CAPSTONE PROJECT: WATER BOTTLE ROCKET LESSON 1

ALEXIA PUIG

SUMMARY

This is the first lesson in an integrated unit on Sir Isaac Newton. For this lesson, students will research Newton on the internet and find the answers to nine questions on his life and contributions. The tenth question is for students to ponder the importance of his discoveries and give their opinion.

GRADE LEVEL

9-12

TIME FRAME

1 hour (1 class period)

SUBJECT(S)

ESL, History, Mathematics, Research, Science

TOPIC(S)

The Life and Contributions of Sir Isaac Newton

NOTES

This is the first lesson of the integrated unit on Sir Isaac Newton, so this lesson will set the groundwork for the next nine lessons.

ARIZONA ACADEMIC STANDARDS

Subject: Social Studies (2006 Final)

- Subject/Grade/Domain: High School
- Strand : Strand 2: World History
- Concept : Concept 1: Research Skills for History
- Performance Objective: PO 3. Formulate questions that can be answered by historical study and research.

Subject: Language Arts

- Subject/ Grade/ Domain : Reading
- Grade : GRADE 9
- Strand : Strand 3: Comprehending Informational Text
- Concept : Concept 1: Expository Text
  Identify, analyze, and apply knowledge of the purpose, structures, and elements of expository text.
- Performance Objective PO 3: Locate specific information by using organizational features (e.g., table of contents, headings, captions, bold print, italics, glossaries, indices, key/guide words, topic sentences, concluding sentences, end notes, footnotes, bibliographic references) in expository text. (Connected to Research Strand in Writing)
- Performance Objective PO 2: Distinguish facts from opinions in expository selections such as editorials, newspaper articles, essays, reviews, and critiques, providing supporting evidence from the text.

Subject: Science

- Subject/ Grade/ Domain : HIGH SCHOOL
- Strand : Strand 2: History and Nature of Science
- Concept : Concept 1: History of Science as a Human Endeavor
  Identify individual, cultural, and technological contributions to scientific knowledge.
- Performance Objective PO 2. : Describe how diverse people and/or cultures, past and present, have made important contributions to scientific innovations.

Subject: Mathematics (2008)

- Subject/ Grade/ Domain : High School (Grades 9 and 10)
- Strand : Strand 3: Patterns, Algebra, and Functions
- Concept : Concept 2: Functions and Relationships
  Describe and model functions and their relationships.
- Performance Objective : PO 2. Determine if a relationship represented by an equation, graph, table, description, or set of ordered pairs is a function.

UNDERSTANDINGS

The students will use their research skills to investigate the life and contributions of Newton. Using the information they obtain, they will answer several questions.

ESSENTIAL QUESTIONS

1. Who was Sir Isaac Newton?
2. What discoveries/contributions made Newton famous?
3. Do you think that his laws/principles are still used today?

KNOWLEDGE AND SKILLS

1. Comprehend the information researched to answer

the questions on the worksheet
2. Apply internet research skills to find information
3. Synthesize an opinion on the importance of Newton's discoveries/contributions

PERFORMANCE TASK

Activity 1: Discussion on how to research on the internet
Activity 2: Students will work together in small groups to research Newton
Activity 3: Students will work together to answer questions from worksheet
Activity 4: Class discussion
Attachments
1. Newton Questions

PERFORMANCE PROMPT

At the beginning of the lesson I will ask the students what they know or heard about Sir Isaac Newton.

ASSESSMENT RUBRICS

This assessment for this activity will be formally assessed using the following rubric.
Rubrics
1. Newton Research

SEQUENCE OF ACTIVITIES

This is a start of a new unit so there will be no need for review and no assignments to be collected prior to lesson implementation.

DIFFERENTIATED INSTRUCTION

Since all of my students are English Language Learners, they will work together in a cooperative-learning setting. This way, they can help each other and share ideas/ information.

RESOURCES

- Worksheets
- Pencils
- Internet access
- 1 computer per 3 students

QUESTIONS ABOUT SIR ISAAC NEWTON

INSTRUCTIONS

Research and find the answers to the following questions on Sir Isaac Newton.

1. What year was Newton born and in what country?

2. What book did Newton publish in 1687?

3. What field of mathematics did Newton develop?

4. What force did Newton discover when he saw an apple fall from a tree?

5. What is Newton's First Law of Motion?

6. What is Newton's Second Law of Motion?

7. What is Newton's Third Law of Motion?

8. What did Newton use to separate white light into a spectrum of colors?

9. Name three fields that Newton contributed to.

10. Do you think that Newton's contribution to math and science was important? Why?

NEWTON RESEARCH RUBRIC

Criteria / Level	Poor (1)	Needs Improvement (2)	Good (3)	Excellent (4)	Score / Level
References	No references or incorrect references	Few references or some incorrect references	Use of references indicate some research	Use of references indicate substantial research	
Understanding of the process	Avoids teacher. Sees task as burden to fill class time with no value. Sees group as free ride.	Sees task as burden, but is somewhat invested in process. Asks, "Do we have to...?" Sees teacher as task master.	Sees task as a school requirement to be filled, but sees some value in work. Sees teacher as evaluator and helper.	Sees opportunity in task for doing and learning. Sees value in the work. Sees teacher as colleague/mentor.	
Effort	Actively avoids jobs when possible. Complains about others. Has large set of excuses.	Reluctantly does jobs when asked. Seeks easiest duties in group. Sometimes works to completion.	Willingly takes on jobs when asked. Works to completion. Will work long hours when required.	Volunteers for jobs no matter how difficult Always works to completion. Willing to work long hours.	
Engagement	Waits for direction. Knows little of what is going on or objectives. Cannot describe where group is in process.	Seeks direction, but does not initiate action. Objectives seen as poorly defined external requirements. May know where group is.	Sometimes initiates action and always works well with direction. Generally knows the specific objectives and where group is.	Enthusiastically initiates action. Personalizes the task and takes ownership of the objectives. Always knows where group is.	
Completion of assignment	None of the questions were answered.	Half or less than half of the questions were answered.	Most of the questions were answered.	All of the questions were answered.	

CAPSTONE PROJECT: WATER BOTTLE ROCKET LESSON 2

ALEXIA PUIG

SUMMARY

This is the second lesson in my integrated unit on Sir Isaac Newton. For this lesson, the students will research the history on rockets and then the designs for water bottle rockets. For the water bottle rockets, students will research how Newton's principles and laws apply to the physics and math analysis of water bottle rockets.

GRADE LEVEL

9-12

TIME FRAME

1 hour (1 class period)

SUBJECT(S)

ESL, History, Mathematics, Research, Science

TOPIC(S)

Rocket History, Water Bottle Rocket Models and Materials, Water Bottle Rocket Analysis (Physics and Math)

NOTES

This lesson is the introduction into water bottle rockets. The students will be performing several activities involving different aspects of water bottle rockets for the next several lessons.

ARIZONA ACADEMIC STANDARDS

Subject: Social Studies (2006 Final)

- Subject/Grade/Domain: High School
- Strand : Strand 2: World History
- Concept : Concept 1: Research Skills for History
- Performance Objective: PO 3. Formulate questions that can be answered by historical study and research.

Subject: Language Arts

- Subject/ Grade/ Domain : Reading
- Grade : GRADE 9
- Strand : Strand 3: Comprehending Informational Text
- Concept : Concept 1: Expository Text
  Identify, analyze, and apply knowledge of the purpose, structures, and elements of expository text.
- Performance Objective PO 3: Locate specific information by using organizational features (e.g., table of contents, headings, captions, bold print, italics, glossaries, indices, key/guide words, topic sentences, concluding sentences, end notes, footnotes, bibliographic references) in expository text. (Connected to Research Strand in Writing)
- Performance Objective PO 2: Distinguish facts from opinions in expository selections such as editorials, newspaper articles, essays, reviews, and critiques, providing supporting evidence from the text.

Subject: Science

- Subject/ Grade/ Domain : HIGH SCHOOL
- Strand : Strand 2: History and Nature of Science
- Concept : Concept 1: History of Science as a Human Endeavor
  Identify individual, cultural, and technological contributions to scientific knowledge.
- Performance Objective PO 2. : Describe how diverse people and/or cultures, past and present, have made important contributions to scientific innovations.

Subject: Mathematics (2008)

- Subject/ Grade/ Domain : High School (Grades 9 and 10)
- Strand : Strand 3: Patterns, Algebra, and Functions
- Concept : Concept 2: Functions and Relationships
  Describe and model functions and their relationships.
- Performance Objective : PO 2. Determine if a relationship represented by an equation, graph, table, description, or set of ordered pairs is a function.

UNDERSTANDINGS

The students will research the history of rockets and how the designs have improved over time. Then students will research bottle rockets and how to design one. They will also need to understand what variables or parameters will affect the altitude and distance of their water bottle rockets.

ESSENTIAL QUESTIONS

1. What causes a bottle rocket to lift off?
2. Why do we have to have water in the bottle in the first place?

KNOWLEDGE AND SKILLS

1. Recall background knowledge from yesterday, Newton's laws and principles.
2. Comprehend the information researched to created a timeline of the history of rockets.
3. Apply Newton's laws to the water bottle rocket.

PERFORMANCE TASK

Activity 1: Introduction into rockets and water bottle rockets
Activity 2: Students will work together on the computers to research rockets and water bottle rockets
Activity 3: Students will complete their worksheets together
Activity 4: Class discussion

Attachments

PERFORMANCE PROMPT

At the beginning of the lesson, I will ask students what they know about rockets and the different types.

ASSESSMENT RUBRICS

This assessment for this activity will be formally assessed using the following rubric.
Rubrics

1. Newton Research

SEQUENCE OF ACTIVITIES

At the end of class, I will collect yesterday's assignment, the questions on Newton's life and contributions. I would normally do this at the beginning of class, but the students may want to use this for reference to Newton's Laws of Motion during today's activity.

DIFFERENTIATED INSTRUCTION

Since some of my students are limited in writing in English, I modified the worksheet to let them draw pictures to supplement their answers. Also, my students will be working together in groups, so that those who are more advanced in English acquisition can help those who are not.

RESOURCES

- Worksheets
- Pencils
- Internet access
- The number of computers required is 1 per 3 students.
- Students Familiarity with Software Tool: Students are very familiar with using computers
- Pencils
- Internet access
- 1 computer per 3 students

ROCKET HISTORY

INSTRUCTIONS

Research and answer the following questions. Good websites to use are:

http://exploration.grc.nasa.gov/education/rocket/BottleRocket/about.htm,
http://www.opentutorial.com/Make_a_water_bottle_rocket,
http://en.wikipedia.org/wiki/Water_rocket,
http://members.aol.com/hayhurst1/h2orocket.htm,
http://www.water-rockets.com/article.pl?112,tZ8mm/1GQzBCdW/ePTO9pg

1. Research the history on rockets. Create a timeline from the 1st rocket to the last. State the year and type of rocket and explain how the design of the rocket was improving.

2. Research the water bottle rocket. Give a description or drawing of it and list what materials you can use to build one. State or show what different models you can build.

3. How does Newton's principle of gravity apply to water bottle rockets? Does any of his laws of motion? What are some of the variables for a bottle rocket? (List at least 5)

ROCKET HISTORY RESEARCH RUBRIC

Criteria / Level	Poor (1)	Needs Improvement (2)	Good (3)	Excellent (4)	Score / Level
Intellectual Contribution	Has little or no grasp of context. Sees task as isolated with no connection to past or future ideas.	Aware of overall context, but makes no connections on own. Can recite connections of others but rarely can support them.	Usually understands overall context of task and asks questions about context. Makes connections on own and "gets" those others make.	Understands overall context of the task. Contributes ideas and proposals. Extends connections to ideas past and future.	
Understanding of the process	Avoids teacher. Sees task as burden to fill class time with no value. Sees group as free ride.	Sees task as burden, but is somewhat invested in process. Asks, "Do we have to ...?" Sees teacher as task master.	Sees task as a school requirement to be filled, but sees some value in work. Sees teacher as evaluator and helper.	Sees opportunity in task for doing and learning. Sees value in the work. Sees teacher as colleague/mentor.	
Effort	Actively avoids jobs when possible. Complains about others. Has large set of excuses.	Reluctantly does jobs when asked. Seeks easiest duties in group. Sometimes works to completion.	Willingly takes on jobs when asked. Works to completion. Will work long hours when required.	Volunteers for jobs no matter how difficult Always works to completion. Willing to work long hours.	
Engagement	Waits for direction. Knows little of what is going on or objectives. Cannot describe where group is in process.	Seeks direction, but does not initiate action. Objectives seen as poorly defined external requirements. May know where group is.	Sometimes initiates action and always works well with direction. Generally knows the specific objectives and where group is.	Enthusiastically initiates action. Personalizes the task and takes ownership of the objectives. Always knows where group is.	
Completion of assignment	Hardly any research was done and none or almost none of the assignment was completed.	Some research was done and some of the assignment was completed.	Research was done and most of the assignment was completed.	Research was done and the assignment was completed fully.	

CAPSTONE PROJECT: WATER BOTTLE ROCKET LESSON 3

ALEXIA PUIG

SUMMARY

This is my third lesson in my integrated unit on Sir Isaac Newton. For this lesson the students will learn how to make technical drawings such as isometric drawings (3-D) for their bottle rockets and orthographic drawings (2-D) to show the different views of their bottle rockets (i.e. top, bottom, front, back, left side, and right side).

GRADE LEVEL

9-12

TIME FRAME

45 minutes (1 shortened class period)

SUBJECT(S)

Art, ESL, Mathematics

TOPIC(S)

Isometric Projection, Orthographic Projection

NOTES

This lesson will teach students how to make technical drawings which are essential to engineers. These drawings will help the students work out the details of their designs and determine what areas need improvement.

ARIZONA ACADEMIC STANDARDS

Subject: Visual Arts (2006)

- Subject/Grade/Domain: Visual Arts
- Strand : Strand 1: Create
- Concept : Concept # 4: Meanings or Purposes- The student will express ideas to communicate meanings or purposes in artwork.
- Performance Objective: PO 202. Create an artwork that serves a function.

Subject: Mathematics (2008)

- Subject/ Grade/ Domain : High School
- Grade : GRADES 9 & 10
- Strand : Strand 4: Geometry and Measurement
- Concept : Concept 1: Geometric Properties Analyze the attributes and properties of 2- and 3- dimensional figures and develop mathematical arguments about their relationships.
- Performance Objective: PO 3. Create and analyze inductive and deductive arguments concerning geometric ideas and relationships.
- Performance Objective: PO 4. Apply properties, theorems, and constructions about parallel lines, perpendicular lines, and angles to prove theorems.
- Performance Objective: PO 5. Explore Euclid's five postulates in the plane and their limitations.
- Concept : Concept 4: Measurement Understand and apply appropriate units of measure, measurement techniques, and formulas to determine measurements.
- Performance Objective: PO 1. Use dimensional analysis to keep track of units of measure when converting.
- Performance Objective: PO 2. Find the length of a circular arc; find the area of a sector of a circle.
- Performance Objective: PO 3. Determine the effect that changing dimensions has on the perimeter, area, or volume of a figure.
- Performance Objective: PO 4. Solve problems involving similar figures using ratios and proportions.

UNDERSTANDINGS

This lesson will show the students how to interpret and represent a 3-dimensional object. They will also learn how to describe 3-dimensional objects using multiple 2-dimensional views.

ESSENTIAL QUESTIONS

1. What is an isometric drawing?
2. What are different views for a 3-D object?

KNOWLEDGE AND SKILLS

1. Apply the skills of isometric and orthographic sketching to their bottle rockets.
2. Analyze the drawings to determine an appropriate scale factor.
3. Synthesize scaled 3-D drawings of the bottle rockets and 2-D drawings from different views.

PERFORMANCE TASK

Activity 1: Introduction into isometric drawings
Activity 2: Students will work together in their groups

to create isometric drawings
Activity 3: Introduction into orthographic drawings
Activity 4: Students will work together in their groups to create orthographic drawings (the six different views)

PERFORMANCE PROMPT

At the beginning of the lesson, I will show my students some examples of isometric and orthographic drawings.

ASSESSMENT RUBRICS

This assessment for this activity will be formally assessed using the following rubric.

Rubrics

1. Isometric Teamwork

SEQUENCE OF ACTIVITIES

At the beginning of class, I will collect yesterday's assignment, researching rockets.

DIFFERENTIATED INSTRUCTION

All of my students are English Language Learners, but this activity does not require advanced fluency in English. All of my students at any level of English acquisition can participate in this activity.

RESOURCES

- Pencils
- Rulers
- Isometric Paper
- Graph Paper

ROCKET HISTORY RESEARCH RUBRIC

Criteria / Level	Poor (1)	Needs Improvement (2)	Good (3)	Excellent (4)	Score / Level
Intellectual Contribution	Has little or no grasp of context. Sees task as isolated with no connection to past or future ideas.	Aware of overall context, but makes no connections on own. Can recite connections of others but rarely can support them.	Usually understands overall context of task and asks questions about context. Makes connections on own and "gets" those others make.	Understands overall context of the task. Contributes ideas and proposals. Extends connections to ideas past and future.	
Understanding of the process	Avoids teacher. Sees task as burden to fill class time with no value. Sees group as free ride.	Sees task as burden, but is somewhat invested in process. Asks, "Do we have to . . .?" Sees teacher as task master.	Sees task as a school requirement to be filled, but sees some value in work. Sees teacher as evaluator and helper.	Sees opportunity in task for doing and learning. Sees value in the work. Sees teacher as colleague/mentor.	
Effort	Actively avoids jobs when possible. Complains about others. Has large set of excuses.	Reluctantly does jobs when asked. Seeks easiest duties in group. Sometimes works to completion.	Willingly takes on jobs when asked. Works to completion. Will work long hours when required.	Volunteers for jobs no matter how difficult Always works to completion. Willing to work long hours.	
Engagement	Waits for direction. Knows little of what is going on or objectives. Cannot describe where group is in process.	Seeks direction, but does not initiate action. Objectives seen as poorly defined external requirements. May know where group is.	Sometimes initiates action and always works well with direction. Generally knows the specific objectives and where group is.	Enthusiastically initiates action. Personalizes the task and takes ownership of the objectives. Always knows where group is.	
Skill development for task	Assumes others will learn skill. Makes no effort to acquire expertise in skill.	Satisfied with general understanding of skill, but will not go for competence.	Will learn skill when it is necessary. Usually minimum competence to complete task.	Readily learns new skills as a matter of course. Seeks to extend the skill.	

CAPSTONE PROJECT: WATER BOTTLE ROCKET LESSON 4

ALEXIA PUIG

SUMMARY

This is my fourth lesson in my integrated unit on Sir Isaac Newton. For this lesson, the students will use computer simulations to see the relationship between the water level and the altitude and height; and the relationship between the angle of elevation and the range and height.

GRADE LEVEL

9-12

TIME FRAME

1 hour (1 class period)

SUBJECT(S)

ESL, Mathematics, Science, Technology

TOPIC(S)

Water Bottle Rocket Simulation, Trajectory Simulation, Water Level v. Max Altitude and Max Velocity, Angle v. Range and Height

NOTES

This lesson will be used for students to collect data so that they can determine the optimal parameters for their water bottle rockets.

ARIZONA ACADEMIC STANDARDS

Subject: Science

- Subject/Grade/Domain: High School
- Strand : Strand 1: Inquiry Process
- Concept : Concept 1: Observations, Questions, and Hypotheses. Formulate predictions, questions, or hypotheses based on observations. Evaluate appropriate resources.
- Performance Objective: PO 3. Formulate a testable hypothesis.

Subject: Mathematics (2008)

- Subject/ Grade/ Domain : High School
- Grade : GRADES 9 & 10
- Strand : Strand 3: Patterns, Algebra, and Functions
- Concept : Concept 2: Functions and Relationships
  Describe and model functions and their relationships.
- Performance Objective: PO 2. Determine if a relationship represented by an equation, graph, table, description, or set of ordered pairs is a function.
- Performance Objective: PO 4. Use equations, graphs, tables, descriptions, or sets of ordered pairs to express a relationship between two variables.
- Performance Objective: PO 5. Explore Euclid's five postulates in the plane and their limitations.

Subject: Technology (old)

- Subject/Grade/Domain: High School
- Standard : Standard 3: Technology Productivity Tools
  Students use technology tools to enhance learning, to increase productivity and creativity, and to construct technology-enhanced models, prepare publications and produce other creative works.
- Grade Range: Proficiency (9-12)
- Key Idea/Concept 3T-P2. Use a variety of technology tools for data collection and analysis to support a decision.
- Performance Objective: PO 1. Select appropriate technology devices to collect and record data (e.g., science probe, graphing calculator, PDA (personal digital assistant), alternative keyboard, webcam, GPS and Internet)

UNDERSTANDINGS

The students will use computer simulations to complete a table of values to determine the relationships between water level and altitude and velocity; and angle of elevation and range and height.

ESSENTIAL QUESTIONS

1. What happens with just pressurized air?
2. Is more water better?

KNOWLEDGE AND SKILLS

1. Comprehend the relationship between the variables.
2. Apply the different water levels and angles to complete the tables.
3. Analyze the tables to determine the optimal water level and angle of elevation.

PERFORMANCE TASK

Activity 1: Review of variables (parameters)
Activity 2: Students will perform the simulations and complete the tables
Activity3: Students will analyze the tables to determine the optimal percent of water level and angle of elevation
Activity 4: Class discussion

PERFORMANCE PROMPT

At the beginning of this lesson, I will review yesterday's assignment and ask students what were some of the variables to consider when building a water bottle rocket.

ASSESSMENT RUBRICS

The assessment for this lesson will be informal.

SEQUENCE OF ACTIVITIES

At the beginning of the class period, I will collect yesterday's assignment, isometric drawings.

DIFFERENTIATED INSTRUCTION

All of my students are English Language Learners, but they will be working together in groups so that they can help each other.

RESOURCES

- Pencils
- Worksheets
- Internet access
- 1 computer per 3 students

ROCKET HISTORY

1. Go to the website: http://www.grc.nasa.gov/WWW/K-12/bottlerocket/ and complete the following table. Use a 2 liter bottle each time and only change the water level (percent filled). What percent of water filled works best?

Percent Water Level	Max Altitude (m)	Max Velocity (m/s)
0%		
5%		
10%		
15%		
20%		
25%		
30%		
35%		
40%		
45%		
50%		
55%		
60%		
65%		
70%		

2. Go to the website: http://phet.colorado.edu/simulations/sims.php?sim=Projectile_Motion and complete the following table. Only change the angle. What angle works best?

Angle (degrees)	Range (m)	Height (m)	Time (s)
0°			
5°			
10°			
15°			
20°			
25°			
30°			
35°			
40°			
45°			
50°			
55°			
60°			
65°			
70°			
75°			
80°			
85°			
90°			

CAPSTONE PROJECT: WATER BOTTLE ROCKET LESSON 5

ALEXIA PUIG

SUMMARY

This is the fifth lesson in my integrated unit on Sir Isaac Newton. For this lesson the students will use the values that they obtained from yesterday's simulations to input into graphing calculators. They will create several graphs and calculate the maximum values to determine what percent of water level to use and what angle of elevation to use.

GRADE LEVEL

9-12

TIME FRAME

1 hour (1 class period)

SUBJECT(S)

ESL, Mathematics, Science, Technology

TOPIC(S)

Graphing Parabolic Curves, Locating Maximum Values

NOTES

In order to complete this activity, the students need to use the data obtained from yesterday's activity. If any students were absent and do not have the data, then the students can use their peer's data.

ARIZONA ACADEMIC STANDARDS

Subject: Science

- Subject/Grade/Domain: High School
- Strand : Strand 1: Inquiry Process
- Concept : Concept 2: Scientific Testing (Investigating and Modeling)
  Design and conduct controlled investigations.
- Performance Objective: PO 5. : Record observations, notes, sketches, questions, and ideas using tools such as journals, charts, graphs, and computers.

Subject: Mathematics (2008)

- Subject/ Grade/ Domain : High School
- Grade : GRADES 9 & 10
- Strand : Strand 3: Patterns, Algebra, and Functions
- Concept : Concept 2: Functions and Relationships
  Describe and model functions and their relationships.
- Performance Objective: PO 1. Sketch and interpret a graph that models a given context, make connections between the graph and the context, and solve maximum and minimum problems using the graph.
- Performance Objective: PO 2. Determine if a relationship represented by an equation, graph, table, description, or set of ordered pairs is a function.

Subject: Technology (old)

- Subject/Grade/Domain: High School
- Standard : Standard 1: Fundamental Operations and Concepts
  Students understand the operations and function of technology systems and are proficient in the use of technology.
- Grade Range: Proficiency (9-12)
- Key Idea/Concept 1T-P1. Use the appropriate technology device to complete a task
- Performance Objective: PO 1. Given a task, select the appropriate technology device(s) (e.g., reporting a news story using digital and video camera and online editing to publish on the Web; gathering data using scientific probes and graphing calculators)

UNDERSTANDINGS

The students will have the opportunity to use technology (graphing calculators) to get a graphical representation of the relationships between the variables they were working with yesterday. With these tools, they can also calculate the maximum values to determine the optimal percent of water level and angle of elevation.

ESSENTIAL QUESTIONS

1. Why do the graphs appear to be parabolic rather than linear?
2. What determines how far a bottle rocket travels?
3. Why did the bottle rocket not go very far when putting little or no water in it?
4. Why did the bottle rocket only go a short distance

when putting a large quantity of water in it?
5. Why is the angle of elevation a factor in the range of the water bottle?

KNOWLEDGE AND SKILLS

1. Apply the skills of entering data into the graphing calculators.
2. Synthesize several graphs based on the tables of values.
3. Evaluate the curves generated to obtain the maximum values.

PERFORMANCE TASK

Activity 1: Instruction on plotting with the graphing calculators
Activity 2: Instruction on calculating the maximum values
Activity 3: Students will draw the graphs on their graph paper and label the maximum values
Activity 4: Students will share what maximum values they obtained with the class

PERFORMANCE PROMPT

Before beginning the lesson, I will review what we did yesterday (obtaining the data tables for our bottle rockets using computer simulations).

ASSESSMENT RUBRICS

This lesson will be formally assessed using the following rubric:

1. Simulation Graphs

SEQUENCE OF ACTIVITIES

I will not be collecting yesterday's assignment, since the students will need it to complete today's activity.

DIFFERENTIATED INSTRUCTION

I will be guiding my students step by step for this activity, but they will also work together. This is so that the students than help their peers while I am assisting those who need more support.

RESOURCES

- Yesterday's Worksheets
- Pencils
- Graph Paper
- Graphing Calculators
- SMARTBoard

SIMULATION GRAPHS RUBRIC

Criteria / Level	Poor (1)	Needs Improvement (2)	Good (3)	Excellent (4)	Score / Level
Visual Representations: Charts, Tables and Graphs	Unable to read or create charts, tables or graphs.	Some difficulty in creating or reading charts, tables, or graphs.	Can make most connections between different representation of a mathematical concept, though some errors are made in use of charts, tables and graphs.	Is able to create and/or interpret tables, charts and graphs that show mathematical concepts visually.	
Use of Manipulatives to Demonstrate Conceptual Understanding	Not able to use manipulatives to explain the mathematical concept.	Some confusion in use of manipulatives.	Can make most connections between different representation of a mathematical concept, though some errors are made in use of manipulatives.	Can use manipulatives to give a detailed and descriptive response.	
Analysis / Mathematical Reasoning	Shows little to no understanding of either the pattern or relationship. Not able to explain the response they have given.	Shows some understanding of the pattern or relationship. Some irrelevant details in explanation.	Short but complete answer that shows an understanding of pattern or relationship.	Can demonstrate a full understanding of the pattern or relationships among the numbers. Explanation is detailed and organized and indicates logical thinking.	
Mathematical Understanding	Shows little to no understanding of the problems underlying concepts.	Shows some understanding of the problem's underlying concepts.	Shows sound understanding of the problem's underlying concepts but is either unable to fully describe the concept or makes some minor errors.	Shows a full understanding of a problem's underlying concepts and is able to describe the concept with no errors.	
Presentation	Did not relay the information or relayed the information incorrectly and could not answer any questions	Relayed the information somewhat and responded to questions with vague replies	Relayed the information correctly but was unable to show comprehension through responses to questions	Clearly relayed the information to the class and responded to questions by showing comprehension of topic	

CAPSTONE PROJECT: WATER BOTTLE ROCKET LESSON 6

ALEXIA PUIG

SUMMARY

This is the sixth lesson in my integrated unit. For this lesson the students are going to use their creativity to describe the design of their bottle rocket and what they would do with it. This assignment is fiction writing, so the students can feel free to use their imagination.

GRADE LEVEL

9-12

TIME FRAME

1 hour (1 class period)

SUBJECT(S)

ESL, Language Arts (English), Mathematics, Science

TOPIC(S)

Creative/Expressive Writing, and Oral Presentations

NOTES

When dividing the class into teams, make sure that at least one member from every team is advanced enough in English and science to help the other team members out. Make that student the "team leader".

ARIZONA ACADEMIC STANDARDS

Subject: Language Arts

- Subject/Grade/Domain: High School
- Strand : Strand 3: Writing Applications
- Concept 1: Expressive
  Expressive writing includes personal narratives, stories, poetry, songs, and dramatic pieces. Writing may be based on real or imagined events.
- Performance Objective: PO 1: Write a personal narrative that:

Example A: describes a sequence of events, focusing on one incident experienced by the author

- Concept 2: Expository
  Expository writing includes non-fiction writing that describes, explains, informs, or summarizes ideas and content. The writing supports a thesis based on research, observation, and/or experience.
- Performance Objective: PO 1: Write an explanatory, multi-paragraph essay that:

Example E: attributes sources of information as appropriate

UNDERSTANDINGS

This activity allows the students to use their creative side whether their ideas are possible to implement or not. The students can use their imagination to create their own unique bottle rocket and purpose/story for it.

ESSENTIAL QUESTIONS

1. What do you want your rocket to look like?
2. If you could do anything with your rocket, what would you do with it?

KNOWLEDGE AND SKILLS

1. Apply their ideas for their bottle rocket to create a scenario on what they would do with their bottle rocket.
2. Analyze their choice of design for their bottle rocket.
3. Synthesize a 2-3 paragraph essay describing their design and function for their bottle rocket.

PERFORMANCE TASK

Activity 1: I will explain the directions on the worksheet and read an example that I wrote.
Activity 2: The students will work together on their worksheets.
Activity 3: I will have the students read their work.

PERFORMANCE PROMPT

At the beginning of the lesson, I will review what we did and learned last week.

ASSESSMENT RUBRICS

The assessment for this lesson will be formal and I will use the following rubric.

1. Bottle Rocket Adventure

SEQUENCE OF ACTIVITIES

Before the beginning of the lesson, I will collect the last assignment and divide the students into teams.

DIFFERENTIATED INSTRUCTION

Some of my students are at the beginning stages of English acquisition, so I will modify the assignment to let them use words from their primary language in the assignment. Also, I will have the students complete the assignment in teams so that the students can help each other.

MY BOTTLE ROCKET

Write 2-3 paragraphs on what design you chose for your water bottle rocket and what you would use your bottle rocket for. This is only fiction so you can use your imagination. If you have trouble writing a word or phrase in English, you can use words in your own language.

BOTTLE ROCKET ADVENTURE RUBRIC

Criteria / Level	Poor (1)	Needs Improvement (2)	Good (3)	Excellent (4)	Score / Level
Speaking	Stumbles over words, mispronunciation; seems to lack confidence with language	Some mispronunciation, expressive with familiar material, stumbles over newly learned vocabulary	Clear use of familiar words; some mispronunciation of new vocabulary; displays understanding of class material by using eye contact, varied expression, and enthusiasm	Exceptional confidence with vocabulary, pronunciation , and class material displayed through poise, clear articulation, and enthusiasm; able to engage in complex dialogue	
Listening	Easily distracted in class; often does not listen to teacher and students, thus unable to follow directions or participate in class discussions	Somewhat distracted by classmates, sometimes listens to teacher and students, has some difficulty following directions or participating fully in class discussions	Listens while teacher is speaking but somewhat distracted while classmates speak; able to follow directions but is sometimes unable to participate fully in class discussions	Carefully and actively listens to teacher and classmates; always follows directions and productively interacts with classmates in discussions	
Ability to Work Collaboratively	Unable to focus in a group, disruptive and does not show respect, is easily frustrated, does not accomplish goals	Respects others in the group, is unable to take initiative and does not do fair share of the work, attempts to focus	Able to work with group productively; accomplishes most goals	Works well in groups; listens to and respects others' ideas, solves problems calmly and productively, stays on task, accomplishes all goals	
Writing	Shows little to no understanding for rules of capitalization, punctuation, and spelling; difficulty expressing clear thoughts	Shows some understanding for rules of capitalization, punctuation, and spelling through developing sense of simple sentences; developing ability to express clear thoughts	Shows understanding for rules of capitalization, punctuation, and spelling through improved simple sentences; improved ability to express clear thoughts	Shows clear understanding for the rules of capitalization, punctuation, and spelling; clear, organized sentence structure; expresses clear thoughts	
Understanding of Task	Does not understand task	Has little understanding of task	Has clear understanding of task	Has clear and unified understanding of task	

CAPSTONE PROJECT: WATER BOTTLE ROCKET LESSON 7

ALEXIA PUIG

SUMMARY

This is the seventh lesson in my integrated unit. For this lesson, the students will work together in teams and begin constructing their bottle rockets. They can build the rockets using 2 liter plastic bottles and can modify the basic design however they choose.

GRADE LEVEL

9-12

TIME FRAME

1 hour (1 class period)

SUBJECT(S)

ESL, Mathematics, Science

TOPIC(S)

Designing and Constructing a Bottle Rocket

NOTES

For this lesson, the students will create the bottle rockets which they are going to test. The previous lessons gave students the background for researching different designs, technical drawing with isometric figures, using simulations and graphing to find the optimal parameters, and using their creativity to visualize their own unique design. Now, the students will finally put their design into action.

ARIZONA ACADEMIC STANDARDS

Subject: Science

- Subject/Grade/Domain: High School
- Strand : Strand 1: Inquiry Process
- Concept : Concept 1: Observations, Questions, and Hypotheses
- Performance Objective: PO 1. : Evaluate scientific information for relevance to a given problem.
- Performance Objective: PO 4. : Predict the outcome of an investigation based on prior evidence, probability, and/or modeling (not guessing or inferring).

Subject: Mathematics (2008)

- Subject/ Grade/ Domain : High School
- Grade : Grades 9 & 10
- Strand : Strand 2: Data Analysis, Probability, and Discrete Mathematics
- Concept : Concept 1: Data Analysis (Statistics) Understand and apply data collection, organization, and representation to analyze and sort data.
- Strand 3: Patterns, Algebra, and Functions
- Concept : Concept 2: Functions and Relationships Describe and model functions and their relationships.
- Performance Objective: PO 4. Use equations, graphs, tables, descriptions, or sets of ordered pairs to express a relationship between two variables.
- Performance Objective: PO 6. Recognize and solve problems that can be modeled using a quadratic function.

UNDERSTANDINGS

For this activity, the students will need to work cooperatively together in teams and apply what they have obtained in the previous lessons.

ESSENTIAL QUESTIONS

1. Why should the rocket have fins?
2. Why does the rocket need a nose cone?
3. Where should the center of gravity be?
4. How should the fins be arranged to create the best areodynamic design?

KNOWLEDGE AND SKILLS

1. Use the background knowledge from the previous lessons for this activity.
2. Apply the skills from the last several lesson to construct a bottle rocket.
3. Synthesize their own unique bottle rocket.

PERFORMANCE TASK

Activity 1: I will explain the instructions and divide the class into teams

Activity 2: I will pass out the materials and answer any questions

Activity 3: Students will begin constructing their bottle rockets

PERFORMANCE PROMPT

Before the students begin the activity, I will ask them

what they know about bottle rockets.did yesterday (obtaining the data tables for our bottle rockets using computer simulations).

ASSESSMENT RUBRICS

For this lesson, I will use the following rubric to assess the students on their group collaboration.

1. Bottle Rocket Teamwork

SEQUENCE OF ACTIVITIES

At the beginning of the lesson, I will show the students examples of bottle rockets.

DIFFERENTIATED INSTRUCTION

All of my students are English Language Learners, but they will be working together in teams so that the students can help each other. Also, this assignment is a hands-on activity, so language barriers will not be as much of a problem.

RESOURCES

- 2 liter plastic bottles
- transparencies
- balsa wood
- glue
- manila folders
- scissors
- markers

BOTTLE ROCKET TEAMWORK RUBRIC

Criteria / Level	Poor (1)	Needs Improvement (2)	Good (3)	Excellent (4)	Score / Level
Skill development for task	Assumes others will learn skill. Makes no effort to acquire expertise in skill.	Satisfied with general understanding of skill, but will not go for competence.	Will learn skill when it is necessary. Usually minimum competence to complete task.	Readily learns new skills as a matter of course. Seeks to extend the skill.	
Creativity	Boundaries set by the fulfilling of minimum requirements. No personal input or attempt to enhance.	Has an occasional new idea, but little follow through. Products are completed in an acceptable form.	Has new ideas or ways of doing things, but may be reluctant to deploy. Products always well done for requirements	Formulates new ideas or new ways of doing things. Products exceed requirements in design and/or content.	
Intellectual contribution	Has little or no grasp of context. Sees task as isolated with no connection to past or future ideas.	Aware of overall context, but makes no connections on own. Can recite connections of others but rarely can support them.	Usually understands overall context of task and asks questions about context. Makes connections on own and "gets" those others make.	Understands overall context of the task. Contributes ideas and proposals. Extends connections to ideas past and future.	
Effort	Actively avoids jobs when possible. Complains about others. Has large set of excuses.	Reluctantly does jobs when asked. Seeks easiest duties in group. Sometimes works to completion.	Willingly takes on jobs when asked. Works to completion. Will work long hours when required.	Volunteers for jobs no matter how difficult. Always works to completion. Willing to work long hours.	
Engagement	Waits for direction. Knows little of what is going on or objectives. Cannot describe where group is in process.	Seeks direction, but does not initiate action. Objectives seen as poorly defined external requirements. May know where group is.	Sometimes initiates action and always works well with direction. Generally knows the specific objectives and where group is.	Enthusiastically initiates action. Personalizes the task and takes ownership of the objectives. Always knows where group is.	

CAPSTONE PROJECT: WATER BOTTLE ROCKET LESSON 8

ALEXIA PUIG

SUMMARY

This is the eighth lesson in my integrated unit. For this lesson the students will test their bottle rockets by varying one parameter three different times and keeping the other parameter constant. The students will record their data and use it to determine the final parameters.

GRADE LEVEL

9-12

TIME FRAME

1 hour (1 class period)

SUBJECT(S)

ESL, Mathematics, Science

TOPIC(S)

Testing The Bottle Rocket Designs, Recording Data

NOTES

This activity is for the students to test their design and determine the optimal parameters. They will then compete and launch their final design.

ARIZONA ACADEMIC STANDARDS

Subject: Science

- Subject/Grade/Domain: High School
- Strand : Strand 1: Inquiry Process
- Concept : Concept 2: Scientific Testing (Investigating and Modeling)
  Design and conduct controlled investigations.
- Performance Objective: PO 4. : Conduct a scientific investigation that is based on a research design.
- Performance Objective: PO 5. : Record observations, notes, sketches, questions, and ideas using tools such as journals, charts, graphs, and computers.

Subject: Mathematics (2008)

- Subject/ Grade/ Domain : High School
- Grade : GRADES 9 & 10
- Strand : Strand 3: Patterns, Algebra, and Functions
- Concept : Concept 2: Functions and Relationships
  Describe and model functions and their relationships.
- Performance Objective: PO 4. Use equations, graphs, tables, descriptions, or sets of ordered pairs to express a relationship between two variables.

UNDERSTANDINGS

Testing a hypothesis or design is part of a scientific process. I want the students to see their plan in action and see how all of the variables (parameters) change and affect the distance of the rocket.

ESSENTIAL QUESTIONS

1. What causes a bottle rocket to lift off?
2. What determines how far a bottle rocket travels?
3. How many variables/parameters are changing after the rocket is launched?
4. Were the results obtained similar to the results from the computer simulations?

KNOWLEDGE AND SKILLS

1. Analyze the data obtained in the tables.
2. Synthesize a new hypothesis for the best conditions/ parameters.
3. Evaluate the results obtained to determine the best percent of water level or angle of elevation.

PERFORMANCE TASK

Activity 1: Class discussion and explanation of directions
Activity 2: Teams will launch their rockets and record data
Activity 3: Teams will choose one variable to change and record data
Activity 4: Discussion

PERFORMANCE PROMPT

At the beginning of the lesson, I will remind the students of the computer simulations that they performed and how the angle of elevation and percent water level affected the height and range of the rockets.

ASSESSMENT RUBRICS

This activity will be assessed by using the following rubric.

1. Bottle Rocket Data

SEQUENCE OF ACTIVITIES

After the students have launched their rockets three times, I will ask them what they think the best conditions/parameters are and how the choice of design makes a difference in the range of the rocket.

DIFFERENTIATED INSTRUCTION

All of my students are English Language Learners, but they will be working together in teams so that the students can help each other. Also, this assignment is a hands-on activity, so language barriers will not be as much of a problem.

RESOURCES

- Bottle Rockets
- Rocket Launchers
- Worksheets
- Pencils

BOTTLE ROCKET TESTING

Choose a parameter to vary (either the percent water level or the angle of elevation) and keep the other parameter constant. Launch your rocket at three different values and record your data in the following table.

Percent Water Level	Angle of Elevation	Range

BOTTLE ROCKET DATA RUBRIC

Criteria / Level	Poor (1)	Needs Improvement (2)	Good (3)	Excellent (4)	Score / Level
Data and Observations	Data and observations are incorrect or missing entirely. Relevant units or labels are missing.	Data and observations are incomplete or do not include sufficient details. Relevant units or labels may be missing.	Data and observations are complete and correct.	Data and observations are complete and correct, with all relevant units and labels included. Student provides a level of detail and organization that goes above and beyond requirements.	
Understanding of Science Context	Little to no understanding of science context is evidenced from student's writing.	Some understanding of science context is evidenced from student's writing, but student does not always reason scientifically.	Firm understanding of science context is evidenced from student's writing.	Complete understanding of science context is evidenced from student's writing. Student provides a level of detail and depth that exceeds requirements.	
Materials and Tools	Student is unable to identify many tools and materials. Student does not use materials and tools appropriately or responsibly.	Student is able to identify nearly all tools and materials. Student does not use all tools and materials appropriately or responsibly.	Student is able to identify all tools and materials. Student usually uses tools and materials appropriately and responsibly.	Student is able to identify all tools and materials. Student uses tools and materials appropriately and responsibly.	
Procedure	Student does not correctly follow many aspects of the procedure.	Student correctly follows some aspects of procedure, but makes crucial mistakes or skips some important steps.	Student follows critical aspects of procedure, but has difficulty responding effectively to problems.	Student correctly follows every aspect of the procedure and supplements procedure with effective and inventive additions.	
Collaboration	Student is unable to work cooperatively with lab partners to complete the activity. Requires continual intervention by teacher.	Student simply follows directions of partner(s) and makes little effort to actively contribute.	Student is able to work cooperatively with lab partners to complete the activity, but may not be receptive to partners' ideas.	Student works cooperatively with lab partners to complete the activity, emerging as an effective collaborator who supports the ideas and suggestions of his/her peers.	

CAPSTONE PROJECT: WATER BOTTLE ROCKET LESSON 9

ALEXIA PUIG

SUMMARY

This is the ninth lesson in my integrated unit. For this lesson, the students will launch their bottle rocket for the final time. We will have a small competition to see which team's rocket travels the farthest.

GRADE LEVEL

9-12

TIME FRAME

1 hour (1 class period)

SUBJECT(S)

ESL, Mathematics, Science

TOPIC(S)

Team Project Competition

NOTES

Depending on the weather conditions (i.e. wind), results may vary.

ARIZONA ACADEMIC STANDARDS

Subject: Science

- Subject/Grade/Domain: High School
- Strand : Strand 1: Inquiry Process
- Concept 3: Analysis, Conclusions, and Refinements
  Evaluate experimental design, analyze data to explain results and propose further investigations. Design models.
- Performance Objective: PO 2. : Evaluate whether investigational data support or do not support the proposed hypothesis.
- Performance Objective: PO 4. : Evaluate the design of an investigation to identify possible sources of procedural error, including:
  Ex: trials, controls

Subject: Mathematics (2008)

- Subject/ Grade/ Domain : High School
- Grade : GRADES 9 & 10
- Strand : Strand 2: Data Analysis, Probability, and Discrete Mathematics
- Concept : Concept 1: Data Analysis (Statistics) Understand and apply data collection, organization, and representation to analyze and sort data.
- Performance Objective: PO 1. Draw inferences about data sets from lists, tables, matrices, and plots.
- Strand : Strand 3: Patterns, Algebra, and Functions
- Concept : Concept 2: Functions and Relationships Describe and model functions and their relationships.
- Performance Objective: PO 4. Use equations, graphs, tables, descriptions, or sets of ordered pairs to express a relationship between two variables.

UNDERSTANDINGS

The purpose for this activity is to let the students apply their knowledge and skills to obtain the final result. Those who have done their research and assignments will have the best chance of reaching their goal.

ESSENTIAL QUESTIONS

1. Where does the vertical force come from?
2. How will the wind affect the rocket after it is launched?
3. How can we maximize the velocity of the rocket?

KNOWLEDGE AND SKILLS

1. Show comprehension from the last activities through these performance tasks.
2. Analyze the results obtained.
3. Evaluate the results to answer the questions.

PERFORMANCE TASK

Activity 1: Students will modify their bottle rockets if needed
Activity 2: Students will launch their bottle rockets and record their data
Activity 3: The teams will take a quiz
Activity 4: Class discussion

PERFORMANCE PROMPT

Before the students launch their rockets, I will remind them to refer to yesterday's data and select the best values for the variables.

ASSESMENT/RUBRICS

The assessment for the team quiz will be based on the following rubric.

1. Team Quiz

SEQUENCE OF ACTIVITIES

In order to perform this activity, the students must have their bottle rockets finalized, because they will launch them only once. If they do not, then they must finish them before launching.

DIFFERENTIATED INSTRUCTION

All of my students are English Language Learners, but they will be working together in teams. Also, this is a hands-on activity, so the students should be able to follow along easily.

RESOURCES

- Bottle Rockets
- Rocket Launcher
- Paper
- Pencils
- Quizzes

BOTTLE ROCKET QUIZ

1. What causes a bottle rocket to lift off?

2. Where does the vertical force come from?

3. What happens with just pressurized air?

4. Is more water better?

5. How can I modify the design of the rocket to increase the duration of the flight?

6. How will the wind affect the rocket after it is launched?

7. What determines how far a bottle rocket travels?

8. How many variables are changing after the rocket is launched?

9. How can we maximize the velocity of the rocket?

10. Why do we have to have water in the bottle in the first place?

BOTTLE ROCKET TEAM QUIZ RUBRIC

Criteria / Level	Poor (1)	Needs Improvement (2)	Good (3)	Excellent (4)	Score / Level
Effort	Actively avoids jobs when possible. Complains about others. Has large set of excuses.	Reluctantly does jobs when asked. Seeks easiest duties in group. Sometimes works to completion.	Willingly takes on jobs when asked. Works to completion. Will work long hours when required.	Volunteers for jobs no matter how difficult Always works to completion. Willing to work long hours.	
Engagement	Waits for direction. Knows little of what is going on or objectives. Cannot describe where group is in process.	Seeks direction, but does not initiate action. Objectives seen as poorly defined external requirements. May know where group is.	Sometimes initiates action and always works well with direction. Generally knows the specific objectives and where group is.	Enthusiastically initiates action. Personalizes the task and takes ownership of the objectives. Always knows where group is.	
Completion of assignment	None of the questions were answered.	Half or less than half of the questions were answered.	Most of the questions were answered.	All of the questions were answered.	
Intellectual contribution	Has little or no grasp of context. Sees task as isolated with no connection to past or future ideas.	Aware of overall context, but makes no connections on own. Can recite connections of others but rarely can support them.	Usually understands overall context of task and asks questions about context. Makes connections on own and "gets" those others make.	Understands overall context of the task. Contributes ideas and proposals. Extends connections to ideas past and future.	
Generalizes Explanation	No extension beyond specific explanation or extension is out side of the boundaries of science.	Little extension of explanation to other situations or phenomena or speculation is inappropriate, and or unsupported.	Speculates on a wider application of explanation, but does not apply to specific situations or phenomena.	Attempts to use explanation to make predictions in different situations. E.G., "If this is right, then maybe its how ... works."	

CAPSTONE PROJECT: WATER BOTTLE ROCKET LESSON 10

ALEXIA PUIG

SUMMARY

This is the tenth lesson in my integrated unit. For this lesson, the teams will give an oral presentation on the design of their bottle rocket and the results from the final launch.

GRADE LEVEL

9-12

TIME FRAME

1 hour (1 class period)

SUBJECT(S)

ESL, Mathematics, Science

TOPIC(S)

Group Oral Presentation

NOTES

Some of the students might be absent, which could affect the team's presentation.

ARIZONA ACADEMIC STANDARDS

Subject: Language Arts

- Subject/Grade/Domain: High School
- Standard 3: Listening and Speaking
- Concept 3: Analysis, Conclusions, and Refinements
- Grade Range : Proficiency (Grades 9-12)
- Performance Objective: LS-P5. Evaluate the effectiveness of informal and formal presentations that use illustrations, statistics, comparisons and analogies

Subject: Mathematics (2008)

- Subject/ Grade/ Domain : High School
- Grade : Grades 9 & 10
- Strand : Strand 3: Patterns, Algebra, and Functions
- Concept : Concept 2: Functions and Relationships
  Describe and model functions and their relationships.
- Performance Objective: PO 4. Use equations, graphs, tables, descriptions, or sets of ordered pairs to express a relationship between two variables.

Subject: Science

- Subject/ Grade/ Domain : High School
- Strand : Strand 1: Inquiry Process
- Concept : Concept 4: Communication
  Communicate results of investigations.
- Performance Objective: PO 3. : Communicate results clearly and logically.

UNDERSTANDINGS

The purpose of this presentation is to let all of the teams share their ideas and results with the class. This is a student-centered activity, so I will act as a student and learn from my students.

ESSENTIAL QUESTIONS

1. Why did you choose the design that you did?
2. Why was the arrangement of the fins important?
3. Did having a larger cone make a difference?
4. What would you change about your bottle rocket?

KNOWLEDGE AND SKILLS

1. Show comprehension of the concepts through the oral presentation.
2. Synthesize a conclusion based on the research done and the results obtained.
3. Evaluate the design of the bottle rocket.

PERFORMANCE TASK

Activity 1: One team at a time will present their bottle rocket
Activity 2: I will ask each team the essential questions
Activity 3: Class discussion

PERFORMANCE PROMPT

This is the last lesson in my integrated unit, so I will briefly review the topics of the last nine lessons and explain how they all tie together.

ASSESMENT/RUBRICS

The team oral presentations will be assessed using the following rubric:

1. Bottle Rocket Presentation Rubric

SEQUENCE OF ACTIVITIES

Since this is the last lesson in my unit, I will ask the students for their thoughts/opinions/feedback about this unit.

DIFFERENTIATED INSTRUCTION

Some of the students are at the beginning levels of English acquisition, so they may not be able to speak as much as their team members. These students can present through visual demonstrations and diagrams.

RESOURCES

- Bottle Rockets
- Results from final launch
- Technology resources:
- SMARTBoard

BOTTLE ROCKET PRESENTATION RUBRIC

Criteria / Level	Poor (1)	Needs Improvement (2)	Good (3)	Excellent (4)	Score / Level
Attention to Audience	Did not attempt to engage audience	Little attempt to engage audience	Engaged audience and held their attention most of the time by remaining on topic and presenting facts with enthusiasm	Engaged audience and held their attention throughout with creative articulation, enthusiasm, and clearly focused presentation	
Clarity	No apparent logical order of presentation, unclear focus	Content is loosely connected, transitions lack clarity	Sequence of information is well-organized for the most part, but more clarity with transitions is needed	Development of thesis is clear through use of specific and appropriate examples; transitions are clear and create a succinct and even flow	
Presentation Length	Greatly exceeding or falling short of allotted time	Exceeding or falling short of allotted time	Remained close to the allotted time	Presented within the allotted time	
Content	Thesis is unclear and information appears randomly chosen	Thesis is clear, but supporting information is disconnected	Information relates to a clear thesis; many relevant points, but they are somewhat unstructured	Exceptional use of material that clearly relates to a focused thesis, abundance of various supported materials	
Creativity	Delivery is repetitive with little or no variety in presentation techniques	Material presented with little interpretation or originality	Some apparent originality displayed through use of original interpretation of presented materials	Exceptional originality of presented material and interpretation	