PRODUCTS IN MOTION

SCIENCE

6

GRADE 6

This guide links the *Products in Motion* unit to the Texas Essential Knowledge and Skills (TEKS) for sixth graders. *Products in Motion* is a science unit that allows students to study force, motion, and energy as well as practical applications through simple machines. *Products in Motion* also has interdisciplinary connections to English language arts and reading and social studies disciplines. For example, students will compose procedural and persuasive texts, as outlined in the English Language Arts and Reading TEKS, and describe ways in which technology influences human interactions with the environment, as described in the Social Studies TEKS. The following document includes the applicable TEKS and the details of the *Products in Motion* unit. The final section of this document presents the applicable Texas College and Career Readiness Standards adopted by the Texas Higher Education Coordinating Board (THECB) on January 24, 2008.

Description of Unit

In this task, students study force, motion and energy and the application of these scientific principles through simple machines. Students explore the differences between potential and kinetic energy, various sources of energy, the conversion and transfer of energy in a system/circuit and real-world applications (e.g. the technologies behind a warehouse/fulfillment logistics system such as that used by Amazon.com to move products from the distribution center to the buyer). Student learning culminates in the development of a machine that moves an object (product) from one point to another. Additionally, students learn about sustainable technology and renewable energy resources and investigate how they might utilize these in their designs.

Goals

Students will meet these goals in their explorations:

- Become familiar with the six types of simple machines
- Learn the science behind how simple machines work

- Understand the differences between potential and kinetic energy
- Explore force, motion, and energy, including the Law of Conservation of Energy
- Gain an awareness of the transfer of energy in a system and how energy can be converted from one form to another (e.g., from electricity into mechanical)
- Ask questions and explore theories
- Have opportunities to generate new ideas
- Research, design and build simple machines that move an object from an origin point to a destination point
- Use scientific observation, measurement skills, and vocabulary
- Develop the essential skills of communicating, creative problem solving, and logical thinking

Teacher Directions	Additional Teacher Preparation & Notes
Elicit How many of you have received a package in the mail for something that either you, a friend, parent, or relative ordered online or over the phone? Have you ever thought about where the packaged came from, and how it travelled through its journey from the maker to you? How many of you have made something to sell in a fair or market? How does selling something change when you are not dealing with people face-to-face? If you don't know when somebody might place an order, how do you store your products so they are ready? When they are ordered, how might you send them to someone in a different geographic location?	This task is about the movement of objects by harnessing the power of physical forces using simple machines. While greatly, oversimplified from the logistics systems used by companies like Amazon.com, framing the problem around the idea of moving a product from one location to another helps students connect their learning to real world applications.
Engage Introduce students to the unit by guiding them through a web exploration of simple machines. For example, students might begin by exploring the *Simple Machines Game* by the Museum of Science and Industry Chicago.	Allow students to explore simple machines, either through this virtual game from the Museum of Science and Industry Chicago or using simple machines you supply. Ask student to describe how in his own words how machine works and how each is different from or similar to the others.

Explain

Review the physical science concepts of force, motion, and energy as well as potential versus kinetic energy. You may wish to conduct a series of lab activities to help students experience the connections between the science principles (e.g., force, motion, and the Conservation of Energy) with their applications in simple machines. Some examples include:

- *What is Energy?*
- *Forces and Motion*
- *Converting Energy*
- *Transforming Energy (Potential vs. Kinetic)*
- *Raceways*
- *The Ultimate Roller Coaster Contest*
- *Friction and Inertia*
- *Simple Machines: Levers*
- *Converting Mechanical Energy into Electrical Energy*

Additionally, students may study computer simulations such as those available from Phet Interactive Simulations (University of Colorado), in particular, the simulations entitled *The Ramp* and *The Energy Skate Park* (Note the system requirements as well as the update Java notice prior to running the simulations).

Help students connect the workings of simple machines to these scientific forces.

Explore

Ask students to conduct Internet research on the six simple machines, and discover how these form the basis for all machines. A possible starting place is the lesson *Inventor's Workshop* available through Discovery Education.

Explore the interactive site *Power Play* to experiment with combinations of simple machines in harnessing different energy types to do work.

Construct various machines that convert energy from one source to another. Examples include:

- *Build an Electric Motor*
- *Mechanical Munchie Maker*

Additionally, students might explore how machines can harness renewable energy sources. Two example activities include:

- *Using Heat from the Sun*
- *Build an Electric Turbine*

Modify this exploration to meet the needs of your students depending upon the amount of time available for this task.

Explain Invite a guest speaker or a Virtual Scientist into the classroom to talk about the opportunities and challenges involved in engineering for a high-tech world.	
Explore Once students have gained awareness and some experience with the practical applications that use these scientific principles—force, motion, and energy— introduce them to the product fulfillment and shipping logistics operation of Amazon.com. Show them a video, such as *Inside One of Amazon's Busiest Days*, *Amazon's Warehouse Processing*, or *A Tour of Amazon's Fulfillment System*. Additionally, you may wish to share this article discussing the "chaotic storage system" that Amazon uses. In this system, the company randomly shelves items to maximize storage space, then, when an order is placed, workers called "pickers" use a radio-frequency scanner to locate the item. The "picked" item is placed in a bin and sent along to the next link in an enormously complex chain of people, technology, and processes that end with the item being shipped to the customer's address.	This Explore activity is designed to help students connect the study of forces and simple machines back to the opening discussion.
Explain Lead a large group discussion following the video. Ask students to try to break down and illustrate the steps they observe in a flow chart. In what ways is the logistics operation like a system? Encourage students to try to describe as many pieces of machinery or technology they saw in the video. • What are some of the machines students see utilized in the system? • How many examples of these machines might utilize combinations of simple machines? • What are some ways the forces of motion and energy might be utilized in the system? • What are some ideas as to the energy sources that might be harnessed to operate such a system? • What are the roles of people in the system? How many different types of job functions might be needed to get a product from the creator to the buyer?	

Elaborate (Phase II)

Research process

1. **Select a topic.** Each student will select a "product" to be moved from his/her own personal collection. Objects might include CDs, books, dolls, video game packages or controllers, articles of clothing, or any other relatively small, singular object. Teachers will provide guidance on how far the object must be moved from point to point. Key constraints include classroom size and time allotted to the development of the "product moving" machine.

2. **Ask guiding questions.** Students will first need to determine the physical properties of the object that might impact the design of its transport system. Then students will need to identify at least three to five guiding questions to explore during their research. Such questions include:
   - What is the shape of the object? What are its dimensions? What is its weight?
   - Will your "product mover" work only for this particular object, or will you design it so that it might transport other students' products too?
   - Is the object fragile? If so, what might be some of the protective features you will need to incorporate into your system?
   - How quickly might you want the object to move from point to point?
   - How far must the object move? Will there be any changes in the incline between the origin and destination points?
   - What readily available materials will you use to create your system?
   - How might you power your system? What sources of energy might you use?
   - What might be some advantages to your system over other transport systems?

3. **Create a research proposal.** Create a research and development plan that identifies the following elements:
   - The name you will give to your transport system
   - The product it is designed to move
   - The energy source that will power your machine
   - The materials you plan to use in building your machine

In the Elaborate phase, students will design and construct a machine to move a product from one location to another.

- A preliminary sketch illustrating how your transport system might work
- Guiding questions for research in order to gain the knowledge you need to build the system
- A timeline for how you will proceed with research and development

4. **Conduct the research.** Once the research and development plan is approved (and checked for feasibility within the scope of the class) by the teacher, students will begin research. Collaborate with local electronics specialists, librarians, and/or technical education specialists to guide student research and development of the products. As students finalize their research, they will need to refine their product plan to include
   - updates to the technical drawing (i.e., a more formalized, computer-rendered version might be created using a program such as Google SketchUp) ,
   - flowcharts that indicate how the energy transfers through each component,
   - an identification of the simple machines in each part of the system,
   - the location of the power source, and
   - a budget and plan for sourcing the materials to be used in building.

5. **Develop the product.** Using readily available materials, students implement their ideas with the help of the teacher and/or mentors, specialists, paraprofessionals, or parent volunteers. Students should practice classroom safety procedures with regards to sharp tools, chemicals, electricity, or other potentially hazardous components.

Explain

Each student gives a demonstration of the product transport system to the class. As an optional extension, students might also create a video describing the system, similar in feel to the Amazon tour.

The product

Students research, design, and build a machine that moves an object (the product) from one point to another in the classroom. These devices (product transport systems) utilize force, motion, and/or energy and transfer that energy though combinations of simple machines. Students may choose to power their machines

using a variety of energy sources. Students should identify modifications they might make to power the system sustainably without using non-renewable sources.

Communication

Each student presents an overview of the research that led him/her to the design solution and gives a live demonstration of how the transport system works. Additionally, during an "Engineer's Debrief," students discuss in small groups the challenges they faced in building the system (and how they overcame any obstacles), modifications that might make it faster, more efficient, and greener, and possible alternative uses for the device.

Evaluate

Use the TPSP Middle School Rubric to assess each student's learning. Additionally, you may wish to develop self- or peer-assessments based on the rubric that students could use to evaluate their products.

The TPSP Middle School Rubric can be downloaded at http://www.texaspsp.org/middleschool/middle-school-assessment.php.

A completed project consists of:

1. Notes from the *Phase I* laboratory experiments on force, motion, and energy
2. The final product research and development plan
3. Drawings and flowcharts describing the system
4. A promotional poster for the final product, including photographs and persuasive text
5. A video of the live demonstration and class presentation, including the question and answer session
6. The student's summary of the "Engineer's Debrief" small group discussion, including additional research questions for further study

In what ways did the student:

- Develop sophisticated, open-ended questions about the self-selected topic;
- Use a variety of sources that access advanced content and include multiple perspectives;
- Collect data using the tools of the discipline;
- Analyze and interpret the data;
- Capture and apply their analysis through an original product; and
- Communicate his/her research findings, learning, and ideas to an audience using the language of the discipline.

Extend

The following interdisciplinary activities can be used to extend this task.

Mathematics

Analyze the throughput of your product movement system — how many items can your system move in an hour? What are the maximum and minimum sizes for items travelling through your system? What is the maximum weight? Explain how you arrived at your answers. Create a set of package design guidelines, using measurements, charts, and graphs to convey your specifications to vendors who might use your system.

Note to teachers: According to the *New Oxford American Dictionary,* ***throughput*** is the amount of items or material passing through a system or process.

Social Studies

Study how communities have managed moving goods such as food and clothing from manufacturers to individuals. How has the process changed as civilizations have developed (i.e., compare what was the process was like during hunter/gatherer societies versus the modern, connected world of online commerce). What geographic features do many cities share that might aid in the movement of goods (e.g., rivers, streams, or open waterways for ports). How have people overcome natural obstacles to moving goods (e.g., tunneling through the Rocky Mountains, reversing the flow of the Chicago river)? Some people say the world is getting smaller due to global trade. What do you think they mean by this and what do you predict will happen to global trade in the next ten years?

English language arts

The genre of science fiction often contains stories about technological marvels that we will encounter in a future time. Some of these imagined devices end up being developed and become real-world tools and technologies. Research science fiction stories written at least twenty years ago and create an inventory of the technologies depicted in the "future" of the story. How many of these ideas became realities? How many are we still waiting to come to fruition (e.g., flying cars)? Using this literary research, and building upon your knowledge of the scientific forces and simple machines, create a short science fiction story that depicts the creation of an invention that changes the world. How does the invention come into being, what are the characters like who create it, who or what in the story tries to block or destroy it, and what big global problem is the device meant to solve?

Internet Resources

http://www.energyeducation.tx.gov/
http://www.teachengineering.org/
http://www.msichicago.org/play/simplemachines/
http://littleshop.physics.colostate.edu/activities/atmos1/EnergyToys.pdf
http://www.discoveryeducation.com/teachers/free-lesson-plans/forces-and-motion.cfm
http://sciencenetlinks.com/lessons/converting-energy/
http://sciencenetlinks.com/lessons/transforming-energy/
http://www.miamisci.org/af/sln/mummy/raceways.html
http://www.discoveryeducation.com/teachers/free-lesson-plans/the-ultimate-roller-coaster-contest.cfm
http://www.nasa.gov/offices/education/programs/national/summer/education_resources/physicalscience_grades4-6/PS_inertia.html
http://www.teachengineering.org/view_lesson.php?url=collection/cub_/lessons/cub_simp_machines/cub_simp_machines_lesson03.xml
http://www.pbs.org/tesla/tt/tt02.html
http://phet.colorado.edu/
http://www.discoveryeducation.com/teachers/free-lesson-plans/inventors-workshop.cfm
http://sciencenetlinks.com/tools/power-play/
http://www.msichicago.org/online-science/activities/activity-detail/activities/build-an-electric-motor/
http://www.instructables.com/id/How-20-PBJ-Mechanical-Munchie-Maker-1/#step1
http://www.teachengineering.org/view_lesson.php?url=collection/duk_/lessons/duk_solaroven_tech_less/duk_solaroven_tech_less.xml
http://www.msichicago.org/online-science/activities/activity-detail/activities/build-a-wind-turbine-1/browseactivities/0/
http://www.ssrvideo.com/virtualscientist.html
http://www.youtube.com/watch?v=Z2Bs0nqVyqs
http://www.youtube.com/watch?v=i6H7nfHjHtY
http://www.youtube.com/watch?v=HOicZ_AgsSA
http://www.ibtimes.com/inside-amazon-warehouse-photos-909410
http://www.ssi-schaefer.de/blog/en/order-picking/chaotic-storage-amazon/

Texas Essential Knowledge and Skills

The unit may address the following TEKS:

English Language Arts and Reading:	
6.1	Reads grade-level text with fluency and comprehension
6.2	Understands new vocabulary and uses it when reading and writing
6.7	Understands, makes inferences and draws conclusions about the varied structural patterns and features of literary nonfiction and provides evidence from text to support their understanding
6.9	Analyzes, makes inferences and draws conclusions about the author's purpose in cultural, historical, and contemporary contexts and provides evidence from the text to support their understanding
6.10	Analyzes, makes inferences and draws conclusions about expository text and provides evidence from text to support their understanding
6.12	Understands how to glean and use information in procedural texts and documents
6.13	Uses comprehension skills to analyze how words, images, graphics, and sounds work together in various forms to impact meaning
6.14	Uses elements of the writing process (planning, drafting, revising, editing, and publishing) to compose text
6.17	Writes expository and procedural or work-related texts to communicate ideas and information to specific audiences for specific purposes
6.18	Writes persuasive texts to influence the attitudes or actions of a specific audience on specific issues
6.19	Understands the function of and uses the conventions of academic language when speaking and writing
6.22	Asks open-ended research questions and develops a plan for answering them
6.23	Determines, locates, and explores the full range of relevant sources addressing a research question and systematically records the information they gather
6.24	Clarifies research questions and evaluates and synthesizes collected information
6.25	Organizes and presents their ideas and information according to the purpose of the research and their audience
6.26	Uses comprehension skills to listen attentively to others in formal and informal settings
6.27	Speaks clearly and to the point, using the conventions of language
6.28	Works productively with others in teams
Science:	
6.1	For at least 40% of instructional time, conducts laboratory and field investigations following safety procedures and environmentally appropriate and ethical practices
6.2	Uses scientific inquiry methods during laboratory and field investigations
6.3	Uses critical thinking, scientific reasoning, and problem solving to make informed decisions and knows the contributions of relevant scientists

6.4	Knows how to use a variety of tools and safety equipment to conduct science inquiry
6.6	Knows matter has physical properties that can be used for classification
6.7	Knows that some of Earth's energy resources are available on a nearly perpetual basis, while others can be renewed over a relatively short period of time
6.8	Knows force and motion are related to potential and kinetic energy
6.9	Knows that the Law of Conservation of Energy states that energy can neither be created nor destroyed, it just changes form
Social Studies:	
6.7	Understands the impact of interactions between people and the physical environment on the development and conditions of places and regions
6.8	Understands the factors of production in a society's economy
6.9	Understands the various ways in which people organize economic systems
6.10	Understands categories of economic activities and the data used to measure a society's economic level
6.15	Understands the similarities and differences within and among cultures in various world societies
6.18	Understands the relationship that exists between the arts and the societies in which they are produced
6.20	Understands the influences of science and technology on contemporary societies
6.21	Applies critical-thinking skills to organize and uses information acquired through established research methodologies from a variety of valid sources, including electronic technology
6.22	Communicates in written, oral, and visual forms
6.23	Uses problem-solving and decision-making skills, working independently and with others, in a variety of settings

Texas College and Career Readiness Standards

This unit may address the following Texas College and Career Readiness Standards:

English Language Arts:	
II.A.1	Uses effective reading strategies to determine a written work's purpose and intended audience
II.A.2	Uses text features and graphics to form an overview of informational texts and to determine where to locate information
II.A.4	Draws and supports complex inferences from text to summarize, draw conclusions, and distinguish facts from simple assertions and opinions
II.A.5	Analyzes the presentation of information and the strength and quality of evidence used by the author, and judges the coherence and logic of the presentation and the credibility of an argument

II.A.9	Identifies and analyzes the audience, purpose, and message of an informational or persuasive text
III.A.1	Understands how style and content of spoken language varies in different contexts and influences the listener's understanding
III.A.2	Adjusts presentation (delivery, vocabulary, length) to particular audiences and purposes
III.B.1	Participates actively and effectively in one-on-one oral communication situations
III.B.2	Participates actively and effectively in group discussions
III.B.3	Plans and delivers focused and coherent presentations that convey clear and distinct perspectives and demonstrates solid reasoning
IV.A.1	Analyzes and evaluates the effectiveness of a public presentation
IV.A.2	Interprets a speaker's message; identifies the position taken and the evidence in support of that position
IV.A.3	Uses a variety of strategies to enhance listening comprehension
IV.B.1	Listens critically and responds appropriately to presentations
IV.B.2	Listens actively and effectively in one-on-one communication situations
IV.B.3	Listens actively and effectively in group discussions
V.A.1	Formulates research questions
V.A.2	Explores a research topic
V.A.3	Refines research topic and devises a timeline for completing work
V.B.1	Gathers relevant sources
V.B.2	Evaluates the validity and reliability of sources
V.B.3	Synthesizes and organizes information effectively
V.C.1	Designs and presents an effective product
V.C.2	Uses source material ethically

Mathematics:

VI.A.1	Plans a study
VI.B.1	Determines types of data
VI.B.2	Selects and applies appropriate visual representations of data
VI.B.3	Computes and describes summary statistics of data
VII.C.1	Applies known function models
VII.C.2	Develops a function to model a situation
VIII.A.1	Analyzes given information
VIII.A.2	Formulates a plan or strategy
VIII.A.3	Determines a solution
VIII.A.4	Justifies the solution
VIII.A.5	Evaluates the problem-solving process
VIII.B.1	Develops and evaluates convincing arguments
VIII.B.2	Uses various types of reasoning

VIII.C.3	Evaluates the problem solving process
IX.A.3	Uses mathematics as a language for reasoning, problem solving, making connections, and generalizing
IX.B.2	Summarizes and interprets mathematical information provided orally, visually, or in written form within the given context
IX.C.1	Communicates mathematical ideas, reasoning, and their implications using symbols, diagrams, graphs, and words
IX.C.2	Creates and uses representations to organize, record, and communicate mathematical ideas
IX.C.3	Explains, displays, or justifies mathematical ideas and arguments using precise mathematical language in written or oral communications
X.A.2	Connects mathematics to the study of other disciplines
X.B.1	Uses multiple representations to demonstrate links between mathematical and real-world situations
X.B.2	Understands and uses appropriate mathematical models in the natural, physical, and social sciences
X.B.3	Knows and understands the use of mathematics in a variety of careers and professions
Science:	
I.B.1	Designs and conducts scientific investigations in which hypotheses are formulated and tested
I.C.1	Collaborates on joint projects
I.C.2	Understands and applies safe procedures in the laboratory and field, including chemical, electrical, and fire safety and safe handling of live or preserved organisms
I.C.3	Demonstrates skill in the safe use of a wide variety of apparatuses, equipment, techniques, and procedures
I.D.1	Demonstrates literacy in computer use
I.D.2	Uses computer models, applications, and simulations
I.D.3	Demonstrates appropriate use of a wide variety of apparatuses, equipment, techniques, and procedures for collecting quantitative and qualitative data
I.E.1	Uses several modes of expression to describe or characterize natural patterns and phenomena. These modes of expression include narrative, numerical, graphical, pictorial, symbolic, and kinesthetic
I.E.2	Uses essential vocabulary of the discipline being studied
III.A.1	Uses correct applications of writing practices in scientific communication
III.B.1	Reads technical and scientific articles to gain understanding of interpretations, apparatuses, techniques or procedures, and data
III.B.2	Sets up apparatuses, carries out procedures, and collects specified data from a given set of appropriate instructions
III.B.3	Recognizes scientific and technical vocabulary in the field of study and uses this vocabulary to enhance clarity of communication
III.B.4	Lists, uses and gives examples of specific strategies before, during, and after reading to improve comprehension

III.C.1	Prepares and represents scientific/technical information in appropriate formats for various audiences
III.D.1	Uses search engines, databases, and other digital electronic tools effectively to locate information
III.D.2	Evaluates quality, accuracy, completeness, reliability, and currency of information from any source
IV.A.1	Recognizes how scientific discoveries are connected to technological innovations
IV.B.1	Understands how scientific research and technology have an impact on ethical and legal practices
IV.B.2	Understands how commonly held ethical beliefs impact scientific research
IV.C.1	Understands the historical development of major theories in science
IV.C.2	Recognizes the role of people in important contributions to scientific knowledge
V.B.2	Knows the processes of energy transfer
V.C.1	Recognizes patterns of change
VII.H.1	Understands the Law of Conservation of Energy and processes of heat transfer
VII.H.2	Understands energy changes and chemical reactions
VII.I.1	Understands the behavior of matter in its various states: solid, liquid, and gas
VII.I.2	Understands properties of solutions
VIII.A.2	Understands states of matter and their characteristics
VIII.A.3	Understands the concepts of mass and inertia
VIII.A.5	Understands the concepts of gravitational force and weight
VIII.C.1	Understands the fundamental concepts of kinematics
VIII.C.2	Understands forces and Newton's Laws
VIII.C.3	Understands the concept of momentum
VIII.D.1	Understands potential and kinetic energy
VIII.D.2	Understands conservation of energy
VIII.D.3	Understands the relationship of work and mechanical energy
VIII.H.2	Understands the basic laws of thermodynamics
IX.F.1	Describes matter and energy transfer in the Earth's systems
X.B.1	Understands energy transformations
X.B.2	Knows the various sources of energy for humans and other biological systems
X.C.1	Recognizes variations in population sizes, including human population and extinction, and describe mechanisms and conditions that produce these variations

Social Studies:

I.A.2	Analyzes the interaction between human communities and the environment
I.A.3	Analyzes how physical and cultural processes have shaped human communities over time
I.A.4	Evaluates the causes and effects of human migration patterns over time
I.A.5	Analyzes how various cultural regions have changed over time

I.A.6	Analyzes the relationship between geography and the development of human communities
I.E.2	Defines the concept of socialization and analyzes the role socialization plays in human development and behavior
I.F.1	Uses a variety of research and analytical tools to explore questions or issues thoroughly and fairly
I.F.2	Analyzes ethical issues in historical, cultural, and social contexts
II.B.4	Evaluates how major philosophical and intellectual concepts influence human behavior or identity
II.B.5	Explains the concepts of socioeconomic status and stratification
II.B.6	Analyzes how individual and group identities are established and change over time
IV.A.1	Identifies and analyzes the main idea(s) and point(s) of view in sources
IV.A.2	Situates an informational source in its appropriate contexts
IV.A.3	Evaluates sources from multiple perspectives
IV.A.4	Understands the differences between a primary and secondary source and uses each appropriately to conduct research and construct arguments
IV.A.5	Reads narrative texts critically
IV.A.6	Reads research data critically
IV.B.1	Uses established research methodologies
IV.B.2	Explains how historians and other social scientists develop new and competing views of past phenomena
IV.B.3	Gathers, organizes, and displays the results of data and research
IV.B.4	Identifies and collects sources
IV.C.1	Understands/interprets presentations critically
IV.D.1	Constructs a thesis that is supported by evidence
IV.D.2	Recognizes and evaluates counter-arguments
V.A.1	Uses appropriate oral communication techniques depending on the context or nature of the interaction
V.A.2	Uses conventions of standard written English
V.B.1	Attributes ideas and information to source materials and authors

Cross-Disciplinary Standards:

I.A.1	Engages in scholarly inquiry and dialogue
I.A.2	Accepts constructive criticism and revises personal views when valid evidence warrants
I.B.1	Considers arguments and conclusions of self and others
I.B.2	Constructs well-reasoned arguments to explain phenomena, validate conjectures, or support positions
I.B.3	Gathers evidence to support arguments, findings, or lines of reasoning
I.B.4	Supports or modifies claims based on the results of an inquiry
I.C.1	Analyzes a situation to identify a problem to be solved
I.C.2	Develops and applies multiple strategies to solving a problem

I.C.3	Collects evidence and data systematically and directly related to solving a problem
I.D.1	Self-monitors learning needs and seeks assistance when needed
I.D.2	Uses study habits necessary to manage academic pursuits and requirements
I.D.3	Strives for accuracy and precision
I.D.4	Perseveres to complete and master tasks
I.E.1	Works independently
I.E.2	Works collaboratively
I.F.1	Attributes ideas and information to source materials and people
I.F.2	Evaluates sources for quality of content, validity, credibility, and relevance
I.F.3	Includes the ideas of others and the complexities of the debate, issue, or problem
I.F.4	Understands and adheres to ethical codes of conduct
II.A.1	Uses effective prereading strategies
II.A.2	Uses a variety of strategies to understand the meanings of new words
II.A.3	Identifies the intended purpose and audience of the text
II.A.4	Identifies the key information and supporting details
II.A.5	Analyzes textual information critically
II.C.1	Understands which topics or questions are to be investigated
II.C.2	Explores a research topic
II.C.3	Refines research topic based on preliminary research and devises a timeline for completing work
II.C.4	Evaluates the validity and reliability of sources
II.C.5	Synthesizes and organizes information effectively
II.C.6	Designs and presents an effective product
II.C.7	Integrates source material
II.C.8	Presents final product
II.D.1	Identifies patterns or departures from patterns among data
II.D.2	Uses statistical and probabilistic skills necessary for planning an investigation, and collecting, analyzing, and interpreting data
II.D.3	Presents analyzed data and communicates findings in a variety of formats
II.E.1	Uses technology to gather information
II.E.2	Uses technology to organize, manage, and analyze information
II.E.3	Uses technology to communicate and display findings in a clear and coherent manner
II.E.4	Uses technology appropriately