activities in the Car Crashes module and how they align to the self-regulated learning (SRL) process before, during, and after learning.

Table 3.2. SRL Process Components

Learning Process Components	Example From Car Crashes Module	Lesson Number
BEFORE LEARNING		
Motivates students	Most students are new drivers or are working toward obtaining their driver's licenses. Students research technological advances in automobiles.	Lesson 1
Evokes prior learning	Students tap into their prior experience with the technology used in cars as they look at the history of cars and the mechanics of car crashes.	Lesson 1
DURING LEARNING		
Focuses on important features	Teachers guide students to develop mathematical models about momentum during different kinds of car crashes.	Lesson 2
Helps students monitor their progress	Students perform investigations of momentum in a group and check their progress in understanding the mathematical models with their group members.	Lesson 2
AFTER LEARNING		
Evaluates learning	Students get feedback on their final challenge products from detailed rubrics.	Lesson 3
Takes account of what worked and what did not work	Students write reflections in their STEM Research Notebooks on whether the expert witness testimonies changed their minds about the driving question.	Lesson 3

STRATEGIES FOR DIFFERENTIATING INSTRUCTION WITHIN THIS MODULE

For the purposes of this curriculum module, differentiated instruction is conceptualized as a way to tailor instruction—including process, content, and product—to various student needs in your class. A number of differentiation strategies are integrated into lessons across the module. The problem- and project-based learning approach used in the lessons is designed to address students' multiple intelligences by providing a variety of entry points and methods to investigate the key concepts in the module. Differentiation strategies for students needing support in prerequisite knowledge can be found in Table 3.1 (p. 28). You are encouraged to use information gained about student prior knowledge during introductory activities and discussions to inform your instructional differentiation. Strategies incorporated into this lesson include flexible grouping, varied environmental learning contexts, assessments, compacting, and tiered assignments and scaffolding.

Flexible Grouping: Students work collaboratively in a variety of activities throughout this module. Grouping strategies you might employ include student-led grouping, grouping students according to ability level, grouping students randomly, or grouping them so that students in each group have complementary strengths (for instance, one student might be strong in mathematics, another in art, and another in writing). You may also choose to group students based on their prior knowledge. For Lesson 2, you may choose to maintain the same student groupings as in Lesson 1 or regroup students according to another of the strategies described here.

Varied Environmental Learning Contexts: Students have the opportunity to learn in various contexts throughout the module, including alone, in groups, in quiet reading and research-oriented activities, and in active learning through inquiry and design activities. In addition, students learn in a variety of ways, including through doing inquiry activities, reading texts, watching videos, participating in class discussion, and conducting web-based research.

Assessments: Students are assessed in a variety of ways throughout the module, including individual and collaborative formative and summative assessments. Students have the opportunity to produce work via written text, oral and media presentations, and modeling. You may choose to provide students with additional choices of media for their products (for example, PowerPoint presentations, posters, or student-created websites or blogs).

Compacting: Based on student prior knowledge, you may wish to adjust instructional activities for students who exhibit prior mastery of a learning objective. For instance, if some students exhibit mastery of compiling technological advances in Lesson 1, you may wish to limit the amount of time they spend practicing these skills and instead introduce various units of measurement and unit conversions to these students.

Tiered Assignments and Scaffolding: Based on your awareness of student ability, understanding of concepts, and mastery of skills, you may wish to provide students with variations on activities by adding complexity to assignments or providing more or fewer learning supports for activities throughout the module. For instance, some students may need additional support in identifying key search words and phrases for web-based research or may benefit from cloze sentence handouts to enhance vocabulary understanding. Other students may benefit from expanded reading selections and additional reflective writing or from working with manipulatives and other visual representations of mathematical concepts. You may also work with your school librarian to compile a set of topical resources at a variety of reading levels.

STRATEGIES FOR ENGLISH LANGUAGE LEARNERS

Students who are developing proficiency in English language skills require additional supports to simultaneously learn academic content and the specialized language associated with specific content areas. WIDA (2012) has created a framework for providing support to these students and makes available rubrics and guidance on differentiating instructional materials for English language learners (ELLs). In particular, ELL students may benefit from additional sensory supports such as images, physical modeling, and graphic representations of module content, as well as interactive support through collaborative work. This module incorporates a variety of sensory supports and provides ongoing opportunities for ELL students to work collaboratively. For example, in Lesson 2, students form groups to investigate momentum using hands-on activities and communicate their findings using mathematical models and diagrams.

Teachers differentiating instruction for ELL students should carefully consider the needs of these students as they introduce and use academic language in various language domains (listening, speaking, reading, and writing) throughout this module. To adequately differentiate instruction for ELL students, you should have an understanding of the proficiency level of each student. The following five overarching 9–12 WIDA learning standards are relevant to this module:

- Standard 1: Social and Instructional Language. Focus on social behavior in group work and class discussions.
- Standard 2: The language of Language Arts. Focus on forms of print, elements of text, picture books, comprehension strategies, main ideas and details, persuasive language, creating informational text, and editing and revising.
- Standard 3: The language of Mathematics. Focus on numbers and operations, patterns, number sense, measurement, and strategies for problem solving.
- Standard 4: The language of Science. Focus on safety practices, energy sources, scientific process, and scientific inquiry.

- Standard 5: The language of Social Studies. Focus on change from past to present, historical events, resources, transportation, map reading, and location of objects and places.

SAFETY CONSIDERATIONS FOR THE ACTIVITIES IN THIS MODULE

In this module, students create mousetrap cars from a variety of materials and should use caution when handling sharp objects and tools that can pinch. For more precautions, see the specific safety notes after the list of materials in each lesson. For more general safety guidelines, see the Safety in STEM section in Chapter 2 (p. 18).

DESIRED OUTCOMES AND MONITORING SUCCESS

The desired outcomes for this module are outlined in Table 3.3, along with suggested ways to gather evidence to monitor student success. For more specific details on desired outcomes, see the Established Goals and Objectives sections for the module and individual lessons.

Table 3.3. Desired Outcomes and Evidence of Success in Achieving Identified Outcomes

Desired Outcome	Evidence of Success	
	Performance Tasks	Other Measures
Students can apply an understanding of various science, mathematics, and legal concepts to complete small group presentations and individual tasks related to the activities within the unit.	• Students maintain STEM Research Notebooks that contain designs, research notes, evidence of collaboration, and ELA-related work. • Students complete graphic organizers on technological advances in automobiles and constructing an argument. • Students give presentations on their chosen topics. • Students are able to correctly interpret technical papers and other statistics found in the suggested sources. • Students successfully complete the labs on momentum and impact and write an accurate laboratory report for each. • Students have compelling arguments for their position that are based on reliable and credible evidence. • Students are assessed using project rubrics that focus on content and application of skills related to academic content.	The presentation rubric has participation built in, so there are no separate measures.

ASSESSMENT PLAN OVERVIEW AND MAP

Table 3.4 (p. 34) provides an overview of the major group and individual *products* and *deliverables*, or things that student teams will produce in this module, that constitute the assessment for this module. See Table 3.5 (p. 34) for a full assessment map of formative and summative assessments in this module.

Table 3.4. Major Products and Deliverables in Lead Disciplines for Groups and Individuals

Lesson	Major Group Products and Deliverables	Major Individual Products and Deliverables
1	• Graphic Organizer for Technological Advances in Automobiles	• STEM Research Notebook prompts • Rubric for Research Presentation on Technological Advances in Automobiles
2	• Rubric for Laboratory Report	• STEM Research Notebook prompts
3	• Rubric for Determining Whether Evidence Is Credible • Graphic Organizer for Constructing an Argument • Rubric for Presentation of Mathematical Model of Car Crash Scenarios	• STEM Research Notebook prompts

Table 3.5. Assessment Map for Car Crashes Module

Lesson	Assessment	Group/ Individual	Formative/ Summative	Lesson Objective Assessed
1	STEM Research Notebook prompts	Individual	Formative	• Identify and explain technological advances in automobiles. • Identify and explain automobile safety issues and regulations. • Explore the formula for stopping distance.
1	Technological Advances in Automobiles graphic organizer	Group	Formative	• Identify technological advances in automobiles. • Explain technological advances in automobiles. • Explain problems caused by technological advances in automobiles.
1	Technological Advances in Automobiles timeline	Individual	Formative	• Compile technological advances presented by students in the class and organize on a timeline. • Analyze the timeline of technological advances in automobiles for trends.

Continued

Table 3.5. (*continued*)

Lesson	Assessment	Group/ Individual	Formative/ Summative	Lesson Objective Assessed
1	Research Presentation on Technological Advances in Automobiles rubric	Individual	Formative	• Identify and explain technological advances in automobiles. • Explain problems caused by technological advances in automobiles. • Deliver presentation with effective introduction, body, and conclusion. • Communicate clearly and effectively using multiple communication modes.
2	STEM Research Notebook prompts	Individual	Formative	• Explain the impact of speed on car crashes. • Give examples of elastic and inelastic collisions. • Determine speed of toy car just before it strikes a wall.
2	Laboratory Report rubric	Group	Formative	• Measure forces, momentum, and impact during a collision. • Analyze factors after a collision to determine the forces, speeds, momentum, and impact during the collision. • Write lab report in formal format.
3	Seat belt timeline	Group	Formative	• Research and create timeline for seat belt safety regulations in the United States.
3	STEM Research Notebook prompts	Individual	Formative	• Write a reflection on the quality of research for the seat belt timeline and whether the sources were reliable. • Revisit earlier reaction to the question of governmental rules versus individual rights.
3	Governmental rules versus individual freedom opinion paper	Individual	Formative	• Develop opinion paper about governmental seat belt regulations.

Continued

Table 3.5. (*continued*)

Lesson	Assessment	Group/ Individual	Formative/ Summative	Lesson Objective Assessed
3	Determining Whether Evidence Is Credible rubric	Individual	Formative	• Evaluate evidence, author credentials, references, and objectivity of resources.
3	Constructing an Argument graphic organizer	Group	Formative	• Evaluate arguments for governmental restrictions for the sake of safety and arguments for individual rights.
3	Presentation of Mathematical Model of Car Crash Scenarios rubric	Group	Summative	• Develop models and mathematical representations of different car crash scenarios. • Illustrate how analysis of momentum and forces can inform law enforcement about how crashes occurred. • Explain the roles of seat belts and airbags. • Present models in simulated courtroom as "expert witnesses."

MODULE TIMELINE

Tables 3.6–3.10 (pp. 37–39) provide lesson timelines for each week of the module. These timelines are provided for general guidance only and are based on class times of approximately 45 minutes.

Table 3.6. STEM Road Map Module Schedule for Week One

Day 1	Day 2	Day 3	Day 4	Day 5
Lesson 1: Technological Advances in Automobiles • Launch the module by introducing car crashes. • Introduce STEM Research Notebook. • Build mousetrap cars. • Introduce the idea of governmental rules to keep people safe	*Lesson 1: Technological Advances in Automobiles* • Investigate technological advances in automobiles and the safety trade-offs due to the technology.	*Lesson 1: Technological Advances in Automobiles* • Conduct in-depth research on one technological advance in cars and prepare a 10-minute expository presentation. • Create a timeline of the technological advances in cars. • Learn about the physics associated with car crashes.	*Lesson 1: Technological Advances in Automobiles* • Give presentations on technological advances in automobiles. • Continue to learn about the physics associated with car crashes.	*Lesson 1: Technological Advances in Automobiles* • Reflect on the presentations and compile a list of dos and don'ts for presentations. • Conduct research on car crashes. • Consider whether progress and technological advances are always positive.

Table 3.7. STEM Road Map Module Schedule for Week Two

Day 6	Day 7	Day 8	Day 9	Day 10
Lesson 2: Reconstructing Collisions • Investigate the outcomes involved in cars crashing into stationary objects at different speeds. • Investigate the outcomes of a two-car head-on collision as compared to two separate cars crashing into a wall.	*Lesson 2 Reconstructing Collisions* • Find examples of collisions online and determine whether each is elastic or inelastic. • Do hands-on lab activities to learn about momentum, force, and impact.	*Lesson 2 Reconstructing Collisions* • Design a scientific investigation to create a collision with toy cars and calculate their velocity just before impact. • Write a formal lab report.	*Lesson 2 Reconstructing Collisions* • Investigate vector forces and momentum in situations of two cars colliding at an angle.	*Lesson 2 Reconstructing Collisions* • Investigate vector forces and momentum in situations of two cars colliding at an angle. • Use reverse engineering to determine the speeds of cars colliding at an angle at different points before the collision.

Table 3.8. STEM Road Map Module Schedule for Week Three

Day 11	Day 12	Day 13	Day 14	Day 15
Lesson 3: Crash Forensics • Investigate the history of seat belts in automobiles.	*Lesson 3: Crash Forensics* • Investigate the history of airbags in automobiles. • Create a timeline for your state for the development of seat belts and airbags along with state laws regarding safety features of automobiles.	*Lesson 3: Crash Forensics* • Evaluate the sources used in the timeline for credibility.	*Lesson 3: Crash Forensics* • Identify the key components of scientific arguments and use these components to write a paper on state laws versus personal freedoms regarding seat belt laws.	*Lesson 3: Crash Forensics* • Revise drafts of argument regarding seat belt laws.

Table 3.9. STEM Road Map Module Schedule for Week Four

Day 16	Day 17	Day 18	Day 19	Day 20
Lesson 3: Crash Forensics • Evaluate peer arguments for both sides regarding governmental rules and individual rights.	*Lesson 3: Crash Forensics* • Research variables for realistic accident scenarios for the final challenge.	*Lesson 3: Crash Forensics* • Construct accident scenarios for final challenge with necessary variables.	*Lesson 3: Crash Forensics* • Calculate forces and momentum for car crash presentations.	*Lesson 3: Crash Forensics* • Calculate velocity and damage/crush analysis for car crash presentations.

Table 3.10. STEM Road Map Module Schedule for Week Five

Day 21	Day 22	Day 23	Day 24	Day 25
Lesson 3: Crash Forensics • Finalize car crash expert witness presentations.	*Lesson 3: Crash Forensics* • Give expert witness presentations on car crash scenarios. • Conduct a peer review.	*Lesson 3: Crash Forensics* • Continue to give expert witness presentations on car crash scenarios. • Continue to conduct a peer review.	*Lesson 3: Crash Forensics* • Continue to give expert witness presentations on car crash scenarios. • Continue to conduct a peer review.	*Lesson 3: Crash Forensics* • Revisit and write about the tension between governmental rules and personal freedoms. • Consider the information given at the peer review and write about improvements to the presentation.

RESOURCES

Teachers have the option to co-teach portions of this module and may want to combine classes for activities such as mathematical modeling, physics laboratory, discussing argumentation, or conducting research. The media specialist can help teachers locate resources for students to view and read about car crashes, examples of safety innovations, and how law enforcement uses physics to inform a situation. Special educators and reading specialists can help find supplemental sources for students needing extra support in reading and writing. Additional resources may be found online. Community resources for this module may include guest speakers who work in automobile engineering, auto body repair, human factors engineering, and law enforcement.

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INDEX

Page numbers printed in **boldface type** indicate tables, figures, or handouts.

A

Activity/Exploration
- Crash Forensics lesson plan, 103
- Reconstructing Collisions lesson plan, 80–82
- Technological Advances in Automobiles lesson plan, 53–55

after learning, SRL theory, **16**, 18, **29**

arguments
- Constructing an Argument Graphic Organizer student handout, **112–113**
- Credible Evidence rubric, **111**
- defined, 98
- formal arguments, 99–100
- Toulmin's argumentation structure, 103–104, **104**

assessment
- assessment maps, 15–16
- assessment plan overview and map, 33, **34–36**
- comprehensive assessment system, 14
- differentiation strategies, 30
- embedded formative assessments, 14–15
- role of, 13–16
- *See also* Evaluation/Assessment; performance tasks

B

balanced forces, 46

before learning, SRL theory, **16**, 17, **29**

Building a Mousetrap Car activity, 49–50, **60–64**

C

Car Crashes module overview, 23–40
- challenge or problem to solve, 24
- content standards, 24
- established goals and objectives, 23
- lead disciplines, 23
- module launch, 27
- module summary, 23
- prerequisite skills and knowledge, 27, **28**
- resources, 40
- safety, 32
- STEM misconceptions, 28–29
- STEM Research Notebook, 24–25, **26**
- theme, 23
- timeline, 36, **37–39**

cause and effect theme, 3

claim, Toulmin's argumentation structure, 103–104, **104**

collisions
- collision types teacher background information, 45–46
- defined, 45
- *See also* Crash Forensics lesson plan; Reconstructing Collisions lesson plan; Technological Advances in Automobiles lesson plan

Common Core State Standards for English Language Arts (CCSS ELA)
- Crash Forensics lesson plan, **96–98**
- Reconstructing Collisions lesson plan, 69, **71–72**
- summary table, **124–127**
- Technological Advances in Automobiles lesson plan, **44**

Common Core State Standards for Mathematics (CCSS Mathematics)
- Crash Forensics lesson plan, **96**
- Reconstructing Collisions lesson plan, 69, **70–71**
- summary table, **124**
- Technological Advances in Automobiles lesson plan, **44**

compacting differentiation strategy, 30

comprehensive assessment system, 14

conceptual misunderstandings, 28

connection to the challenge
Crash Forensics lesson plan, 102
Reconstructing Collisions lesson plan, 78–79
Technological Advances in Automobiles lesson plan, 49
content standards
Car Crashes module overview, 24
Crash Forensics lesson plan, 94, **95–98**
Reconstructing Collisions lesson plan, 69, **70–72**
summary table, 121, **122–123**
Technological Advances in Automobiles lesson plan, 43, **43–44**
Crash Forensics lesson plan, 94–115
Constructing an Argument Graphic Organizer student handout, **112–113**
content standards, 94, **95–98**
Crash Scenarios Mathematical Model rubric, **114**
Credible Evidence rubric, **111**
essential questions, 94
established goals and objectives, 94
internet resources, 110
key vocabulary, 94–95, **98**
learning components, 102–110
Activity/Exploration, 103
Elaboration/Application of Knowledge, 105–110
Evaluation/Assessment, 110
Explanation, 103–104
Introductory Activity/Engagement, 102–103
materials, 94
preparation for lesson, 102
STEM misconceptions, 100, **101**
teacher background information, 99–100
formal arguments, 99–100
governmental rules versus individual rights, 99
seat belt laws, 99
timeline, **38–39**, 94
crash tests for vehicle safety, teacher background information, 45
crosscutting concepts
Crash Forensics lesson plan, **95**
Reconstructing Collisions lesson plan, **70**
summary table, 121, **123**
Technological Advances in Automobiles lesson plan, **43**

D
desired outcomes and monitoring success, 32, **33**
differentiation strategies, 27, **28**, 30–31
disciplinary core ideas
Crash Forensics lesson plan, **95**
Reconstructing Collisions lesson plan, **70**
summary table, 121, **123**
Technological Advances in Automobiles lesson plan, **43**
drag factors, **107**
during learning, SRL theory, **16**, 17–18, **29**

E
Elaboration/Application of Knowledge
Crash Forensics lesson plan, 105–110
Reconstructing Collisions lesson plan, 84–90
Technological Advances in Automobiles lesson plan, 57–58
elastic collisions, 72, 84
embedded formative assessments, 14–15
energy
Elastic and Inelastic Collisions demonstration, 84
Reconstructing a Crash activity, 82–84
teacher background information, 72–73
Two Vehicles Colliding Head-On activity, 85–86
engineering design process (EDP), 9–11, **10**, **101**
English language arts (ELA)
Crash Forensics lesson plan, 102–103, 104, 105
Reconstructing Collisions lesson plan, 79, 82, 90
Technological Advances in Automobiles lesson plan, 53, 54–55, 57
English Language Development (ELD) Standards, **132**
English language learner (ELL) strategies, 31–32
essential questions
Crash Forensics lesson plan, 94
Reconstructing Collisions lesson plan, 68
Technological Advances in Automobiles lesson plan, 41
established goals and objectives
Crash Forensics lesson plan, 94

Reconstructing Collisions lesson plan, 68
Technological Advances in Automobiles lesson plan, 41
Evaluation/Assessment
Crash Forensics lesson plan, 110
Reconstructing Collisions lesson plan, 90
Technological Advances in Automobiles lesson plan, 58
evidence, Toulmin's argumentation structure, 103–104, **104**
"expert witness" presentations, 24, 27, 45–46, 49, 51, 79, 102, 105–106, 109–110, 117
Explanation
Crash Forensics lesson plan, 103–104
Reconstructing Collisions lesson plan, 82–84
Technological Advances in Automobiles lesson plan, 55–57

F
factual misconceptions, 28
flexible grouping, 30
forces
defined, 45
prerequisite skills and knowledge, **28**
STEM misconceptions, **48**, **78**, **101**
teacher background information, 46–47
forensics. *See* Crash Forensics lesson plan
formal arguments, 99–100
Framework for 21st Century Learning skills
Crash Forensics lesson plan, **98**
Reconstructing Collisions lesson plan, **72**
summary table, **128–131**
Technological Advances in Automobiles lesson plan, **44**
framework for STEM integration, 6–7

G
governmental rules versus individual rights, 99
Graphic Organizer student handout, **65–66**

I
impacts, 46–47
impulse, 73
individual rights, 45, 99
inelastic collisions, 72, 84
inertia, 54
innovation and progress theme, 3
internet research, 47
internet resources
Crash Forensics lesson plan, 110
Reconstructing Collisions lesson plan, 90–91
Technological Advances in Automobiles lesson plan, 58–59
Introductory Activity/Engagement
Crash Forensics lesson plan, 102–103
Reconstructing Collisions lesson plan, 78–80
Technological Advances in Automobiles lesson plan, 49–53

K
key vocabulary
Crash Forensics lesson plan, 94–95, **98**
Reconstructing Collisions lesson plan, 69, **72**
Technological Advances in Automobiles lesson plan, 43, **45**
kinetic energy
defined, 45
Technological Advances in Automobiles lesson plan, 55–56
KWL (Know, Want to Know, Learned) charts, 51–52

L
laboratory reports
Laboratory Report rubric, **92–93**
writing laboratory reports teacher background information, 76–77
learning cycle, 11–12
literacy standards, Crash Forensics lesson plan, **98**

M
materials
Crash Forensics lesson plan, 94
Reconstructing Collisions lesson plan, 68–69
Technological Advances in Automobiles lesson plan, 42
mathematics
Crash Forensics lesson plan, 102–103, 105
Reconstructing Collisions lesson plan, 79, 80, 82, 84–85

Technological Advances in Automobiles lesson plan, 52, 54–55, 55–56, 57
See also Common Core State Standards for Mathematics (CCSS Mathematics)
momentum
Crash Forensics lesson plan, 109
defined, 45
teacher background information, 46–47, 72–73
Two Vehicles Colliding Head-On activity, 85–86
Two Vehicles Hitting Each Other at an Angle activity, 86–89

N
Newton's second law, 54
Next Generation Science Standards
Reconstructing Collisions lesson plan, 69, **70**
summary table, 121, **122–123**
Technological Advances in Automobiles lesson plan, 43, **43**
nonscientific beliefs, 28

O
optimizing the human experience theme, 5

P
performance expectations
Crash Forensics lesson plan, **95**
Reconstructing Collisions lesson plan, **70**
Technological Advances in Automobiles lesson plan, **43**
performance tasks
Crash Forensics lesson plan, 110
desired outcomes and monitoring success, 32, **33**
Reconstructing Collisions lesson plan, 90
Technological Advances in Automobiles lesson plan, 58
preconceived notions, 28
preparation for lesson
Crash Forensics lesson plan, 102
Reconstructing Collisions lesson plan, 78
Technological Advances in Automobiles lesson plan, 48–49
prerequisite skills and knowledge, 27, **28**
presentations, creating presentations, 47–48
process components, self-regulated learning theory (SRL), 16–18, **16**, **29**
project- and problem-based learning, 9

R
reading standards
Reconstructing Collisions lesson plan, 71
Technological Advances in Automobiles lesson plan, 44
reasoning, Toulmin's argumentation structure, 103–104, **104**
Reconstructing Collisions lesson plan, 68–93
content standards, 69, **70–72**
Elastic and Inelastic Collisions demonstration, 84
essential questions, 68
established goals and objectives, 68
internet resources, 90–91
key vocabulary, 69, **72**
Laboratory Report rubric, **92–93**
learning components, 78–90
Activity/Exploration, 80–82
Elaboration/Application of Knowledge, 84–90
Evaluation/Assessment, 90
Explanation, 82–84
Introductory Activity/Engagement, 78–80
materials, 68–69
preparation for lesson, 78
Reconstructing a Crash activity, 82–84
safety, 69
Scavenger Hunt activity, 80
STEM misconceptions, 77–78, **78**
teacher background information, 72–77
crash reconstruction, 77
momentum and energy, 72–73
vectors, 73–76
writing laboratory reports, 76–77
timeline, **37**, 68
Toy Car Crashes activity, 81
Two Vehicles Colliding Head-On activity, 85–86
Two Vehicles Hitting Each Other at an Angle activity, 86–89
Why Do Catchers Use Mitts? activity, 80–81
regulation, 98
the represented world theme, 4, 23
Research Presentation rubric, **67**
retrodiction, 45, 53, 77
reverse engineering, 72

S
safety
    Car Crashes module overview, 32
    Reconstructing Collisions lesson plan, 69
    in STEM, 18–19
    Technological Advances in Automobiles lesson plan, 42
scaffolding, 31
Scavenger Hunt activity, 80
science
    Crash Forensics lesson plan, 102–103, 105
    prerequisite skills and knowledge, **28**
    Reconstructing Collisions lesson plan, 79, 80, 82, 84–85
    Technological Advances in Automobiles lesson plan, 49–50, 53–54, 55, 57
science and engineering practices
    Crash Forensics lesson plan, **95–96**
    Reconstructing Collisions lesson plan, **70**
    summary table, 121, **122**
    Technological Advances in Automobiles lesson plan, **43**
seat belt laws, 99
self-regulated learning theory (SRL), 16–18, **16**, **29**
skid marks, 52, 53, 77, 105, 106–107, **107**
social studies
    Crash Forensics lesson plan, 102–103, 104, 105
    Reconstructing Collisions lesson plan, 79, 80, 82, 84–85
    Technological Advances in Automobiles lesson plan, 53, 55, 56, 57–58
speaking and listening standards, Crash Forensics lesson plan, **97**
speed
    Crash Forensics lesson plan, 106–109, **107**
    defined, 98
    prerequisite skills and knowledge, **28**
STEM misconceptions
    Car Crashes module overview, 28–29
    Crash Forensics lesson plan, 100, **101**
    Reconstructing Collisions lesson plan, 77–78, **78**
    Technological Advances in Automobiles lesson plan, 48, **48**
STEM Research Notebook
    Car Crashes module overview, 24–25, **26**
    Crash Forensics lesson plan, 103, 109–110
    described, 12–13
    preparation for lesson, 48–49
    Reconstructing Collisions lesson plan, 79–80, 81–82
    Technological Advances in Automobiles lesson plan, 50–52, 53, 54–55, 56–58
STEM Road Map Curriculum Series
    about, 1
    cause and effect theme, 3
    engineering design process (EDP), 9–11, **10**
    framework for STEM integration, 6–7
    innovation and progress theme, 3
    learning cycle, 11–12
    need for, 7
    need for integrated STEM approach, 5–6
    optimizing the human experience theme, 5
    project- and problem-based learning, 9
    the represented world theme, 4
    role of assessment in, 13–16
    safety in STEM, 18–19
    self-regulated learning theory (SRL), 16–18, **16**
    standards-based approach to, 2
    STEM Research Notebook, 12–13
    sustainable systems theme, 4–5
    themes in, 2–3
    transformation of learning with, 117–119
sustainable systems theme, 4–5

T
teacher background information
    Crash Forensics lesson plan, 99–100
    Reconstructing Collisions lesson plan, 72–77
    Technological Advances in Automobiles lesson plan, 45–48
Technological Advances in Automobiles lesson plan, 41–67
    Building a Mousetrap Car student handout, **60–64**
    content standards, 43, **43–44**
    essential questions, 41
    established goals and objectives, 41
    Graphic Organizer student handout, **65–66**
    internet resources, 58–59

key vocabulary, 43, **45**
learning components, 49–58
Activity/Exploration, 53–55
Elaboration/Application of Knowledge, 57–58
Evaluation/Assessment, 58, **65–66**
Explanation, 55–57, **67**
Introductory Activity/Engagement, 49–53, **60–64**
materials, 42
preparation for lesson, 48–49
Research Presentation rubric, **67**
safety, 42
STEM misconceptions, 48, **48**
teacher background information, 45–48
collision types, 45–46
crash tests for vehicle safety, 45
creating presentations, 47–48
forces, momentum, and impact, 46–47
internet research, 47
timeline, **37**, 41
tiered assignments, 31
timeline
Car Crashes module overview, 36, **37–39**
Crash Forensics lesson plan, **38–39**, 94
Reconstructing Collisions lesson plan, **37**, 68
Technological Advances in Automobiles lesson plan, **37**, 41
Toulmin's argumentation structure, 103–104, **104**
Toy Car Crashes activity, 81
Two Vehicles Colliding Head-On activity, 85–86

U
unbalanced forces, 46
Uncovering Student Ideas in Physical Science (Keeley and Harrington), 29
Uncovering Student Ideas in Science (Keeley and Harrington), 28–29

V
varied environmental learning contexts, 30
vectors
defined, 72
STEM misconceptions, **78**, **101**
teacher background information, 73–76
velocity
defined, 98
prerequisite skills and knowledge, **28**
Toy Car Crashes activity, 81–82
Two Vehicles Colliding Head-On activity, 85–86
Two Vehicles Hitting Each Other at an Angle activity, 86–89
vernacular misconceptions, 28
vocabulary. *See* key vocabulary

W
Why Do Catchers Use Mitts? activity, 80–81
writing standards
Crash Forensics lesson plan, **96–97**
Reconstructing Collisions lesson plan, 71–72
See also Common Core State Standards for English Language Arts (CCSS ELA)

Grade 12

STEM Road Map for High School

Car Crashes

What if you could challenge your 12th graders to understand car crashes in the context of physical forces, manufacturing challenges, government safety standards, and individual rights? With this volume in the *STEM Road Map Curriculum Series*, you can!

Car Crashes outlines a journey that will steer your students toward authentic problem solving while grounding them in integrated STEM disciplines. As are the other volumes in the series, this book is designed to meet the growing need to infuse real-world learning into K–12 classrooms.

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