PA – 3 Region
Mathematics and Science Partnership

UNIT #2 TITLE: How Do Scientists Study the World?

For use with grades: 8 - 12

Developed by:

- Yassara Antar
- Daniel Berkey
- Emily Intelicato
- Ericka Nicol
- KC Lancenese
- Laura Tope

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ROLES AND RESPONSIBILITIES

MISSION/TEAM NAME: PALCS PEOPLE

Team Member	Role	Responsibilities
Yassara Antar	Coordinator & Physics Researcher	Research ways to incorporate NASA data in physics lessons.
Daniel Berkey	Mathematics Researcher	Research ways to incorporate NASA data in mathematics lessons.
Emily Intelicato	General Science Researcher	Research ways to incorporate NASA data in general science lessons.
Ericka Nicol	Biology Researcher	Research ways to incorporate NASA data in biology lessons.
KC Lancenese	Recorder & Forensic Science Researcher	Research ways to incorporate NASA data in biology and/or forensic science lessons.

Laura Tope	General Science Researcher	Research ways to incorporate NASA data in life science lessons.

Unit #2 Outline

GRADE LEVEL(S): 8-12

PA CONTENT STANDARDS:

4.1.10.E – Analyze how humans influence the pattern of natural changes (e.g., primary/ secondary succession and desertification) in ecosystems over time.

3.1.10.A1 - Explain the characteristics of life common to all organisms.

3.1.10.A3 - Compare and contrast the life cycles of different organisms.

3.1.10.A6 - Identify the advantages of multi-cellularity in organisms.

3.2.10.B6- PATTERNS SCALE MODELS CONSTANCY/ CHANGE Explain how the behavior of matter and energy follow predictable patterns that are defined by laws.

3.2.10.B7- Compare and contrast scientific theories. Know that both direct and indirect observations are used by scientists to study the natural world and universe. Identify questions and concepts that guide scientific investigations. Formulate and revise explanations and models using logic and evidence. Recognize and analyze alternative explanations and models.

2.6.11.B: Select or calculate the appropriate measure of central tendency, calculate and apply the interquartile range for one-variable data, and construct a line of best fit and calculate its equation for two-variable data.

2.7.11.A: Use probability to predict the likelihood of an outcome in an experiment.

2.7.11.E: Use probability to make judgments about the likelihood of various outcomes.

2.6.11.A: Design and conduct an experiment using random sampling.

2.6.11.E: Make predictions based on lines of best fit or draw conclusions on the value of a variable in a population based on the results of a sample.

2.7.11.A: Use probability to predict the likelihood of an outcome in an experiment.

2.7.11.E: Use probability to make judgments about the likelihood of various outcomes.

3.1.10.A1: Explain characteristics of life

3.1.10.A3: Compare and contrast life cycles

3.4.10.E1: Assess how medical technologies over time have impacted medicine

3.1.10.A9: Know that both direct and indirect observations are used by scientists to study the natural world

S8.D.2.1.1: Explain the impact of water systems on the local weather or the climate of a region (e.g., lake effect snow, land/ocean breezes).

S8.D.2.1.2: Identify how global patterns of atmospheric movement influence regional weather and climate.

S8.D.2.1.3: Identify how cloud types, wind directions, and barometric pressure changes are associated with weather patterns in different regions of the country.

3.3.7.B1: Explain how gravity is the major force in the formation of the planets, stars, and the solar system. Describe gravity as a major force in determining the motions of planets, stars and the solar system. Compare and contrast properties and conditions of objects in the solar system to those on Earth**.**

3.2.10.B7: Compare and contrast scientific theories. Know that both direct and indirect observations are used by scientists to study the natural world and universe. Identify questions and concepts that guide scientific investigations. Formulate and revise explanations and models using logic and evidence. Recognize and analyze alternative explanations and models.

ASSESSMENT ANCHORS:

S11.B.3.1.3 Describe how living organisms affect the survival of one another.

S11.B.3.3.3 Explain the environmental benefits and risks associated with human-made systems

S11.B.1.1.1 Explain how structure determines function at multiple levels of organization (e.g., chemical, cellular, anatomical).

S11.B.1.1.2 Compare and contrast the structural and functional similarities and differences among living things (e.g., classify organisms into classification groups, compare systems).

S11.C.2.1.1 Compare or analyze waves in the electromagnetic spectrum (e.g., ultraviolet, infrared, visible light, X-rays, microwaves) as well as their properties, energy levels, and motion. Evaluate wave properties of frequency, wavelength and speed as applied to sound and light through different media.

S11.A.3.1.2 Analyze and predict the effect of making a change in one part of a system on the system as a whole.

S11.A.3.1.4 Apply the universal systems model of inputs, processes, outputs, and feedback to a working system (e.g., heating, motor, food production) and identify the resources necessary for operation of the system.

M11.E.3.1.1 Find probabilities for independent, dependent, or compound events and represent as a fraction, decimal or percent.

M11.E.3.1.2 Find, convert, and/or compare the probability and/or odds of a simple event.

M11.E.3.2.1 Determine the number of permutations and/or combinations or apply the fundamental counting principle.

M11.E.1.1.2 Analyze data and/or answer questions based on displayed data (box-and-whisker plots, stem-and-leaf plots, or scatter plots).

M11.E.3.1.1 Find probabilities for independent, dependent, or compound events and represent as a fraction, decimal or percent.

M11.E.3.1.2 Find, convert, and/or compare the probability and/or odds of a simple event.

M11.E.4.1.2: Use probability to predict outcomes.

S11.B.1.1.1 Structure relates to function

S11.A.1.1.4 Explain how specific scientific knowledge or technological design concepts solve problems

S11.A.1.1.5 Analyze or compare the use of both direct and indirect observations as means to study

S8.D.3.1.2 Describe the role of gravity as the force that governs the movement of the solar system and universe.

S11.A.2.2.2 Explain how technology is used to extend human abilities and precision

S11.B.1.1.2 Compare and contrast structural differences

S11.A.3.3 Compare and analyze repeated processes or recurring elements in patterns.

S11.A.3.3.3 Analyze physical patterns of motion to make predictions or draw conclusions

S11.A.3.1.4 Apply the universal systems model of inputs, processes, outputs, and feedback to a working system (e.g., heating, motor, food production) and identify the resources necessary for operation of the system.

S11.A.3.3.1 Describe or interpret recurring patterns that form the basis of biological classification, chemical periodicity, geological order, or astronomical order.

S11.A.3.3.3 Analyze physical patterns of motion to make predictions or draw conclusions (e.g., solar system, tectonic plates, weather systems, atomic motion, waves).

KEYSTONES

BIO.A.1.1.1 - Describe the characteristics of life shared by all prokaryotic and eukaryotic organisms.

BIO.A.1.2.1 - Compare and contrast cellular structures and their functions in prokaryotic and eukaryotic cells.

BIO.A.1.2.2 - Describe and interpret relationships between structure and function at various levels of biological organization (i.e., organelles, cells, tissues, organs, organ systems, and multicellular organisms).

BIO.B.4.2.4 – Describe how ecosystems change in response to natural and human disturbances (e.g., climate changes, introduction of nonnative species, pollution, fires)

ESSENTIAL QUESTION:
(DEVELOP A GLOBAL QUESTION THE UNIT IS DESIGNED TO ADDRESS)

How do scientists study the world and the universe?

UNIT OBJECTIVES:

TSWBAT:

Students will be able to explain how human activities can impact chemical cycles.

Students will be able to explain how pollution can affect food chains.

Students will be able to give an example of rapid plant movement.

Students will be able to define three different tropisms of plants.

Students will be able to define circadian rhythm.

Students will be able to explain how day length may affect plant flowering.

The student will understand and be able to use the fundamental counting principle to determine sample spaces.

The student will use tree diagrams to determine the number of positive outcomes.

The student will use NASA SOHO data to determine the probability of a solar flare happening on any given day.

The student will understand and be able to use frequency tables.

The student will be able to determine the probability of an event using simple probability theory and using a binomial distribution.

The student will use NASA data to determine the probability of avionic disruption due to neutrino collisions.

Students will be able to distinguish between various "special" plants based on their nutritional and growth requirements.

Students will be able to understand why such organisms are studied.

How is NASA using technology to study pathogenic diseases?

Know the difference between weather and climate

Understand how a changing climate can impact the people around the world.

Describe the geographical features on Earth that affect climate

Students will learn how the universe is arranged.

Students will learn how stars form patterns in the sky.

Students will learn how the motions of bodies in space appear from Earth.

Distinguish between specular and diffuse reflection of light.

Apply the law of reflection for flat mirrors.

Describe the nature of images formed by flat mirrors.

Describe the nature of images formed by flat mirrors by investigating the Hubble Space Telescope.

Explain how the Earth is like a bar magnet.

Describe the Earth's magnetic field.

Explain magnetic declination.

Give evidence for magnetic field reversals.

Describe the role the magnetosphere plays in the aurora and in auroral substorms.

Understand the history of space exploration as a whole.

Explain how Newton's Laws of Motion relate to rockets.

Describe how rockets lift off the ground.

Explain how clouds form.

Identify three kinds of clouds.

Explain how precipitation forms.

Explain how NASA studies clouds.

GENERAL MATERIALS NEEDED FOR UNIT: (include technology, NASA resources, etc…)

From all teachers:

- Computer, pencil, notebook.
- Each student will need the internet, and access to PALCS Moodle to complete the lessons.
- PowerPoint

Specifics from certain lessons:

- Java climate model
- Excel, Fathom, or calculator
- NASA mission data (several websites)
- Video: BrainPop: Global Warming
- Interactive Program: NASA's Jet Propulsion Laboratory – Climate Time Machine:

http://climate.nasa.gov/kids/ClimateTimeMachine/climateTimeMachine_kids.cfm

- NASA's Global Climate Change: Climate:http://climate.nasa.gov/kids/

- Rubber ducks Employed By NASA at:

http://www.rubaduck.com/news/rubber-duck-news-20080922-NASA-glacier-ducks.htm

- EPA's Climate Change Kids Site: http://epa.gov/climatechange/kids/index.html

- Lesson "What Makes Up the Universe?"
- Textbook "Space Science"
- Video: "The Universe" from Discovery Channel.
- Moodle lessons 13.3 Flat Mirrrors, 13.3b Flat Mirror Example: Hubble Space Telescope
- JAVA enabled browser for virtual simulation lab activity – anticipatory set
- Movie Clip: October Sky
- Microsoft Word/Open Office Program: Notes and Rocket Timeline
- Lesson PowerPoint: Rockets and How They Work
- Video: Exploring Space Rockets
- Interactive Program: Rocket Science 101
- Website: NASA History Timeline
- Microsoft Word/Open Office Program
- Interactive Programs:
    - S'COOL: On-line Cloud Chart
    - Clouds Brainpop Video
    - Teacher Domain: Cloud Types

MODELING AND GUIDED INSTRUCTION: (the whole class will be involved in the following learning experience)

All teachers: Through the use of written instruction, powerpoints, reading guides, graphic organizers, and chats in Adobe Community**.**

Specific examples from certain lesson plans:

- Students will read an introduction to the lesson which is the information from the PowerPoint summarized briefly. They are also asked questions like what happens to plants in space and how being on a space shuttle or station where the light is artificial and there is little or no gravity affects the tropisms of plants to get them thinking about plants in space. They will then watch a brief video on the Space Shuttle 118 (STS-118).

- The Students will begin by looking at a recent class x solar flare. They will learn about the types of solar flares how often they occur.

- Students will view a short video from the Discovery Channel.

- Student will use the NASA Resource "Navigate Objects Around a Planet"

- Students will view images of the universe using the NASA Photo Journal

- Explore light with mirrors: "Multiple Images" Interactive Java Tutorial. Students will explore how light bounces back from flat mirrors first before applying this to the construction of the Hubble mirrors and its structure for collecting.

COLLABORATION/GROUP WORK: (problem-based/inquiry learning)

All teachers:
Chats in Adobe Community (Connect) (break-out rooms)

Specific examples:

- Students will view the PowerPoint that has been converted to a shockwave file using i-Spring in which I discuss the impact humans have on the environment. One of the topics that I have highlighted is the hole in the ozone layer. Students will learn about the ozone hole. How it forms and why it has not disappeared yet. They will view images from space and information provided by NASA.

- Students will view the PowerPoint that has been converted to a shockwave file using i-Spring in which I discuss some of the missions that NASA has carried out in which they sent plants or seeds into space. I mention STS-118, which they watched a video about. I also talk about the seeds that were left behind on the International Space Station (Expedition 15 and 16). I show them the pictures of the plants growing in space that were taken by a flight engineer. I get them thinking about uses for this data like possibly growing plants on the moon, Mars, or in space on long trips. I talk about how microgravity makes the plants rely on the light (phototropism instead of gravitropism). I included pictures taken aboard Space Shuttle mission 91 (STS-91)

- To begin the lesson the fundamental counting principle will be studied. The counting principle will be demonstrated using simple sample spaces. Next, students will be given NASA SOHO data on solar flares. Using this data, students will look for trend in solar flare occurrences. Primarily we will look at the frequency of different classes of solar flares. Using the data and trends students will apply the fundamental counting principle to find the probability of a specific type of solar flare. Look at permutations and combinations, and compare those results.

INDEPENDENT PRACTICE: (student exploration and elaboration)

Specific examples from certain lessons:

Students independently research satellites.

Students independently take the quiz or test.

In our final activity, students will be asked to create a timeline of 10 major events that have taken place for rockets and space exploration. In order to accomplish this task, I have provided a video called Exploring Space Rockets by Discovery Education and NASA's History Timeline. Students will start with the 1950 and end with 2010. The timeline should be written in sequential order and a small description should also be written for the event. To enhance this activity, students will focus on one event and then conduct further research and explain why this event was significant.

Students will also answer the following questions:

How has space exploration changed since the 1960's?

What have we learned through space exploration?

What will we learn about outer space in the future?

How will space exploration be different in 2020?

ASSESMENT/EVALUATION: (authentic student products and how assessed)

Formative:

General assessments – found in all lessons:

- Quizzes – multiple choice, free response, short essay.

Specific examples of assessments – found in certain lessons:

- They will take a short quiz in which they basically match the word with the proper definition or explanation. There is nothing in the quiz specifically relating to plants in space.
- Give data and ask students to use the fundamental counting principle to determine the probability of an event.
- Give data and ask the students to use permutation or combination formulas to calculate the probability of an event.
- Students will complete the worksheet "Single Event Upsets in Aircraft Avioncs".
- Students must research one of the "special" plants and describe it.
- As the government attempts to decide what agencies to fund and which ones to take money from to balance the budget, NASA may be in trouble. Take a stand: **should the government fund this type of research? Why or why not? Will this type of research be financially profitable in the long run? Why or why not?**
  If you have chosen to fund this research: which diseases that we have discussed might benefit the most from this research? (In other words, which disease could we have less of due to this research?)
  If you have chosen to defund (take money away from) this research: where should money be spent instead to help slow or stop the transmission of disease?
- Students will use a dichotomous key to classify different types of cloud pictures. They will then answer the following questions:
  - Briefly describe each of the three main types of clouds.
  - What clues help you identify the type of clouds at each level?
  - What can clouds tell you about atmospheric conditions and the weather?

Summative: PA3-MSP post-test.

Links to lessons –

1. Click on the links below to access each lesson.
2. General access: username = notarealstudent / password = unreal

Or

1. moodle.palcs.org
2. Username = notarealstudent / password = unreal
3. Search for teacher name to enter course. Search for lesson name and click on link.

Yassara Antar:

Lesson 1: Optics: Hubble Space Telescope
http://moodle.palcs.org/moodle/mod/resource/view.php?id=579293

Lesson 2: The Magnetosphere and Space Weather
http://moodle.palcs.org/moodle/mod/resource/view.php?id=529119

KC Lancenese:

Lesson 1: Human Impact on the Environment
http://locker.palcs.org/~klancenese/palcs/bio/mp3/bio36_4.html
Lesson 2: Tropisms and Circadian Rhythm
http://locker.palcs.org/~klancenese/palcs/bio/mp4/bio22_2n3.html

Laura Tope:

LESSON 1 – Earth's Climate: http://moodle.palcs.org/moodle/mod/quiz/view.php?id=583665
LESSON 2 – What Makes Up the Universe:
http://moodle.palcs.org/moodle/mod/quiz/view.php?id=593384

Daniel Berkey:

Lesson 1: http://locker.palcs.org/~dberkey/mathclasses/nasa/lesson3/lesson.html
Lesson 2: http://locker.palcs.org/~dberkey/mathclasses/nasa/lesson4/lesson.html

Ericka Nicol:

Lesson #1 ~ http://moodle.palcs.org/moodle/mod/assignment/view.php?id=587401

Lesson #2 ~ http://moodle.palcs.org/moodle/mod/assignment/view.php?id=593416

Emily Intelicato:

Lesson 1: http://moodle.palcs.org/moodle/mod/assignment/view.php?id=578782

Lesson 2: http://moodle.palcs.org/moodle/mod/quiz/view.php?id=519762 and http://moodle.palcs.org/moodle/mod/assignment/view.php?id=593512

B. A professional development component is required for each unit. This requirement may be met in any one of the following forms (or another of your choice):

- Professional development training to colleagues

C. Plan of implementation (Meetings, events, etc.):

Will deliver professional development training to entire science department (13 members) at one of our regularly scheduled bi-weekly meetings. We will implement this sharing session at the close of marking period 4 at the June 31st, 2011 meeting.

Lesson Plan #1 – Unit #2 (Intelicato)

Topic:

Rockets and How They Work

PA Academic Standards:

S11.A.1.1.5, S11.A.3.1.1, S11.A.3.3.3, S11.C.2.1.2, S11.C.3.1.1, S11.C.3.1.2, S11.C.3.1.3, 3.2.10.B1, 3.2.10.B6

Objectives:

Understand the history of space exploration as a whole.

Explain how Newton's Laws of Motion relate to rockets.

Describe how rockets lift off the ground.

Materials:

Movie Clip: October Sky

Microsoft Word/Open Office Program: Notes and Rocket Timeline

Lesson PowerPoint: Rockets and How They Work

Video: Exploring Space Rockets

Interactive Program: Rocket Science 101

Website: NASA History Timeline

Anticipatory Set:

Show the movie clip October Sky. This clip shows the final scene of the movie where the boys launch a rocket for Miss. Riley, their teacher. I also give a written description of what the boys did and how their hard work paid off.

In October 1957, 14 – year hold Homer Hickam looked upward and saw a speck of light move across the sky. It was the Russian satellite Sputnik, the first artificial satellite. It was propelled into space by a powerful rocket. This sight inspired Homer and his friends. They spent the next three years designing, building, and launching rockets in their hometown of Coalwood, West Virginia.

Many of their first attempts failed, but they did not give up. Eventually, they built a rocket that soared to a height of almost ten kilometers. Their hard work paid off. In 1960, they won first place in the National Science Fair. Since then, rocket launches have become more familiar, but they are still an awesome sight.

Activities: (modeling, guided practice, independent practice & group work)

Guided Reading:

For this lesson, students will complete notes while watching the lesson. In the lesson, you will see purple words. Place these words in your notes to help you understand the key concepts.

Independent Practice: Rocket Science 101

In this interactive activity, students can choose to create a Delta II, Delta IV, Atlas, or Pegasus Rocket. In order to launch a successful mission, students will learn what it takes to build each rocket and the parts that make it up. For example, here are the parts for a Delta 11 rocket:

- Firing, Spacecraft, Payload Attach Fitting, Star-48B Solid Rocket Motor, Spin Table, Second Stage Guidance, Second Stage Fuel and Oxidizer Tanks, Second Stage Engine, Interstage, First Stage Fuel Tank, First Stage LO2 Tank, Graphite Epoxy Motor, Engine Section, Extended Air-Lit Nozzle, First Stage Engine

Wrap-up:

The motion of a rocket from the surface of the Earth to landing on the moon can be explained and described by the principles of Sir Isaac Newton. Remember, Newton created three laws of motion. Let's review:

Law 1: Every object remains at rest until an external force acts on the object. A rocket will stay at rest unless an external force like thrust acts upon it.

Law 2: Force is equal to mass times acceleration. The amount of thrust (force) produced by a rocket engine will be determined by the mass of the rocket fuel that is burned and how fast the gas escapes the rocket.

Law 3: For every action force, there is an equal and opposite re-action force. With rockets, the action is the expelling of gas out of the rocket engine. The reaction is the movement of the rocket in the opposite direction.

As you can see, Newton's laws play a big role in rocket development and their implementation. Knowing the laws is not enough. One must know how to apply them as well.

Evaluation / Assessment:

Independent Practice:

In our final activity, students will be asked to create a timeline of 10 major events that have

taken place for rockets and space exploration. In order to accomplish this task, I have provided a video called Exploring Space Rockets by Discovery Education and NASA's History Timeline. Students will start with the 1950 and end with 2010. The timeline should be written in sequential order and a small description should also be written for the event. To enhance this activity, students will focus on one event and then conduct further research and explain why this event was significant.

Students will also answer the following questions:

How has space exploration changed since the 1960's?

What have we learned through space exploration?

What will we learn about outer space in the future?

How will space exploration be different in 2020

Lesson Plan #2 – Unit #2 (Intelicato)

Topic:
Clouds
PA Academic Standards:
S11.A.1.1.5 S11.A.3.1.1 S11.A.3.2.1 S11.A.3.3.3 S11.D.2.1.1 S11.D.2.1.2 3.3.10.A3 3.3.10.A6 3.3.10.A7 3.3.10.A8
Objectives:
Explain how clouds form. Identify three kinds of clouds. Explain how precipitation forms. Explain how NASA studies clouds.
Materials:
Lesson PowerPoint Microsoft Word/Open Office Program Interactive Programs:

S'COOL: On-line Cloud Chart

Clouds Brainpop Video

Teacher Domain: Cloud Types

Anticipatory Set:

Start this lesson with the video called Cloud In A Bottle. In this video, the speaker shows how to create a cloud using a bottle, rubbing alcohol, and a pump. This will demonstrate that you need high pressure to heat the molecules and low pressure to create a cloud.

Activities: (modeling, guided practice, independent practice & group work)

Day 1: Clouds Quiz (Using Moodle)

Day 2: Cloud Dichotomous Key

Wrap-up:

In the lesson, students will learn about the about clouds and how they form. We will then focus on how NASA studies clouds and how they affect climate change. Students will learn that satellites are often used to collect cloud data. An instrument called CERES is one several NASA satellites orbiting Earth. CERES stands for Clouds and the Earth's Radiant Energy System. CERES is on board many different types of satellites such as TRMM, Terra, Aqua, Cloudsat, and CALIPSO. Multiple satellites are needed to provide adequate temporal sampling since clouds and radiative fluxes vary throughout the day. CERES measures the energy at the top of the atmosphere, as well as estimate energy levels in the atmosphere and at the Earth's surface. Using information from very high resolution cloud imaging instruments on the same spacecraft, CERES also will determine cloud properties, including altitude, thickness, and the size of cloud particles. All of these measurements are critical for advancing the understanding of the Earth's total climate system and the accuracy of climate prediction models.

To date, satellite studies have found that clouds have an overall cooling effect on the Earth. Additional missions will take place in the future to fill the gap between Aqua and next generation of highly accurate Earth radiation budget measurements. These observations are expected to be made by the National Polar-orbiting Operational Environmental Satellite System (NPOESS) that will be launched in 2014 by NASA.

Evaluation / Assessment:

This lesson has two assessment pieces.

In the quiz, students will complete a series of questions that are either cloze-ended questions or multiple choice. This quiz will focus on the essential questions I listed above.

In the second assessment piece, students will use a dichotomous key to classify different types of cloud pictures. They will then answer the following questions:

Briefly describe each of the three main types of clouds.

What clues help you identify the type of clouds at each level?

What can clouds tell you about atmospheric conditions and the weather?

For extra credit, students can take a picture of the clouds outside and then classify them.

Lesson Plan #1 – Unit #2 (Lancenese)

Topic:

Human Impact on the Environment – The Ozone Layer

PA Academic Standards:

4.1.10.E – Analyze how humans influence the pattern of natural changes (e.g., primary/ secondary succession and desertification) in ecosystems over time.

S11.B.3.1.3 - Describe how living organisms affect the survival of one another.

S11.B.3.3.3 - Explain the environmental benefits and risks associated with human-made systems

Keystone BIO.B.4.2.4 – Describe how ecosystems change in response to natural and human disturbances (e.g., climate changes, introduction of nonnative species, pollution, fires)

Objectives:

- Students will be able to explain how human activities can impact chemical cycles.
- Students will be able to explain how pollution can affect food chains.

Materials:

Computer with internet access and access to PALCS Moodle.

Anticipatory Set:

Students will read an introduction to the lesson which is the information from the PowerPoint summarized briefly.

Activities: (modeling, guided practice, independent practice & group work)

Students will view the PowerPoint that has been converted to a shockwave file using i-Spring in which I discuss the impact humans have on the environment. One of the topics that I have highlighted is the hole in the ozone layer. Students will learn about the ozone hole. How it forms and why it has not disappeared yet. They will view images from space and information provided by NASA.

Wrap-up:

There is no Wrap-up associated with this particular lesson.

Evaluation / Assessment:

There is no Evaluation/Assessment associated with this particular lesson. The information from this lesson is assessed in later lessons and the unit exam.

Lesson Plan #2 – Unit #2 (Lancenese)

Topic:

Tropisms and Circadian Rhythm

PA Academic Standards:

3.1.10.A1 - Explain the characteristics of life common to all organisms.

3.1.10.A3 - Compare and contrast the life cycles of different organisms.

3.1.10.A6 - Identify the advantages of multi-cellularity in organisms.

S11.B.1.1.1 - Explain how structure determines function at multiple levels of organization (e.g., chemical, cellular, anatomical).

S11.B.1.1.2 - Compare and contrast the structural and functional similarities and differences among living things (e.g., classify organisms into classification groups, compare systems).

Keystone BIO.A.1.1.1 - Describe the characteristics of life shared by all prokaryotic and eukaryotic organisms.

Keystone BIO.A.1.2.1 - Compare and contrast cellular structures and their functions in prokaryotic and eukaryotic cells.

Keystone BIO.A.1.2.2 - Describe and interpret relationships between structure and function at various levels of biological organization (i.e., organelles, cells, tissues, organs, organ systems, and multicellular organisms).

Objectives:

- Students will be able to give an example of rapid plant movement.
- Students will be able to define three different tropisms of plants.
- Students will be able to define circadian rhythm.
- Students will be able to explain how day length may affect plant flowering.

Materials:

Computer with internet access and access to PALCS Moodle.

Anticipatory Set:

Students will read an introduction to the lesson which is the information from the PowerPoint summarized briefly. They are also asked questions like what happens to plants in space and how being on a space shuttle or station where the light is artificial and there is little or no gravity affects the tropisms of plants to get them

thinking about plants in space. They will then watch a brief video on the Space Shuttle 118 (STS-118).

Activities: (modeling, guided practice, independent practice & group work)

Students will view the PowerPoint that has been converted to a shockwave file using i-Spring in which I discuss some of the missions that NASA has carried out in which they sent plants or seeds into space. I mention STS-118, which they watched a video about. I also talk about the seeds that were left behind on the International Space Station (Expedition 15 and 16). I show them the pictures of the plants growing in space that were taken by a flight engineer. I get them thinking about uses for this data like possibly growing plants on the moon, Mars, or in space on long trips. I talk about how microgravity makes the plants rely on the light (phototropism instead of gravitropism). I included pictures taken aboard Space Shuttle mission 91 (STS-91)

Wrap-up:

They will continue through the PowerPoint, also learning about circadian rhythm and photoperiodism. At the end of the PowerPoint they should be ready to take a short quiz on tropisms and circadian rhythm.

Evaluation / Assessment:

They will take a short quiz in which they basically match the word with the proper definition or explanation. There is nothing in the quiz specifically relating to plants in space

Lesson Plan #1 – Unit #2 - Nicol

Topic or Title:

Crazy Plants (Plants that do not fit traditional growth conditions)

PA Academic Standards (List number and short description):

science & technology
3.1.10.a1 – Explain characteristics of life
3.1.10.a3 – Compare and contrast life cycles
anchors
s11.b.1.1.1 – Structure relates to function
s11.b.1.1.2 – Compare and contrast structural differences
keystones
bio.a.1.1.1 – Describe characteristics of life
bio.a.1.2.2 – Describe and interpret relationships between structure and function

Objectives:

Students will be able to distinguish between various "special" plants based on their nutritional and growth requirements.

Students will be able to understand why such organisms are studied.

Materials:

Internet

Speakers (for audio recordings)

Anticipatory Set:

In previous lessons, discussed nutritional and growth requirements and alluded that there are plants that do not fit the norm.

Activities: (modeling, guided practice, independent practice & group work)

Students need to read and/or listen to the information provided on parasitic, epiphytic, and carnivorous plants

Wrap-up:

An interview with a student researching hydroponic plants for space.

Evaluation / Assessment:

Students must research one of the "special" plants and describe it.

Lesson Plan #2 – Unit #2 (Nicol)

Topic or Title:

Satellites & the Study of Disease

PA Academic Standards (List number and short description):

science & technology
3.4.10.E1 – assess how medical technologies over time have impacted medicine
3.1.10.A9 – know that both direct and indirect observations are used by scientists to study the natural world anchors
s11.a.1.1.4 – explain how specific scientific knowledge or technological design concepts solve problems
s11.a.1.1.5 – analyze or compare the use of both direct and indirect observations as means to study
s11.a.2.2.2 – explain how technology is used to extend human abilities and precision

Objectives:

How is NASA using technology to study pathogenic diseases?

Materials:

Internet

Anticipatory Set:

Within the unit, students will have already been introduced to epidemiology and the general study of disease transmission

Activities: (modeling, guided practice, independent practice & group work)

Students will read/listen to several NASA articles about satellite imagery.

Wrap-up:

NASA's satellites can gather quite a lot of information. TERRA, in particular, is a satellite whose main focus is the earth. It can track weather patterns, but it can also track vegetation patterns. It may not seem like a lot of data to you... but think about it: TERRA can "see" temperature, clouds, hurricanes, elevations, algal blooms, forests, deforestation, glaciers, and all the colors of the earth! Want to see some pictures that TERRA has taken? Click HERE.

As you have hopefully figured out by now, some of these factors definitely play a role in disease transmission.

Evaluation / Assessment:

As the government attempts to decide what agencies to fund and which ones to take money from to balance the budget, NASA may be in trouble. Take a stand: **should the government fund this type of research? Why or why not? Will this type of research be financially profitable in the long run? Why or why not?**
If you have chosen to fund this research: which diseases that we have discussed might benefit the most from this research? (In other words, which disease could we have less of due to this research?)
If you have chosen to defund (take money away from) this research: where should money be spent instead to help slow or stop the transmission of disease?

Lesson Plan #2 – Unit #2 (Antar)

Topic:

Light and Reflection: Optics on the Hubble Space Telescope

PA Academic Standards:

S11.C.2.1.1 Compare or analyze waves in the electromagnetic spectrum (e.g., ultraviolet, infrared, visible light, X-rays, microwaves) as well as their properties, energy levels, and motion. Evaluate wave properties of frequency, wavelength and speed as applied to sound and light through different media.

S11.A.3.1.2 Analyze and predict the effect of making a change in one part of a system on the system as a whole.

3.2.10.B6- PATTERNS SCALE MODELS CONSTANCY/ CHANGE Explain how the behavior of matter and energy follow predictable patterns that are defined by laws.

3.2.10.B7- Compare and contrast scientific theories. Know that both direct and indirect observations are used by scientists to study the natural world and universe. Identify questions and concepts that guide scientific investigations. Formulate and revise explanations and models using logic and evidence. Recognize and analyze alternative explanations and models.

S11.A.3.1.4- Apply the universal systems model of inputs, processes, outputs, and feedback to a working system (e.g., heating, motor, food production) and identify the resources necessary for operation of the.

Objectives:

* Distinguish between specular and diffuse reflection of light.

* Apply the law of reflection for flat mirrors.

* Describe the nature of images formed by flat mirrors.

* Describe the nature of images formed by flat mirrors by investigating the Hubble Space Telescope.

Materials:

Moodle lessons 13.3 Flat Mirrrors, 13.3b Flat Mirror Example: Hubble Space Telescope

JAVA enabled browser for virtual simulation lab activity – anticipatory set

Anticipatory Set:

Explore light with mirrors: "Multiple Images" Interactive Java Tutorial. Students will explore how light bounces back from flat mirrors first before applying this to the construction of the Hubble mirrors and its structure for collecting.

Activities: (modeling, guided practice, independent practice & group work)

Moodle lessons, webquest, review activity – virtual optics JAVA simulation, independent reading, websearch, reflection check questions for understanding

Wrap-up:

Application – pictures and videos from the Hubble:

1. Hubblesite gallery: picture album embedded in lesson.
2. Three videos of telescope maintenance on mirrors / one video on how the telescope works – embedded.

Evaluation / Assessment:

Six short answer questions based on reading, lessons on optics, and *reference websites:

*

- http://hubblesite.org/

- http://www.nasa.gov/multimedia/nasatv/on_demand_video.html?param=http://anon.nasa-global.edgesuite.net/anon.nasa-global/ccvideos/Hubble_20_Discovery.asx&_id=231410&_title=Hubble%3A%2020%20Years%20of%20Discovery&_tnimage

- http://www.pbs.org/deepspace/hubble/index.

Lesson Plan #2 – Unit #2 (Antar)

Topic:

Earth As A Magnet: The Magnetosphere and Space Weather

PA Academic Standards:

S11.A.3.3 Compare and analyze repeated processes or recurring elements in patterns.
S11.A.3.3.3 Analyze physical patterns of motion to make predictions or draw conclusions

S11.A.3.1.4- Apply the universal systems model of inputs, processes, outputs, and feedback to a working system (e.g., heating, motor, food production) and identify the resources necessary for operation of the system.

S11.A.3.3.1- Describe or interpret recurring patterns that form the basis of biological classification, chemical periodicity, geological order, or astronomical order.

S11.A.3.3.3- Analyze physical patterns of motion to make predictions or draw conclusions (e.g., solar system, tectonic plates, weather systems, atomic motion, waves).

3.2.10.B7- Compare and contrast scientific theories. Know that both direct and indirect observations are used by scientists to study the natural world and universe. Identify questions and concepts that guide scientific investigations. Formulate and revise explanations and models using logic and evidence. Recognize and analyze alternative explanations and models.

Objectives:

Explain how the Earth is like a bar magnet.

Describe the Earth's magnetic field.

Explain magnetic declination.

Give evidence for magnetic field reversals.

Describe the role the magnetosphere plays in the aurora and in auroral substorms.

Materials:

Moodle lesson 36.7 Earth's Magnetic Field

Resources:

- http://science.nasa.gov/heliophysics/big-questions/
- http://www.nasa.gov/multimedia/nasatv/on_demand_video.html? http://www.nasa.gov/mpeg/167053main_raeder_themis_feb2007_320x240.mpeg
- http://helios.gsfc.nasa.gov/magnet.html
- http://science.nasa.gov/heliophysics/big-questions/how-does-solar-variability-affect-human-society-technological-systems-and-the-habitability-of-planets/

36.9 of text.

Notebook, pencil. A lot of uninterrupted reading time.

Flash player, Quicktime, and Java enabled browser.

Anticipatory Set:

Learn about how space weather is studied – current mission – NASA's Time History of Events and Macroscale Interactions during Substorms (THEMIS).

Featured image and mini explanation: THEMIS aligned (NASA image of THEMIS in magnetosphere. Lead in to 2 feature videos –

1. Solar Particles and Earth's Magnetic Field – embedded in lesson

   (http://www.nasa.gov/multimedia/nasatv/on_demand_video.html.jpg)

2. THEMIS Mission and Substorm Simulation - embedded in lesson (http://www.nasa.gov/mpeg/167053main_raeder_themis_feb2007_320x240.mpeg)

Begin lesson with essential question: How is the Earth like a bar magnet?.

Activities: (modeling, guided practice, independent practice & group work)

Moodle lessons reading, text reading supplement, video warm ups (NASA site) – embedded, article summary review notes for quiz (NASA site) – embedded. Optional videos on magnetic field reversal from NOVA and National Geographic – links also embedded.

Wrap-up:

I. Application – current events / ongoing studies of the magnetosphere:

1. *NASA's Cosmicopia*: Earth's Magnetosphere in the News (list starting from 1/20/11)
2. *NASA Science: Heliophysics*: Big Question topic: "**What Are The Impacts On Humanity**" (How space weather affects Earth's population.)

II. Review for assessment from NASA article:

NASA.gov – News & Features – News Topics – Earth – Earth's *Inconstant Magnetic Field*

Evaluation / Assessment:

Short quiz following lesson 36.7 Earth's Magnetic Field

Quiz - (MP4) 36.7 Earth's Magnetic Field Check Questions

Lesson Plan #1 – Unit #2 (Berkey)

Topic or Title:
The Probability of Solar Flares – The Fundamental Counting Principle
PA Academic Standards (List number and short description):
2.6.11.B: Select or calculate the appropriate measure of central tendency, calculate and apply the interquartile range for one-variable data, and construct a line of best fit and calculate its equation for two-variable data. 2.7.11.A: Use probability to predict the likelihood of an outcome in an experiment. 2.7.11.E: Use probability to make judgments about the likelihood of various outcomes. M11.E.3.1.1: Find probabilities for independent, dependent, or compound events and represent as a fraction, decimal or percent. M11.E.3.1.2: Find, convert, and/or compare the probability and/or odds of a simple event. M11.E.3.2.1: Determine the number of permutations and/or combinations or apply the fundamental counting principle.
Objectives:
The student will understand and be able to use the fundamental counting principle to determine sample spaces. The student will use tree diagrams to determine the number of positive outcomes. The student will use NASA SOHO data to determine the probability of a solar flare happening on any given day.
Materials:
NASA mission data (website) Other web resources Excel, Fathom, or calculator
Anticipatory Set:
The Students will begin by looking at a recent class x solar flare. They will learn about the types of solar flares how often they occur.
Activities: (modeling, guided practice, independent practice & group work)
To begin the lesson the fundamental counting principle will be studied. The counting principle will be demonstrated using simple sample spaces. **Next, students will be given NASA SOHO data on solar flares. Using this data,**

students will look for trend in solar flare occurrences. Primarily we will look at the frequency of different classes of solar flares.

Using the data and trends students will apply the fundamental counting principle to find the probability of a specific type of solar flare.

Look at permutations and combinations, and compare those results.

Wrap-up:

Solar flares can cause disruptions to electronic devices on Earth. Being able to predict class x solar flares could help people to prepare for them.

Evaluation / Assessment:

Online Quiz:

- Give data and ask students to use the fundamental counting principle to determine the probability of an event.
- Give data and ask the students to use permutation or combination formulas to calculate the probability of an event.

Lesson Plan #2 – Unit #2 (Berkey)

Topic or Title:

The Probability of a Neutron Causing Electronics Failure

PA Academic Standards (List number and short description):

2.6.11.A: Design and conduct an experiment using random sampling.

2.6.11.E: Make predictions based on lines of best fit or draw conclusions on the value of a variable in a population based on the results of a sample.

2.7.11.A: Use probability to predict the likelihood of an outcome in an experiment.

2.7.11.E: Use probability to make judgments about the likelihood of various outcomes.

M11.E.1.1.2: Analyze data and/or answer questions based on displayed data (box-and-whisker plots, stem-and-leaf plots, or scatter plots).

M11.E.3.1.1: Find probabilities for independent, dependent, or compound events and represent as a fraction, decimal or percent.

M11.E.3.1.2: Find, convert, and/or compare the probability and/or odds of a simple event.

M11.E.4.1.2: Use probability to predict outcomes.

Objectives:

The student will understand and be able to use frequency tables.

The student will be able to determine the probability of an event using simple probability theory and using a binomial distribution.

The student will use NASA data to determine the probability of avionic disruption due to neutrino collisions.

Materials:

NASA mission data (website)

Other web resources

Excel, Fathom, or calculator

Anticipatory Set:

The Students will begin by looking at the history of avionics. Has avionic advances made flight safer?

Activities: (modeling, guided practice, independent practice & group work)

To begin the lesson students will review frequency tables and basic probability theory.

Next, we will study binomial distributions, and how they are used to determine the probability of an event.

We will look at NASA data on neutrino impacts on aircraft. Students will collect this data in a frequency table. Students will then determine the probability of a neutrino impact on the avionics equipment causing failure. Students will also determine if the probability of a neutrino impact increases with altitude and if so why.

Wrap-up:

Using the probability of neutrino impact, students will predict the likelihood of avionic equipment being disrupted due to neutrino impacts.

Evaluation / Assessment:

Online Quiz:

- Students will complete the worksheet “Single Event Upsets in Aircraft Avioncs”.

Lesson Plan #1 – Unit #2 (Tope)

Topic:

Introduction To Earth's Climate

PA Academic Standards:

S8.D.2.1.1- Explain the impact of water systems on the local weather or the climate of a region (e.g., lake effect snow, land/ocean breezes).

S8.D.2.1.2- Identify how global patterns of atmospheric movement influence regional weather and climate.

S8.D.2.1.3- Identify how cloud types, wind directions, and barometric pressure changes are associated with weather patterns in different regions of the country.

Objectives:

Students will be able to

- know the difference between weather and climate
- understand how a changing climate can impact the people around the world.
- describe the geographical features on Earth that affect climate

Materials:

Computer

Internet Access

Lesson PowerPoint: The Factors That Affect Climate

Video: BrainPop: Global Warming

Interactive Program: NASA's Jet Propulsion Laboratory – Climate Time Machine

Websites found at
http://climate.nasa.gov/kids/ClimateTimeMachine/climateTimeMachine_kids.cfm

NASA's Global Climate Change: Climate Kids found at:

http://climate.nasa.gov/kids/

RubaDuck Forum: Rubber ducks Employed By NASA found at:

http://www.rubaduck.com/news/rubber-duck-news-20080922-NASA-glacier-ducks.htm

EPA's Climate Change Kids Site found at:

http://epa.gov/climatechange/kids/index.html

Anticipatory Set:

Read written introduction, which discusses the definitions of climate and weather, and distinguishes the two from one another and gives examples.

Students are prepared in advance to look for and pay attention to the five important factors that affect climate that will be found in the PowerPoint lesson.

Global warming and the reasons for climate study are presented.

Several government agencies that use technology to study climates are mentioned.

Students will view/listen/interact with the PowerPoint presentation lesson.

Students may explore other sites listed to gain more information.

The textbook pages associated with this subject are given for student review.

Activities: (modeling, guided practice, independent practice & group work)

In this lesson, students are asked to interact with : NASA's Jet Propulsion Laboratory – Climate Time Machine Website.

In this activity, students can move a slider to see the effects of climate change on sea ice, sea level, carbon emissions, and average global temperature over time.

Students are also guided to look at an article to see how NASA has used an accidental spill of rubber ducks into the Pacific Ocean to use as data points for ocean current research. A time line of their journey is given.

Wrap-up:

The factors that affect climate change are: latitude, proximity to large bodies of water, geographic effect (how mountains have a dry, warm side and a cool moist side), elevation, and ocean currents. Each of these is presented using data, maps, graphs and examples.

Evaluation / Assessment:

10 points are earned by the successful completion of a 10 question multiple choice quiz.

Lesson Plan #2 – Unit #2 (Tope)

Topic:

In this lesson, students will learn about views of space from Earth and about the arrangement of the universe.

PA Academic Standards:

3.3.7.B1 Explain how gravity is the major force in the formation of the planets, stars, and the solar system. Describe gravity as a major force in determining the motions of planets, stars and the solar system. Compare and contrast properties and conditions of objects in the solar system to those on Earth.

Anchor: S8.D.3.1.2 Describe the role of gravity as the force that governs the movement of the solar system and universe.

Objectives:

Students will learn how the universe is arranged.

Students will learn how stars form patterns in the sky.

Students will learn how the motions of bodies in space appear from Earth.

Materials:

Lesson "What Makes Up the Universe?"

Computer with Interne access

Textbook "Space Science"

Video: "The Universe" from Discovery Channel.

Anticipatory Set:

To begin the lesson, students read a short passage about how we have acquired knowledge about space.

Gravity is discussed and is used as a basis for grouping 4 basic ideas of how our solar system works.

Activities: (modeling, guided practice, independent practice & group work)

Students will view a short video from the Discovery Channel.

Student will use the NASA Resource "Navigate Objects Around a Planet"

Wrap-up:

Students will view images of the universe using the NASA Photo Journal

Evaluation / Assessment:

Students will take a 10 point quiz.

UNIT PROGRESSION FORM: Unit #____

Group/Coordinator: _____
Date: _____

UNIT ASSESSMENT

The degree to which the lesson(s):	√	**Write a statement to describe how this item was met.**
Identified the prior knowledge required by the students.		
Identify and/or provide an authentic real-world problem relevant to the students for them to solve		
Was aligned with PA standards.		
Followed problem-based/inquiry learning model.		
Allowed for student exploration and elaboration.		
Required authentic student products.		
Integrated PIMS technology into the lesson(s).		
Clearly defined how students would be assessed.		
Utilized and incorporated NASA resources throughout lesson(s).		

GROUP ASSESSMENT (see next page for details)

The group showed:	√	**Write a statement to describe how this item was met.**
Contributions/participation, Attitude		
Cooperations/Working with others		
Focus on task/commitment		
Team role fulfillment		

Group Signature: _____ Date: _____

Coordinator Signature: _____ Date: _____

Group Work Rubric

Team Participant Names:

_____

Skills	Basic	Sound	Thorough	Extensive
Contributions/participation Attitude	Seldom cooperative, rarely offers useful ideas. Is disruptive.	Sometimes cooperative, sometimes offered useful ideas. Rarely displays positive attitude.	Cooperative, usually offered useful ideas. Generally displays positive attitude.	Always willing to help and do more, routinely offered useful ideas. Always displays positive attitude.
Working with others/cooperation	Did not do any work – does not contribute, does not work well with others, usually argues with teammates.	Could have done more of the work – has difficulty, requires structure, directions and leadership, sometimes argues.	Did their part of the work – cooperative. Works well with others, rarely argues.	Did more than others – highly productive Works extremely well with others, never argues
Focus on task/commitment	Often is not a good team member. Does not focus on the task and what needs to be done. Lets others do the work.	Sometimes not a good team member. Sometimes focuses on the task and what needs to be done. Must be prodded and reminded to keep on task.	Does not cause problems in the group. Focuses on the task and what needs to be done most of the time. Can count on this person.	Tries to keep people working together. Almost always focused on the task and what needs to be done. Is very self-directed.
Team role fulfillment	Participate in few or no group meetings. Provided no leadership. Did little or no work assigned by the group.	Participated in some group meetings. Provided some leadership. Did some of the work assigned by the group.	Participated in most group meetings. Provided leadership when asked. Did most of the work assigned by the group	Participated in all group meetings, assumed leadership role as necessary. Did the work that was assigned by the group.
Communication/listening Information sharing	Rarely listens to, shares with, or supports the efforts of others. Is always talking and never listens to others. Provided no feedback to others. Does not relay any information to teammates	Usually listens to, shares with, and supports the efforts of others. Sometimes talks too much. Provided some effective feedback to others. Relays some basic information – most relates to the topic.	Almost always listens to, shares with, and supports the efforts of others. Seldom talks too much. Provides good feedback to others. Relays solid basic information – usually relates to the topic.	Always listens to, shares with, and supports the efforts of others. Provided effective feedback to other members. Relays a great deal of information – all relates to the topic.

http://www.google.com/#hl=en&q=group+work+rubric&aq=f&oq=&aqi=g4&fp=flbC24gbdiA