

E-Learning Connections, Inc.

Circle of Learning: More Than Just Science!

Physical Science Thematic Lesson
Plans

Bonnie Goonen & Susan Pittman-Shetler



09

| | |
|--|-------------------------------------|
| Circle of Learning: There's More Than Science! | 3 |
| Looking for Newton: Physical Science Unit | 3 |
| Introduction: | 3 |
| Looking for Newton - Writing | 4 |
| Looking for Newton – Social Studies | 6 |
| Looking for Newton - Science..... | 8 |
| Looking for Newton - Reading..... | 15 |
| Looking for Newton - Mathematics..... | 16 |
| Periodic Table: Physical Science Unit | 17 |
| Introduction: | 17 |
| Periodic Table – Writing | 18 |
| Periodic Table – Social Studies..... | 21 |
| Identify the Element..... | Error! Bookmark not defined. |
| The Periodic Table of Elements | 27 |
| Periodic Table – Reading | 28 |
| Periodic Table – Mathematics | 30 |
| Samples of Periodic Table of Elements | 32 |

Circle of Learning: There's More Than Science!

There are many ways to integrate science with other academic areas. The following are two lesson plans for physical science that incorporate all subject areas into the topics of Newton's three laws of motion and it also describes a method to read the periodic table.

Integrating science into other academic areas is one way for the GED teacher to reinforce scientific concepts through transferring knowledge to other areas of instruction.

Looking for Newton: Physical Science Unit

Introduction:

You may wish to begin this lesson by dropping an apple onto the ground. Share with students the story about Sir Isaac Newton and the apple falling from the tree. Although the story is not based in fact, it is a well-known tale about Newton and the "discovery of gravity."

Although the story about the discovery of gravity is not true, Newton was responsible for identifying numerous scientific laws. These laws are a basic part of our physical world. This lesson will cover Newton's Three Laws of Motion. You may wish to begin with the science lesson to provide students with basic information on the Laws of Motion. Another strategy would be to have students first research Newton and his life

Objectives:

- Apply writing skills to scientific subject matter
- Use the skill of hypothesizing to anticipate possible outcomes of scientific experiments and why things work
- Identify and apply Newton's Three Laws to real-world situations
- Identify and apply tone and meaning to poetic works
- Discover historic happenings that resulted from Newton's Laws
- Apply knowledge of charts and tables to other subject areas
- Identify independent versus dependent variables
- Apply knowledge about science to other subject areas

Websites:

A search of the World Wide Web on Newton will provide you with massive amounts of information. Following are just a few sites, which will help to get you started.

- Fear of Physics <http://www.fearofphysics.com/>
- Isaac Newton Institute for Mathematical Studies <http://www.newton.cam.ac.uk/newton.html>
- NASA <http://liftoff.msfc.nasa.gov/toc.asp?s=Mechanics>
- Newton's 3 Laws of Motion <http://www.aloha.com/~isaac/3laws/3laws.htm>
- The Physics Classroom
<http://www.glenbrook.k12.il.us/gbssci/phys/Class/newtlaws/newtltoc.html>
- Physics4Kids http://www.physics4kids.com/files/motion_laws.html

Looking for Newton - Writing

Title: Exactly What Happened?

Overview:

Observation and documentation are important writing skills in today's world. Using Newton's Third Law of Motion and a simple experiment, this lesson will provide students with the opportunity to use the written language to explain what happened in their project.

Materials:

- Regular sheet of bond paper
- Sharpened fat pencil
- Ruler
- Cellophane tape
- Scissors
- A straw (thinner than the pencil)
- Paper and pen to use for writing assignment

Procedure/Guided Practice:

Students should complete the following simple activity. The activity requires that they follow a step-by-step written procedure. You will notice that the resulting project may differ from student to student.

When the students have finished their project, they should write a summary of their results. If the project worked, they should describe what occurred and a possible rationale. If the project did not work, they should explain what the problem was and possible changes that could be made to improve the project. The objective of the writing assignment is to provide a complete explanation of the project and justification for why or why it did not work.

Provide students with the following procedure and paper and pen with which to document their results. After they have completed the project, they should use their notes to write their formal results.

Procedure

- Cut a rectangle (13 cm x 2 cm) and roll it tightly around the pencil. Tape it and remove from the pencil.
- Cut one end of the paper cylinder to make it a cone and put it back on the pencil.
- Slide the cut end onto the sharpened tip of the pencil, squeeze and tape the paper together in such a way that it is completely sealed forming a cone-shaped end.
- Remove the paper cone from the pencil and check the seal by gently blowing into the cylinder.
- Draw and cut out two fins or flaps. Fold them and tape the fins near the open end of the cylinder.
- Slip the straw into the rocket's open end and blow sharply to launch the rocket. Make sure that the rocket is not aiming at anyone to avoid eye injury.

To assist students in writing a summary of what was learned from doing the experiment/project, provide them with the following three-paragraph format to follow.

Essential Elements in Writing a Scientific Summary

The following is a three-paragraph format to follow in writing your conclusion or summary. The outline is a guide to help you include the necessary information. Adhere to all writing rules in completing your summary. Treat it as though you were writing a formal three-paragraph essay.

1. Paragraph One

- In your own words describe the basic project/experiment.
- Discuss any terms that were relevant to understanding and conducting the experiment/project.

2. Paragraph Two

- Restate your hypothesis and your reason for this prediction.
- Summarize the procedure.
- Explain the basic steps that you took and any safety precautions.

3. Paragraph Three

- Describe the outcome of the experiment/project.
- Describe why the experiment/project worked or why the experiment/project did not work.
- Analyze any problems with the experiment/project and steps that could be taken to improve the outcome.
- Conclude the summary by explaining exactly what was/was not accomplished or learned from completing the experiment/project.

Evaluation:

Have students show their project to the class and read their summary aloud. Have the students compare and contrast the different results from the same directions. Discuss the importance of reading and following directions and good observation in writing a “scientific summary.” You may wish to have students rewrite the procedure for this project. What types of changes would make the directions more easily followed? Would graphics help? Would an introductory paragraph assist a person in understanding what is required?

Discuss how the type of writing used for a project summary is similar to certain types of prompts on the GED Language Arts, Writing Test.

Title: The Space Race

Overview:

Rome wasn't built in a day and neither was America's space program. It took decades of study and exploration to reach the point where astronauts and cosmonauts could live together in space for months at a time as they do now on the International Space Station (ISS). In fact, at one time America and Russia were in fierce competition.

The whole "space race" concept was underscored in a 1961 speech where President John F. Kennedy declared America's resolve to land a human on the Moon by 1970. The U.S.S.R. (Union of Soviet Socialist Republic, now known as Russia) and the United States had been disagreeing on things since 1917. When World War II ended in 1945, the Cold War began.

The Cold War was not actually a real war; it was mainly a big competition for military leadership. It was more of a political battle than anything else. One of the main disagreements between the two countries was on the other's type of government. (The U.S.S.R. was communist, while the U.S. had a democratic government.) During the Cold War, both countries thought that the other was trying to expand their form of government in unjust ways. The Soviets would be tightly controlling the areas that they thought were important, while the U.S. was trying to convince all nations to be independent and democratic. These disagreements, along with mistrust, rumors, and misunderstanding, started the Cold War. In the Cold War, both sides thought their view of everything was right, so strived to strengthen their military power.

The Space Race grew out of the Cold War. Space was a crucial arena for this rivalry. So what does Newton have to do with the space race? Mass, acceleration, and thrust. Rockets operate according to Newton's Laws of Motion.

Space was a crucial arena for this rivalry. Before a watchful world, each side sought to demonstrate its superiority through impressive feats in rocketry and space flight. Secret satellites kept a wary eye on the adversary.

At the end of the Cold War, the United States and Russia agreed to build a space station and pursue other joint ventures in space. A contest that began in fear and enmity has become a partnership.

Materials:

- Computers and Internet access
- Printed materials on the historic period of the 1950s through the 1970s
- Index cards

Procedure/Guided Practice:

During the early years of the Space Race, success was marked by headline-making "firsts": the first satellite, first robotic spacecraft to the Moon, first man in space, first woman in space, and first space walk.

Have students brainstorm names of astronauts from NASA space missions. For each astronaut, ask students if they know why his or her flight was significant. Have students select a specific astronaut and write his/her name on an index card along with the date of the flight and any significant details regarding the flight.

Next, have students identify a historic event that occurred in the same year as the space mission they selected. Have them write this event on another card.

Use the cards to play a matching game where students must match the space event to a historic event.

Examples might include such things as:

- 1961
- On May 1961, American astronaut Alan Shepard went briefly into space, but not into orbit, on the Mercury 3 mission.
- On May 1961, John F. Kennedy set the goal of putting a man on the Moon before the end of the decade through his famous speech - "I believe that this nation should commit itself to achieving the goal, before this decade is out, of landing a man on the Moon and returning him safely to the Earth. No single space project...will be more exciting, or more impressive to mankind, or more important...and none will be so difficult or expensive to accomplish...."
- President John F. Kennedy, 1961
- 1969
- U.S. astronaut Neil Armstrong landed on the Moon in 1969 and stated: "That's one small step for man, one giant leap for mankind."
- President Nixon states he will end the War in Vietnam by 1970

You may wish to use some of the following NASA websites:

- <http://www.hq.nasa.gov/office/pao/History/humansp.html>
- <http://www.spaceflight.nasa.gov/history/>
- <http://spaceflight.nasa.gov/gallery/index.html>
- <http://www-pao.ksc.nasa.gov/kscpao/factoids/hundred.htm> (NASA's First Hundred Manned Space Flights)
- National Space and Air Museum <http://www.nasm.si.edu/galleries/gal114/gal114.htm>
- A site to provide information on what occurred in history on a specific date is: Any Day in History at <http://www.scopesys.com/today/>.

Evaluation:

Have students choose teams and compete against each other in playing Space Race match. As a class, discuss the impact of the Cold War on the Space Race. Ask students whether or not the end of the Cold War has had an impact on our interest in space. Why or why not?

Title: What Law Do I Want?

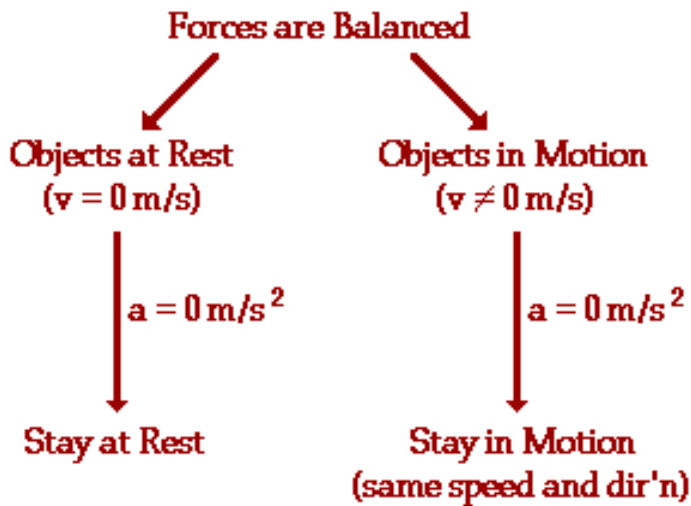
Overview:

Provide students with an overview of Newton's Laws. The following will give you the basic information that you need.

Newton's First Law of Motion – Objects keep on doing what they're doing! (Law of Inertia)

An object at rest tends to stay at rest and an object in motion tends to stay in motion with the same speed and in the same direction unless acted upon by an unbalanced force. There are two parts to this statement – one that predicts the behavior of stationary objects and the other, which predicts the behavior of moving objects.

The following is a graphic depicting Newton's First Law of Motion:



Example:

- Relay race. If you carry water around a racetrack, there is a tendency for it to spill during specific times, such as when:
- The container is at rest and you attempt to move it
- The container is in motion and you attempt to stop it
- The container is moving in one direction and you attempt to change its direction

Newton's Second Law of Motion

The acceleration of an object is produced by a net force that is:

- Directly proportional to the magnitude of the net force
- In the same direction as the net force

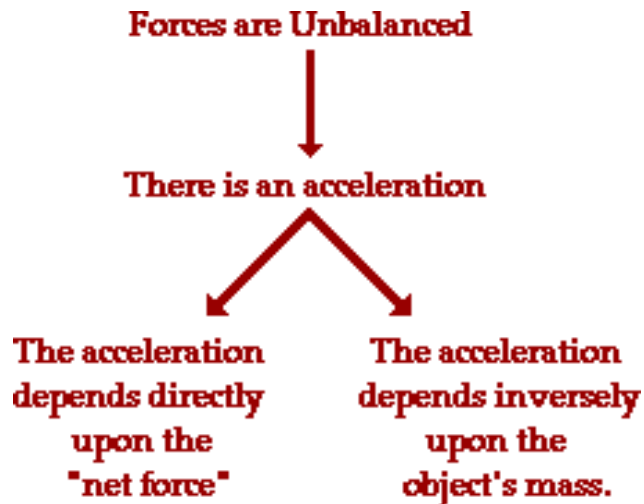
- Inversely proportional to the mass of that object

An object will move in the direction of the force acting upon it and the force that an object will have depends on its mass and its acceleration.

Newton's Second Law of Motion pertains to the behavior of objects for which all existing forces are not balanced. The Second Law states that the acceleration of an object is dependent upon two variables:

- The net force acting upon the object
- The mass of the object

Below is an example of how Newton's Second Law works:



Everyone unconsciously knows the Second Law - heavier objects require more force to move the same distance than do lighter objects. The Second Law, however, gives us an exact relationship between force, mass, and acceleration.

Example:

Take students outside and have them stand on a line. Ask them to throw a ball as far as they can. Then have them throw a ball that has a different size or weight. Measure off the distance of each ball and calculate the difference. Have them compare the distance of the balls. Continue to question them until they hit on the concept that because they have different size or weight they don't go as far. Explain to them Newton's Second Law. Have students record in their journal what they did, what happened, why they think it happened, and Newton's law.

Newton's Third Law of Motion - You Can't Touch Without Being Touched

For every action, there is an equal (in size) and opposite (in direction) reaction force.

Example:

While driving, Anna Litical observed a bug striking the windshield of her car. Obviously, this is a case of Newton's Third Law of Motion. The bug hits the windshield and the windshield hits the bug. Which of the two forces is greater: the force on the bug or the force on the windshield?

Trick question! The forces are equal. The fact that the bug splatters only means that due to its smaller mass it is less able to maintain shape in response to the larger acceleration of the interaction.

The interaction between a baseball bat and a baseball - a bowling ball pushes a pin rightwards and the pin pushes the ball leftwards - compressed air pushes a balloon wall outwards and the balloon wall pushes compressed air inwards - all are examples of Newton's Third Law of Motion.

Materials:

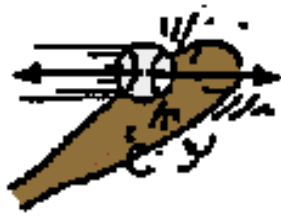
- Handout A for Newton Activity (one for each group – you may wish to make these handouts on poster paper)
- Envelopes with sample activities of each law (Handout B divided into separate strips – one strip for each activity)
- Answer Sheet (Handout B in its entirety)

Procedure/Guided Practice:

After you have provided students with the basics, see how well they can do by matching the activity to the law. Divide the class into small groups. Give each group an empty chart divided into three columns or use the attached worksheet. Give each group an envelope into which you have placed strips with each of the sample activities provided (see handout B). Students should match the activity to the law.

Evaluation:

Have students share their results with the class. Discuss the “why” of each example, especially if there is disagreement. Refer to the actual law and what it means.



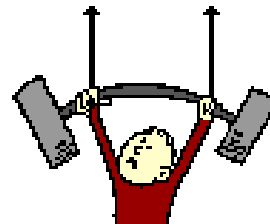
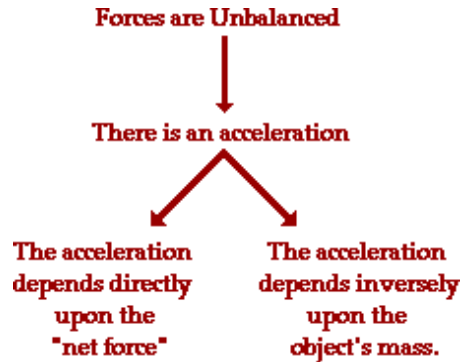
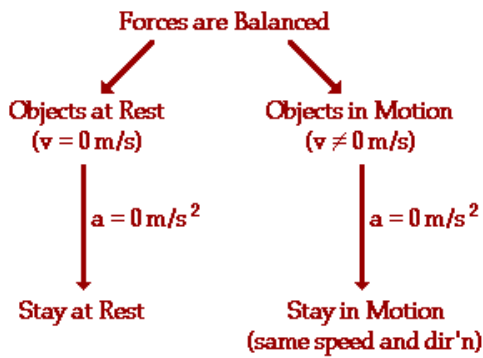
To dislodge ketchup from the bottom of a ketchup bottle, the bottle is often turned upside down, thrust downward at a high speed and then abruptly halted.

Driving at highway speed, you quickly brake. The force of the road on the locked wheels provides the unbalanced force to change the car's state of motion, yet there is no unbalanced force to change your own state of motion.

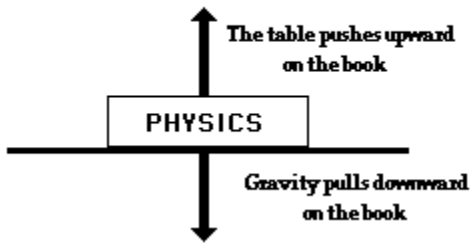
Newton's law that supports the wearing of a seatbelt.

Acceleration = $\frac{\text{Force}}{\text{Mass}}$

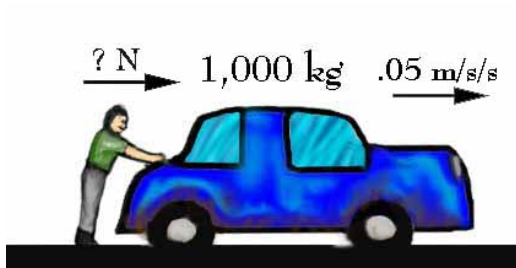
Balls of different sizes and weights travel different distances when thrown.



The forces on the book are balanced.



The force of gravity on an individual walking down a steep hill.



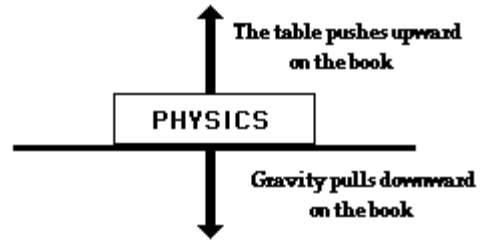
Bonnie is holding a cup full of coffee as she walks around the room talking. Not a drop is spilled.

A fish who is swimming in the lake or a bird who is flying in the air.

A large roller coaster is rapidly accelerating while it is going through curves, turns, and twists and yet it stays on the track.

A rocket accelerates in space.

The forces on the book are balanced.



The forces on the person are balanced.



While driving, you notice a bug striking the windshield of the car.


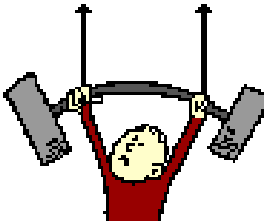
Handout A

Looking for Newton

| Newton's First Law of Motion | Newton's Second Law of Motion | Newton's Third Law of Motion |
|---|--|---|
| | | |

Handout B

Looking for Newton

| Newton's First Law of Motion | Newton's Second Law of Motion | Newton's Third Law of Motion |
|---|---|---|
| <div style="text-align: center; margin-bottom: 10px;">Forces are Balanced</div> <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p>Objects at Rest ($v = 0 \text{ m/s}$)</p> <p>$a = 0 \text{ m/s}^2$</p> <p>Stay at Rest</p> </div> <div style="text-align: center;"> <p>Objects in Motion ($v \neq 0 \text{ m/s}$)</p> <p>$a = 0 \text{ m/s}^2$</p> <p>Stay in Motion (same speed and dir'n)</p> </div> </div> | <div style="text-align: center; margin-bottom: 10px;">Forces are Unbalanced</div> <div style="text-align: center; margin-bottom: 10px;">There is an acceleration</div> <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p>The acceleration depends directly upon the "net force"</p> </div> <div style="text-align: center;"> <p>The acceleration depends inversely upon the object's mass.</p> </div> </div> |   |
| <p>Driving at highway speed, you quickly brake. The force of the road on the locked wheels provides the unbalanced force to change the car's state of motion, yet there is no unbalanced force to change your own state of motion.</p> | <p>Acceleration = $\frac{\text{Force}}{\text{Mass}}$</p> | |
| <p>Newton's law that supports the wearing of a seatbelt.</p> | <p>Balls of different sizes and weights travel different distances when thrown.</p> | |

To dislodge ketchup from the bottom of a ketchup bottle, the bottle is often turned upside down, thrust downward at a high speed and then abruptly halted.

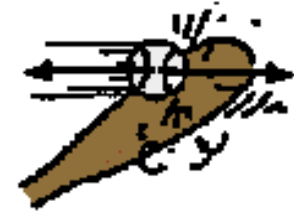
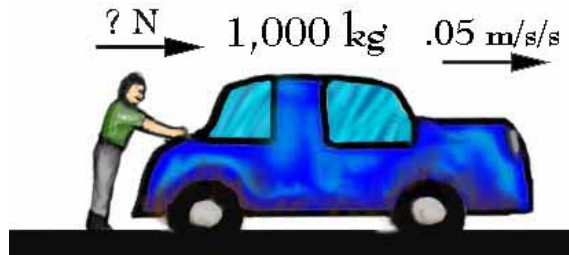
Bonnie is holding a cup full of coffee as she walks around the room talking. Not a drop is spilled.

The forces on the person are balanced.



A large roller coaster is rapidly accelerating while it is going through curves, turns, and twists and yet it stays on the track.

The force of gravity on an individual walking down a steep hill.

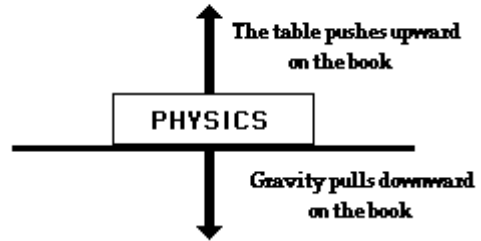


A rocket accelerates in space.

A fish who is swimming in the lake or a bird who is flying in the air.

While driving, you notice a bug striking the windshield of the car.

The forces on the book are balanced.



Looking for Newton - Reading

Overview:

Poetry often exhibits some sort of rhyme scheme. Begin the lesson talking about rhyming words and how certain types of poetry follow a very strict rhyme scheme. An example is a limerick. Limericks are five lined poems that contain a pun or clever twist about the subject. A limerick has a definite rhyme scheme where the end of first, second, and fifth lines rhyme and the end of the third and fourth lines rhyme. Limericks are an excellent way of teaching students how to analyze an author's tone and underlying meaning. Students can also quickly learn how to write a basic limerick. Creating the pun or clever twist, however, will take work!

Materials:

- Limerick on Newton
- Limerick template
- Thesaurus
- Rhyming dictionary

Procedure/Guided Practice:

- Read the following limerick on Newton:

Newton was brilliant of mind,
A genius of rarest kind,
His new laws of motion,
Caused quite a commotion,
But Leibniz shared his best find.

- Have the students outline the rhyme scheme of the limerick (a a b b a).
- Next have them identify the pun or clever twist of the limerick by asking what was the author's intent. Students do not have to have historic background knowledge to use their evaluation skills to determine that Newton and Leibniz must have both been working on the same basic ideas. Newton devised his famous laws of motion between 1684 and 1686.

Although he had the ideas earlier (1665-6), Newton shares credit for creating the study of calculus with Wilhelm Gottfreid Leibniz (published 1684). However, in their day there was much acrimony between them. Thus, the limerick's pun is that although Newton's name is attached to the laws of motion, the credit for the laws includes the name of Gottfreid Leibniz.

Have students identify another topic related to Newton's Laws of Motion and create their own limerick. You may wish to help them get started by brainstorming rhyming words for the different topics/terms.

Evaluation:

Have students read aloud their limericks to the class. Have the class identify the pun or creative twist for each of the limericks. This will help them in identifying tone and meaning in writings.

Looking for Newton - Mathematics

Title: Graphing Inertia: An Oxymoron?

Overview:

Inertia is one of the laws of Newton. Completing an experiment and using the data to graph the results is a skill needed in both science and mathematics. Have students complete the following activity and develop an appropriate type of graph. Discuss common graph types and their purposes: line graphs generally show trends, bar graphs show comparisons, circle graphs show percentages of a whole, etc.

Materials:

- Two liter soda bottle
- Rubber band
- 30 cm. Of string
- Scissors
- Ruler
- Water
- Graph paper and pencil

Procedure/Guided Practice:

Discuss that identifying and graphing variables is part of both science and math. Have students complete the following experiment to demonstrate the effect of weight on inertia. Have them compile the data and then use the appropriate type of graph to plot their information.

Procedure

- Tie the string to the rubber band and put the rubber band around the bottom of the bottle.
- Pull on the string until the bottle starts to move.
- Measure the amount that the rubber band stretches.
- Repeat the steps with different amounts of water in the bottle.
- Chart the data.

Questions to ask regarding charting data:

- What is the independent variable? What is the dependent variable?
- Which data should be graphed on the horizontal axis of the graph? Why?
- Which data should be graphed on the vertical axis of the graph? Why?
- What intervals should be used on the graph? Quarts? Pints? Milliliters? Inches? Feet?
- What happened when more water was added to the bottle?
- Does the stretch of the rubber band depend on how hard one pulled the bottle or how much water was in the bottle?

You may wish to remind students that the amount of water used was measured in milliliters and the distance that the rubber band was stretched was measured in centimeters.

Evaluation:

Have students compare and contrast their graphs and provide a reason for choosing a specific graph type.

Periodic Table: Physical Science Unit

Introduction:

Ask three volunteers to stand at the front of the class. Put two of them together and ask the third to step off to the side for a moment. Ask the class what similar characteristics the two students share - in other words, why would these two be grouped together? List the students' responses on the board. Encourage students to look for as many similarities as possible. Now separate the two and ask the third student to stand next to one member of the pair. Repeat the exercise. Compare the two lists of characteristics. Discuss with the class the similarities and differences in the lists.

The Periodic Table was developed based on similarities and differences in three types of elements of atoms, similar to the above activity. Discuss how this lesson will provide students with information on atoms – the basis of everything in the universe. – and how they will use this information in each of the areas of the GED Tests.

You may wish to begin with the science lesson to provide students with basic information on the Periodic Table. Another strategy would be to have students first research the historic period in which Mendeleev lived (social studies) or to read the biography on Mendeleev (writing).

Objectives:

- Identify the scientist who first wrote the Periodic Table
- State or write specific data related to the history of the Periodic Table
- Demonstrate an understanding of the Periodic Table by identifying the different parts
- Identify elements by symbols and names
- Demonstrate an understanding of the historic times that surrounded Mendeleev's life
- Apply writing skills to scientific subject matter
- Apply knowledge of charts and tables to other subject areas
- Apply knowledge about science to other subject areas

Websites:

A search of the World Wide Web on the topic of the Periodic Table will provide you with massive amounts of information. Following are just a few sites, which will help to get you started on this fascinating topic:

- <http://library.thinkquest.org/>
- <http://www.chem.msu.su/eng/misc/mendeleev/>
- <http://www.quia.com/>
- <http://ptoe.move.to/>
- <http://www.woodrow.org/teachers/ci/1992/Mendeleev.html>
- <http://www.chemistry.co.nz/mendeleev.htm>
- <http://www.chemicalelements.com/>
- <http://highschoolhub.org/hub/chem.cfm> (printable version of periodic table)
- <http://worksheets.teach-nology.com/science/element/periodic/> (printable version of periodic table for handout)
- <http://www.uky.edu/Projects/Chemcomics/>
- <http://www.woodrow.org/teachers/ci/1992/Mendeleev.html>
- <http://ad.doubleclick.net/646906/MGBv3.html> (an interactive game)

- <http://pearl1.lanl.gov/periodic/default.htm> (interactive periodic table)
- <http://www.colorado.edu/physics/2000/applets/a2.html> (interactive periodic table site)

Periodic Table – Writing

Title: Getting Personal/Autobiographies

Overview:

Biographies and autobiographies are ways of learning about a person's life. Mendeleev had a very interesting life in a historic time period that was filled with strife and turmoil. To help students better understand the "author" of the Periodic Table, use this lesson to have students first read a short biography on Mendeleev. Then have students use a concept map/graphic organizer to outline important events in their own lives. From the information in the organizer, students should write a five-paragraph essay incorporating the different time periods and important details in their lives. Have the students proceed through the different stages of the writing process.

Materials:

- Overhead transparencies
- Sample concept maps/graphic organizers
- Biography of Mendeleev (located at the end of the lesson)

Procedure/Guided Practice:

Read and discuss the biography of Dmitri Mendeleev, the Russian scientist who first created the Periodic Table. Briefly discuss the similarities and differences of a biography versus an autobiography. Students may wish to identify different biographies/autobiographies that they have read.

Have students identify the different elements or details that are provided in the biography on Mendeleev. Have students organize the different elements into categories, such as birth, education, adult life, etc. You may also wish to follow the reading of the biography with questions about the passage. The following are samples that you may wish to use.

- Where and when was Mendeleev born?
- What properties of the elements did Mendeleev use to bring organizing the elements?
- Explain the process by which Mendeleev designed the first Periodic Table. Give details. By what property did Mendeleev arrange the elements?
- What other important contributions did Mendeleev make to the scientific community?

Using an overhead, brainstorm events from students' lives. Ideas may include the birth of children, marriage, moves, first day on a job, school, a time when the person won an award or game, etc.

Draw a basic graphic organizer on the overhead. Show students how to organize the different ideas through the use of graphics. You may wish to first draw a graphic organizer or concept map of your own life. Show students how the ideas that are included can then create sentences that form paragraphs.

Ask students to draw a similar graphic organizer depicting either a scene from their own life or an overview of their life.

When they are they finished, have students write their autobiographies using the information from the graphic organizer. Students should use a basic five-paragraph essay structure.

Evaluation:

Have students implement peer revising using questioning strategies. Students should switch papers, read each other's narrative, and write down five questions to help their peers further develop their autobiographies.

Have students assess their own autobiographies through the use of the GED Language Arts, Writing, Four Point Rubric Scale.

Analytically score the autobiographies based on a predetermined criteria, i.e. today, we will look at how you use punctuation in your writing.

Dmitri Mendeleev (1834-1907)

Dmitri Ivanovich Mendeleev was born in Tobolsk, Siberia, on February 7, 1834. The blonde-haired, blue-eyed boy was the youngest of fourteen children. However, some authorities say that Maria Dmitrievna Korniliev and Ivan Pavolovitch Mendeleev had eleven or seventeen children.

Dmitri's father died when he was quite young, leaving his mother to support the large family. Because his father had been a teacher, his mother had to go to work in a glass factory.

Dmitri, being the youngest, appeared to be his mother's favorite and was provided as many opportunities as she could afford. Mendeleev's childhood was influenced not only by his mother, but also by the chemists in the glass factory in which his mother worked, and by his sister's husband, a teacher who taught him the science of the day.

As Mendeleev grew older, it became apparent that he had an exceptional comprehension of complex topics. Through major sacrifices by his mother, Mendeleev entered the Institute of St. Petersburg to study science. During this time, his mother and sister both died from tuberculosis. Mendeleev also was struck with an illness that caused him to be bedridden for an entire year. Diagnosed as having tuberculosis and only two years to live, Mendeleev moved to the Crimean Peninsula to begin his life's ambition of scientific research. This move was fortuitous as his health improved and he was able to both teach and continue his studies and research.

Mendeleev's life was filled with both successes and failures. Known as the father of the periodic table of elements, Mendeleev spent much of his life identifying patterns in elements. His hypothesis was that elements have similar chemical and physical properties and that these similarities were the key to unlocking the hidden pattern of the elements.

In the late 1860s, Mendeleev began working on the periodic table of properties. To accomplish this feat, Mendeleev organized all the known information for every element. He began by writing all of the facts about the elements on individual cards. The information included such things as the elements' melting points, densities, colors, atomic masses (the average mass of one atom of that element), and bonding powers (the number of chemical bonds an element can form). Once Mendeleev's cards were made, he continued to arrange them until he noticed that patterns appeared when the elements were arranged in order of increasing atomic mass. By arranging all of the 63 elements then known by their atomic weights, he managed to organize them into groups possessing similar properties. He called his table a periodic table because periodic means that there is a repeating pattern – the properties of the elements repeat with each row or period of the table. Where a gap existed in the table, he predicted a new element would one day be found and deduced its properties. Three of those elements were found during his lifetime—gallium, scandium, and germanium. They provided the strongest support for his periodic table, a cornerstone both in chemistry and in man's understanding of how the universe is put together.

During his lifetime, Mendeleev also wrote and published the first chemistry textbook, a two-volume work called *Principles of Chemistry*.

Throughout his life, Mendeleev dedicated his life to research and education. He made it his special responsibility to educate people wherever he would go. When he traveled, he would ride in the third class section of the train just to share findings with peasants over a cup of tea. However, Mendeleev was also a product of his times. Russia was in political turmoil during his lifetime, which resulted in his being fired from the University of St. Petersburg for his potential to lead students to an uprising. Mendeleev used this experience in later writings to express his political viewpoints.

Mendeleev accomplished much during his lifetime. His research and publications number well over 250. His research was also responsible for improving technological advances in Russia. Some of his studies lead to the development of an accurate barometer and studies in meteorology.

Mendeleev died on January 20, 1907, at the age of 73.

Title: The Time of Mendeleev

Overview:

The Imperial Period of Russian History

The Romanov Dynasty began in 1613 and ended with the Bolshevik Revolution of 1917. To begin the lesson, have students explore Russia's rich history through the lives of some of its most famous leaders. By using the following website, students can click on a date and meet with the rulers of the House of Romanov. To begin have them meet the Czars face-to-face at:
<http://www2.sptimes.com/Treasures/TC.2.3.html>

Materials:

- Chart paper and markers
- Computers with Internet access
- Websites or materials on Russian History of the 1800s

Procedure/Guided Practice:

Mendeleev lived during a very strife filled era of Russian history. At one point in his career, he was fired from the University of St. Petersburg due to the concern that he would assist the students in rebelling. Knowing about the time in which a person lived is important in understanding a person's accomplishments and often times the reasons for what and why they did something. One method to understand basic historic concepts is through looking at timelines.

Reading a timeline is an important skill for the GED Tests. Have students make a timeline of Russian history during the life of Mendeleev. Students may choose to work together and create a timeline using chart paper that can be placed on the classroom wall. Timelines can use script to identify important periods or graphics and script.

Assist students in identifying major events that occurred during the 1800s in Russia. Write these events on chart paper. Discuss their importance and their potential impact on Mendeleev.

There are numerous excellent websites to assist students in creating a timeline. A good place to begin is Chronology of Russian History – The Imperial Period at:
<http://www.departments.bucknell.edu/russian/chrono2.html>

Other web resources for this project include:

- The Face of Russia – PBS Online – great interactivity and timeline.
- <http://www.pbs.org/weta/faceofrussia/>
- The World Wide Web Virtual Library – Russian History Index
- <http://www.iue.it/LIB/SISSCO/VL/hist-russia/Index.html>
- A Chronology of Russian History – Bucknell University, Lewisburg, PA
- <http://www.departments.bucknell.edu/russian/chrono.html>

Evaluation: Have students transfer their knowledge of timelines to United States history through developing a subject timeline of a specific era, such as the Road to Independence (1700s), Modern Warfare (WWI to today), Westward Expansion (1800s), etc.

Periodic Table – Science

Title: Where's the Period in the Periodic Tables?

Overview:

Information on the Periodic Table

Atoms are the basis of chemistry. In fact, they are the basis for everything in the Universe. The world to your eyes might be made up of animals, plants, water and a bunch of other stuff. All of that stuff is made up of very small pieces. Eventually when you find the smallest pieces, you find atoms. Atoms are the smallest pieces of a specific ELEMENT. Because they are unique for each element, an oxygen (O) atom looks different than a sodium (Na) atom. There are different atoms for each element and they combine together to build the world you see around you. When those atoms combine they create compounds.

Atom Basics

Elements are the building blocks of all matter. As far as we know, there are only so many basic elements. Up to this point in time, we have discovered/created over 100. While there may be more out there to discover, the basic elements remain the same. Iron atoms found on Earth are identical to Iron atoms found on meteorites. The Iron atoms on Mars that make the soil red are the same too. It is important to understand that although there may be new reactions and compounds, the elements will remain the same.

A List of Elements

Provide students with a Periodic Table. The Periodic Table is organized like a big grid. The elements are placed in specific places because of the way they look and act. There are ROWS (left to right) and COLUMNS (up and down). When you look at a Periodic Table, each of the rows is considered to be different PERIODS (like in PERIODic Table). In the Periodic Table, elements have something in common if they are in the same row. All of the elements in a period have the same number of atomic SHELLS. Every element in the top row (the first period) has one shell for its electrons. All of the elements in the second row (the second period) have two shells for their electrons. It goes down the Periodic Table in that type of order. At this time, the maximum number of shells is seven.

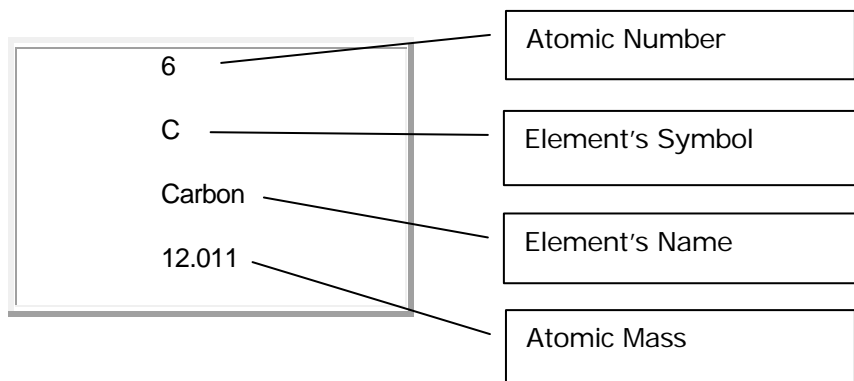
The Periodic Table has a special name for its columns too. When a column goes from top to bottom, it's called a GROUP. The elements in a group have the same number of electrons in their outer shell. Every element in the first column (group one) has one electron in its outer shell. Every element on the second column (group two) has two electrons in the outer shell. By counting the columns, you can know how many electrons are in the outer shell.

There are some exceptions to this rule. HYDROGEN is special. Hydrogen can have the talents and electrons of two groups, one and seven. To scientists, Hydrogen is sometimes missing an electron and sometimes it has an extra.

HELIUM is another exception. Helium is different than all of the other elements. It can only have two electrons in its outer shell. Even though it only has two it is still grouped with elements that have eight. The elements in between, with the gray color, are called TRANSITION elements. They have special electron rules.

Reading a Periodic Table

When you look at the Periodic Table, you should notice that each box represents a different element. Each box contains vital information about the element, including its name, symbol, atomic number, and atomic mass. Look at the sample box below for a description of each of these pieces of information.



The top number is the atomic number. Every element has its own unique atomic number. The atomic number tells how many protons are in one atom of that element. Since no two elements have the same atomic number, no two elements have the same number of protons.

The large letter is the element's symbol and just below that is the element's name. Each element has its own unique symbol and name. It is often very useful to memorize symbols and names for elements, especially the more commonly used elements.

Below the name is the element's atomic mass. The atomic mass is the mass in atomic mass units for all possible isotopes of that element. The atomic mass essentially gives you an estimate of how massive one atom of that element is.

Materials:

- Copies of the Periodic Table for each student
- Background information on the Periodic Table
- Overhead and transparencies on different elements
- Worksheets (as appropriate)
- Computer and Internet connection for use with websites on the Periodic Table

Procedure/Guided Practice:

Give students a list of element symbols and have them match them with the correct element.

Give students a list of characteristics for a group of elements and have them complete sample entries from the Periodic Table to fill in the missing information.

Have students write a short paragraph explaining what they learned. Make the task more interesting by scoring it through the correct use of the following words, which will earn them 10 points for each word. Word list: Periodic Table, atomic weight, atomic number, element, electrons, ions, metal, nonmetal, metalloid, and symbol.

Have students complete a graphic organizer on the Periodic Table.

The following pages include sample worksheets that you may wish to use in the classroom for the above activities.

Evaluation:

Use the sample worksheets to evaluate students' knowledge or provide GED like questions regarding the Periodic Table. You may also wish to have students create their own charts and graphs and develop questions.

Identify the Element

Directions: Give the name for each of the element symbols below. Calculate the number of electron, proton, and neutrons that compose each element.

| Symbol | Element | # of Protons | # of Electrons | # of Neutrons |
|--------|---------|--------------|----------------|---------------|
| Ni | | | | |
| Os | | | | |
| F | | | | |
| Ca | | | | |
| Ba | | | | |
| Pb | | | | |
| I | | | | |
| Ra | | | | |
| Pt | | | | |
| Pu | | | | |
| Si | | | | |
| Xe | | | | |

Identify the Symbol

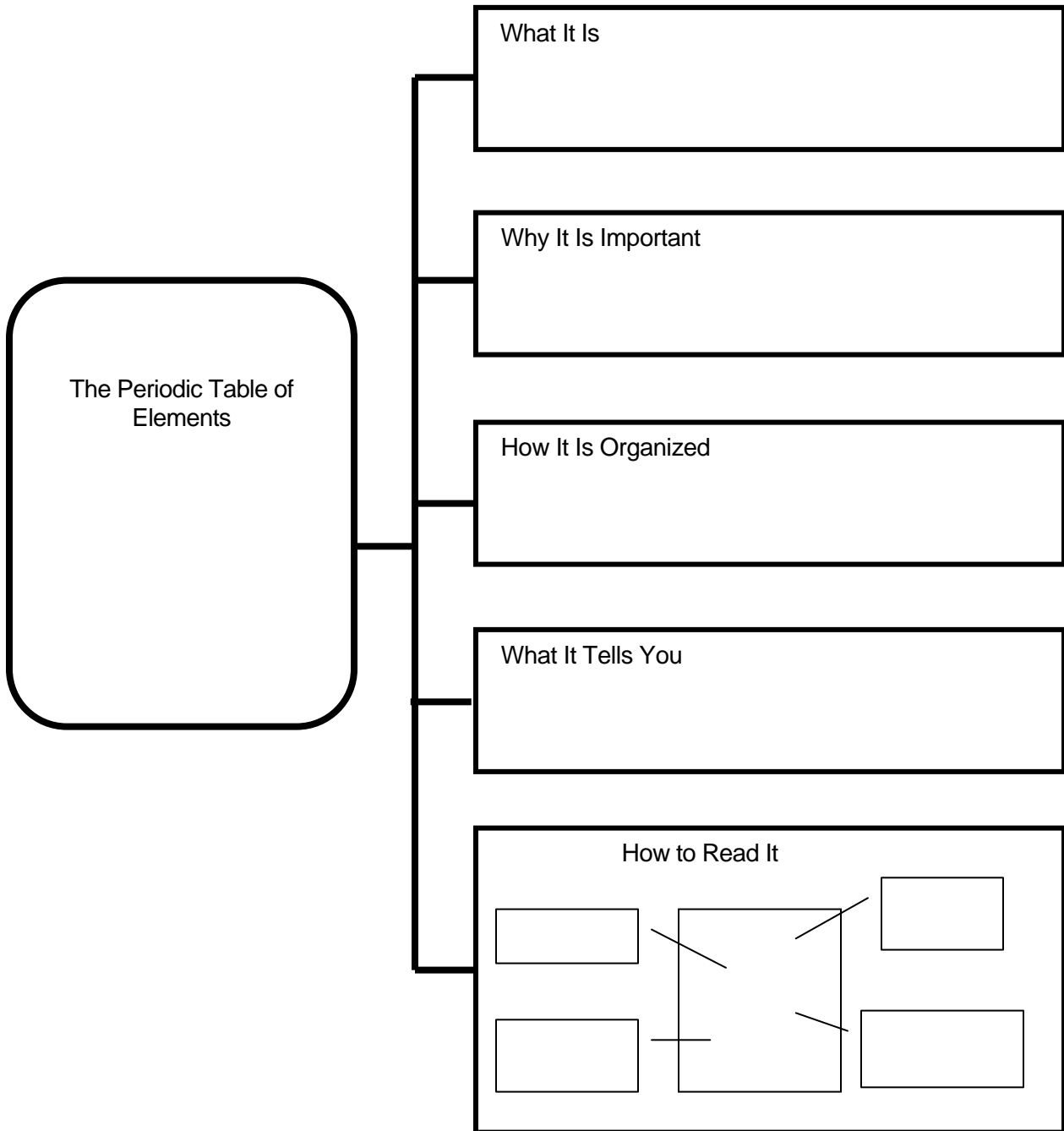
Directions: Give the symbol for each of the named elements below.

| Element | Symbol |
|--------------|--------|
| a. lithium | |
| b. potassium | |
| c. carbon | |
| d. silver | |
| e. sulfur | |
| f. fluorine | |
| g. nitrogen | |
| h. oxygen | |
| i. boron | |
| j. hydrogen | |
| k. helium | |
| l. sodium | |

The Periodic Table of Elements

Introduction: An element is a substance that contains only one kind of atom. Understanding elements is important to understanding the nature of the universe. Because there are so many elements, scientists use a Periodic Table to organize them.

Directions: Use your notes, textbook, and other appropriate resources to complete the graphic organizer.



Periodic Table – Reading

Title: Periodic Poetry

Overview:

To assist students in understanding more about the different elements, have students create pieces of poetry about a specific element. You may wish to have students create their own poetry style or use the templates that are provided in this lesson.

Materials:

- Sample poems
- Poetry templates
- Thesaurus

Procedure/Guided Practice:

Have students read aloud examples of “periodic poetry.” Have students then choose an element(s) from the periodic table and write a poem about it using one of formulas provided or another poetic style. Students may wish to research an element that they are not familiar with to gather more knowledge about its properties.

Poetry Templates and Examples

Cinquain Poem – 5 line poem

Line 1 a noun

Line 2 two adjectives

Line 3 three verbs ending in “ing.”

Line 4 a phrase

Line 5 a noun (the same as line 1 or different)

Example of a Cinquain Poem

Neon

gaseous, stable

illuminating, flashing, reacting

Lighting up city skies at night

Haiku – 3 line poem

Line 1 has 5 syllables

Line 2 has 7 syllables

Line 3 has 5 syllables

Example of Haiku

Nitrogen, a gas

In this state I do explode!

Fire in the sky

Name Poem

Write the name of the element in a vertical column. Using each letter, describe the element.

Example of Name Poem

Sixteen is its atomic number

Unique element

Lighter than iron

Flammable

Ultimately needed by humans

Referred to as brimstone in Genesis

Evaluation:

Have students read aloud their own poems or sample poems about the different elements. This lesson provides students with an opportunity to discover scientific facts about an element and to write about what they have learned through the use of poetry.

Periodic Table – Mathematics

Title: Information at a Glance – Using Tables in Mathematics

Overview:

Mendeleev found that by using a table format, he could clearly show the relationship between the different elements of the universe. The use of tables in mathematics can also help students to visually depict information that can be used either in that format or changed into a graphic.

Materials:

- Chart paper and markers
- Graph paper
- The Data Is In! Handout
- Data created by the class or instructor to use in developing tables/graphs

Procedure/Guided Practice:

Give students a copy of the handout The Data Is In! Have them develop a table to display all of the data located in the paragraph. Next have the students use the information in the table to create a graph. Students should select the most appropriate graphic display for the data. If students need practice in figuring percentages, have them determine the percentage differences between the scores of passers versus non-passers on each of the subject area tests.

Give students newspapers and that display numerical data and develop GED like questions based on mathematical areas.

Evaluation:

Have students show the class their table of information on the GED Tests and the other type of graphic display that they created. Discuss how students set up their tables. Sample questions to ask students may include some of the following:

Was one table created for the whole test or were separate tables created for each subject area?

Were all of the subject areas together?

Were separate tables created for passers versus non-passers?

Is the information more clearly seen in a table rather than through the paragraph format? Why or why not?

Next analyze the type of graphs the students used to display the data. Ask the students why they chose a particular type of graph or chart. Have the class respond to the clarity of each type of graph or chart.

The Data Is In!

The data is in for the GED Tests for your school. Below are the average scores for each of the subtests for both those students who passed each individual test and those who did not pass. However, the data is somewhat confusing because nothing was organized on the report. All of the information is presented in paragraph format. Since, you will be presenting this information to your peers; you would like to make it visually more attractive.

Develop a table into which you can place the appropriate scores from the following report. Next, take the information from the table that you developed and create another type of graphic display.

Official Overview of GED Test Results for XYZ School

The following average scores in each of the five subtests of the GED Tests were obtained by XYZ School for the first six months of the current fiscal year. The following scores include both an average score for passers and an average score for non-passers for each of the subtests. Students passing the Language Arts, Writing Test received an average score of 467. Non-passers received an average score of a 296 on the Language Arts, Writing Test. The next lowest scores were noted in the Mathematics area where passers for this test received an average score of 472, whereas non-passers received an average score of 312. In Social Studies, passers obtained an average score of 511 and non-passers received an average score of 363. The average score for Science for students who passed the test was a 480 with an average Science score for non-passers of a 322. In Language Arts, Reading, the average score was a 522 for those students who passed the test and a 364 average for non-passers.

Samples of Periodic Table of Elements

Periodic Table of the Elements

| | | | | | | | | | | | | | | | | | | | |
|---|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-------------|-------------|-------------|-----|-----|-----|-----|-----|------------|-----|
| | 1A (1) | | | | | | | | | | | | | | | | | 8A (18) | |
| 1 | H | 2A (2) | | | | | | | | | | | | | | | | | He |
| 2 | Li | Be | | | | | | | | | | | | | | | | | Ne |
| 3 | Na | Mg | 3B (3) | 4B (4) | 5B (5) | 6B (6) | 7B (7) | 8B (8) | 9B (9) | 10B (10) | 11B (11) | 12B (12) | | | | | | | Ar |
| 4 | K | Ca | Sc | Ti | V | Cr | Mn | Fe | Co | Ni | Cu | Zn | Ga | Ge | As | Se | Br | | Kr |
| 5 | Rb | Sr | Y | Zr | Nb | Mo | Tc | Ru | Rh | Pd | Ag | Cd | In | Sn | Sb | Te | I | | Xe |
| 6 | Cs | Ba | Lu | Hf | Ta | W | Re | Os | Ir | Pt | Au | Hg | Tl | Pb | Bi | Po | At | | Rn |
| 7 | Fr | Ra | Lr | Rf | Db | Sg | Bh | Hs | Mt | Uun | Uuu | Uub | Uut | Uuq | Uup | Uuh | Uus | | Uuo |

| | | | | | | | | | | | | | | |
|-------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| lanthanides | La | Ce | Pr | Nd | Pm | Sm | Eu | Gd | Tb | Dy | Ho | Er | Tm | Yb |
| actinides | Ac | Th | Pa | U | Np | Pu | Am | Cm | Bk | Cf | Es | Fm | Md | No |

