# Nov.  Grade 7 Unit 3A: Transportation Systems

Content Area: **Science**
Course(s):
Time Period: **November**
Length: **2 Weeks**
Status: **Published**

## Unit Overview

People use airplanes, highways, and subways to get from their homes to their destination. In this concept, you will learn about the different types of transportation systems.

## Enduring Understandings

By the end of the lesson, students should be able to:

- Describe the uses of different forms of transportation systems.
- Describe the benefits and drawbacks of different transportation systems for individuals and a community.
- Describe the forces engineers consider when designing a vehicle.

## Essential Questions

- **Overarching Question**
    - How can one explain the structure, properties, and interactions of matter?
- **Focus Questions**
    - What is the process for developing potential design solutions?
    - How can various proposed design solutions be compared and improved?
- **Lesson Questions**
    - How do different transportation systems meet people’s transportation needs?
    - What factors influence a community’s choice of a transportation system?
    - What do engineers need to consider when designing transportation vehicles?
- **Can You Explain?**
    - How can you evaluate how well a transportation system meets the needs of a community?

## Instructional Strategies & Learning Activities

# DISCOVERY TECHBOOK LESSONS:

**The Five E Instructional Model**

- Science Techbook follows the 5E instructional model. As you plan your lesson, the provided Model Lesson includes strategies for each of the 5Es.
- Engage (45–90 minutes)

  Students are asked to consider the different types of vehicles used for transportation and how they are designed to meet specific needs. Students begin to formulate ideas around the Can You Explain? (CYE) question.
- Explore (135 minutes)

  Students investigate questions about different types of transportation systems by using evidence from text and media assets.
- Explain (45–90 minutes)

  Students construct scientific explanations to the CYE question by including evidence of how different transportation systems function, how they can be tailored to meet different needs, and how they designed.
- Elaborate with STEM (45–90 minutes)

  Students apply their understanding of transportation systems as they learn about the work of air traffic controllers. Students investigate how aviation technologies have progressed thru time, evaluate alternative solutions to a transportation problem.<
- Evaluate (45–90 minutes)

  Students are evaluated on the state science standards, as well as Standards in ELA/Literacy and Standards in Math standards, using Board Builder and the provided concept summative assessments.

## Integration of Career Exploration, Life Literacies and Key Skills

Students will explore the careers associated with transportation systems.

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| 9.4.8.CI | Creativity and Innovation |
| 9.2.5.CAP | Career Awareness and Planning |

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| | An individual's passions, aptitude and skills can affect his/her employment and earning potential. |
| | An individual's strengths, lifestyle goals, choices, and interests affect employment and income. |
| | Gathering and evaluating knowledge and information from a variety of sources, including global perspectives, fosters creativity and innovative thinking. |
| 9.2.5.CAP.1 | Evaluate personal likes and dislikes and identify careers that might be suited to personal likes. |
| 9.2.5.CAP.2 | Identify how you might like to earn an income. |
| 9.4.8.CI.2 | Repurpose an existing resource in an innovative way (e.g., 8.2.8.NT.3). |
| 9.4.8.CI.3 | Examine challenges that may exist in the adoption of new ideas (e.g., 2.1.8.SSH, 6.1.8.CivicsPD.2). |
| 9.2.5.CAP.3 | Identify qualifications needed to pursue traditional and non-traditional careers and occupations. |
| 9.2.5.CAP.4 | Explain the reasons why some jobs and careers require specific training, skills, and certification (e.g., life guards, child care, medicine, education) and examples of these requirements. |
| 9.4.8.CI.4 | Explore the role of creativity and innovation in career pathways and industries. |
| 9.4.8.CT | Critical Thinking and Problem-solving |
| | Multiple solutions often exist to solve a problem. |
| 9.4.8.CT.1 | Evaluate diverse solutions proposed by a variety of individuals, organizations, and/or agencies to a local or global problem, such as climate change, and use critical thinking skills to predict which one(s) are likely to be effective (e.g., MS-ETS1-2). |
| 9.4.8.CT.2 | Develop multiple solutions to a problem and evaluate short- and long-term effects to determine the most plausible option (e.g., MS-ETS1-4, 6.1.8.CivicsDP.1). |
| | An essential aspect of problem solving is being able to self-reflect on why possible solutions for solving problems were or were not successful. |
| 9.4.8.CT.3 | Compare past problem-solving solutions to local, national, or global issues and analyze the factors that led to a positive or negative outcome. |
| 9.2.8.CAP.12 | Assess personal strengths, talents, values, and interests to appropriate jobs and careers to maximize career potential. |
| | Some digital tools are appropriate for gathering, organizing, analyzing, and presenting information, while other types of digital tools are appropriate for creating text, visualizations, models, and communicating with others. |
| 9.4.8.TL.3 | Select appropriate tools to organize and present information digitally. |
| CRP.K-12.CRP1 | Act as a responsible and contributing citizen and employee. |
| CRP.K-12.CRP2 | Apply appropriate academic and technical skills. |
| CRP.K-12.CRP3 | Attend to personal health and financial well-being. |
| CRP.K-12.CRP4 | Communicate clearly and effectively and with reason. |
| CRP.K-12.CRP5 | Consider the environmental, social and economic impacts of decisions. |
| CRP.K-12.CRP6 | Demonstrate creativity and innovation. |
| CRP.K-12.CRP7 | Employ valid and reliable research strategies. |
| CRP.K-12.CRP8 | Utilize critical thinking to make sense of problems and persevere in solving them. |
| CRP.K-12.CRP9 | Model integrity, ethical leadership and effective management. |
| CRP.K-12.CRP10 | Plan education and career paths aligned to personal goals. |

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| CRP.K-12.CRP11 | Use technology to enhance productivity. |
| CRP.K-12.CRP12 | Work productively in teams while using cultural global competence. |
| CAEP.9.2.8.B.1 | Research careers within the 16 Career Clusters ® and determine attributes of career success. |
| CAEP.9.2.8.B.4 | Evaluate how traditional and nontraditional careers have evolved regionally, nationally, and globally. |

## Technology Integration

Technology is fully integrated using Discovery Techbook.

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| TECH.8.2.8.C.1 | Explain how different teams/groups can contribute to the overall design of a product. |
| TECH.8.2.8.C.2 | Explain the need for optimization in a design process. |
| TECH.8.2.8.C.3 | Evaluate the function, value, and aesthetics of a technological product or system, from the perspective of the user and the producer. |
| TECH.8.2.8.C.4 | Identify the steps in the design process that would be used to solve a designated problem. |
| TECH.8.2.8.C.5a | Explain the interdependence of a subsystem that operates as part of a system. |
| TECH.8.2.8.C.5b | Create a technical sketch of a product with materials and measurements labeled. |
| TECH.8.2.8.C.CS1 | The attributes of design. |
| TECH.8.2.8.C.CS2 | The application of engineering design. |
| TECH.8.2.8.C.CS3 | The role of troubleshooting, research and development, invention and innovation and experimentation in problem solving. |

## Interdisciplinary Connections

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| LA.RST.6-8.1 | Cite specific textual evidence to support analysis of science and technical texts. |
| LA.RST.6-8.2 | Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions. |
| LA.RST.6-8.3 | Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks. |
| LA.RST.6-8.4 | Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 6-8 texts and topics. |
| LA.RST.6-8.5 | Analyze the structure an author uses to organize a text, including how the major sections contribute to the whole and to an understanding of the topic. |
| LA.RST.6-8.6 | Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text. |
| LA.RST.6-8.7 | Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table). |
| LA.RST.6-8.8 | Distinguish among facts, reasoned judgment based on research findings, and speculation in a text. |
| LA.RST.6-8.9 | Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic. |

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| LA.RST.6-8.10 | By the end of grade 8, read and comprehend science/technical texts in the grades 6-8 text complexity band independently and proficiently. |
| LA.WHST.6-8.1 | Write arguments focused on discipline-specific content. |
| MA.7.EE.B | Solve real-life and mathematical problems using numerical and algebraic expressions and equations. |
| LA.WHST.6-8.2 | Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes. |
| LA.WHST.6-8.4 | Produce clear and coherent writing in which the development, organization, voice, and style are appropriate to task, purpose, and audience. |
| LA.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. |
| LA.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. |
| LA.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. |
| LA.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. |
| LA.WHST.6-8.9 | Draw evidence from informational texts to support analysis, reflection, and research. |

## Differentiation

**See differentiation suggestions in the above lessons.**

Struggling Students

1. Using a two-column chart, ask students to compare and contrast two different examples of transportation systems.
2. Ask students which of the transportation systems featured in the Core Interactive Text they have had experience with. Can they describe some of the features of a given system and how it works?
3. Ask students what their favorite transportation system is, and why it is their favorite.

ELL

1. Assist students in identifying familiar prefixes and/or words within words for each glossary term (e.g., *propulsion* is from the Latin word *propellere*, which means "to push or drive forward").
2. Encourage students to demonstrate their understanding by drawing concepts. For example, they can create a diagram of an airplane flying and label the forces acting on it (thrust, lift, and drag).

Accelerated Students

1. Have students consider a specific transportation system (e.g., the district's school busses, local mass transit, private cars) and construct a schematic diagram of the system and its subsystems.
2. Have students choose one mode of transportation and research and diagram the history of that particular transportation mode.
3. Invite students to write an essay or opinion piece for the school newspaper on the topic: "Features of a digital-age transportation system."

Differentiation in science can be accomplished in several ways. Once you have given a pre-test to students, you know what information has already been mastered and what they still need to work on. Next, you design activities, discussions, lectures, and so on to teach information to students. The best way is to have two or three groups of students divided by ability level.

While you are instructing one group, the other groups are working on activities to further their knowledge of the concepts. For example, while you are helping one group learn the planet names in order, another group is researching climate, size, and distance from the moon of each planet. Then the groups switch, and you instruct the second group on another objective from the space unit. The first group practices writing the order of the planets and drawing a diagram of them.

Here are some ideas for the classroom when you are using differentiation in science:

- Create a tic-tac-toe board that lists different activities at different ability levels. When students aren't involved in direct instruction with you, they can work on activities from their tic-tac-toe board. These boards have nine squares, like a tic-tac-toe board; and each square lists an activity that corresponds with the science unit. For example, one solar system activity for advanced science students might be to create a power point presentation about eclipses. For beginning students, an activity might be to make a poster for one of the planets and include important data such as size, order from the sun, whether it has moons, and so on.

- Find websites on the current science unit that students can explore on their own.

- Allow students to work in small groups to create a project throughout the entire unit. For example, one group might create a solar system model to scale. Another group might write a play about the solar system. This is an activity these groups can work on while they are not working directly with you.

Differentiation in science gets students excited to learn because it challenges them to expand their knowledge and skills, instead of teaching the whole group concepts they have already mastered.

## Modifications & Accommodations

Refer to QSAC EXCEL SMALL SPED ACCOMMOCATIONS spreadsheet in this discipline.

**Modifications and Accommodations used in this unit:**

In addition to differentiated instruction, IEP's and 504 accommocations will be utilized.

## Benchmark Assessments

**Benchmark Assessments** are given periodically (e.g., at the end of every quarter or as frequently as once per month) throughout a school year to establish baseline achievement data and measure progress toward a standard or set of academic standards and goals.

**Schoolwide Benchmark assessments:**

Aimsweb benchmarks 3X a year

Linkit Benchmarks 3X a year

**Additional Benchmarks used in this unit:**

**Science Benchmarks are given in Dec. and June.**

## Formative Assessments

Assessment allows both instructor and student to monitor progress towards achieving learning objectives, and can be approached in a variety of ways. **Formative assessment** refers to tools that identify misconceptions, struggles, and learning gaps along the way and assess how to close those gaps. It includes effective tools for helping to shape learning, and can even bolster students' abilities to take ownership of their learning when they understand that the goal is to improve learning, not apply final marks (Trumbull and Lash, 2013). It can include students assessing themselves, peers, or even the instructor, through writing, quizzes, conversation, and more. In short, formative assessment occurs throughout a class or course, and seeks to improve student achievement of learning objectives through approaches that can support specific student needs (Theal and Franklin, 2010, p. 151).

**Formative Assessments used in this unit:**

See assessments located in the unit link above

## Summative Assessments

**Summative assessments** evaluate student learning, knowledge, proficiency, or success at the conclusion of an instructional period, like a unit, course, or program. Summative assessments are almost always formally graded and often heavily weighted (though they do not need to be). Summative assessment can be used to great effect in conjunction and alignment with formative assessment, and instructors can consider a variety of ways to combine these approaches.

**Summative assessments for this unit:**

See assessments located in the unit link above

**Summative Project: Transportation System for the City of Leinad.**

## Instructional Materials

See materials located in Unit above.

Discovery Techbook

Teacher made materials

Additonal labs available through NJCTL on line curriculum

## Standards

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| | Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories. |
| ETS1.A | Defining and Delimiting an Engineering Problem |
| | The more precisely a design task's criteria and constraints can be defined, the more likely it is that the designed solution will be successful. Specification of constraints includes consideration of scientific principles and other relevant knowledge that is likely to limit possible solutions. |
| MS-PS3-5 | Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object. |
| | Engaging in Argument from Evidence |
| | Engaging in argument from evidence in 6–8 builds on K–5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed worlds. |
| | Construct, use, and present oral and written arguments supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon. |
| MS-LS2 | Ecosystems: Interactions, Energy, and Dynamics |