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Earth Sun Moon Phenomena: Seasons, Lunar Cycle, Tides [7th-8th grade]

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UNDERSTANDING BY DESIGN

Unit Cover Page

Unit Title: Earth Sun Moon Phenomena: Seasons, Lunar Cycle, Tides

Grade Level: Grades 7 & 8

Subject/Topic Area(s): Science, Earth & Space

Designed By: Theo Risinger *trisin@neisd.net*

Time Frame: 4-6 Weeks

School District: North East ISD

School: Barbara Bush Middle School

School Address and Phone: 1500 Evans Rd, San Antonio TX 78258, (210)491-8450

Brief Summary of Unit (Including curricular context and unit goals):

This unit focuses on the interactions and motions of the earth, sun, and moon that cause seasons, the lunar cycle and tides on earth. Most middle school age students have misconceptions of these topics. The primary goal of this unit to correct any misconceptions students may have on these topics. Secondly, to further their understanding of how and why things on earth happen the way they do. For each of the topics covered no one single rule or individual event will cover all the aspects involved in the great question of "Why?". Students will be challenged because they will have to look models of things much larger than their immediate world, analyze them, and develop multiple cause and effect relationships to explain the phenomena.

The performance assessments will require the student to apply some very drastic changes to the earth sun moon systems operation and explain how these changes will affect life on earth. Student groups will role play as expert scientists & government officials, making presentations and challenging the presentations.

This unit's assessment piece could be combined with some of the TEKS involving weather, convection currents, and Oceans to include interactions of multiple systems, forcing the student to assimilate ever more concepts, and make more precise predictions.

Unit: Earth Sun and Moon Phenomena: Seasons, Lunar Cycle, Tides

Grade: 8th TEKS 8.7 A, B, C 2010-2011

Stage 1: Desired Results

Understandings

Students will understand....

- *That the regular and predictable movement patterns of objects in the universe create regular and predictable phenomena on earth.*
- *That the earth, sun, and moon exist as a system where changing one aspect may change other aspects.*
- *Seasons experienced on earth are dependent upon global location and movements.*

If you include TEKS 8.10 A & C

- *That weather experienced on earth is the product of interactions between earth's systems (hydrosphere, geosphere, & atmosphere) and the solar system (specifically the sun).*

Essential Questions

1. *Where do the measurements of time for days, seasons, and years come from?*
2. *Why do earth's seasons happen over and over again with consistency?*
3. *How does where you live on earth change how you experience earth's seasons?*

If TEKS 8.10 A & C are included

4. *How does earth's motions, orientation, and interactions with the sun effect climate and weather patterns?*

Knowledge *Students will know...*

- *How earth moves within the universe.*
- *What causes day and night & years on earth.*
- *The causes of earth's seasons.*
- *That location on the globe relative to latitude is a major factor in how seasons and climate are experienced*
- *The cause and phases of the moon. (Lunar Cycle)*
- *How the moon and Sun effect earth's oceans' tides.*

Skills *Students will be able to...*

- *Model and Diagram the earth, sun, and moons motions.*
- *Explain why Earth's seasons change*
- *Predict how phenomena on earth may be effected if the earth or moon's motions change.*
- *Identify and predict the Lunar Cycle (Phases of the Moon).*
- *Read and Analyze tide tables/charts.*

TEKS (2010-2011)

(7) *Earth and space. The student knows the effects resulting from cyclical movements of the Sun, Earth, and Moon. The student is expected to:*

(A) *model and illustrate how the tilted Earth rotates on its axis, causing day and night, and revolves around the Sun causing changes in seasons;*

(B) *demonstrate and predict the sequence of events in the lunar cycle; and*

(C) *relate the position of the Moon and Sun to their effect on ocean tides.*

(10) *Earth and space. The student knows that climatic interactions exist among Earth, ocean, and weather systems. The student is expected to:*

(A) *Recognize that the Sun provides the energy that drives convection within the atmosphere and oceans, producing winds and ocean currents;*

(C) *identify the role of the oceans in the formation of weather systems such as hurricanes.*

Stage 2: Assessment Evidence

Performance Task:

Think of movies like: “The Day After Tomorrow” “The Core” and “Armageddon.” Crazy, completely impossible, or not, scenarios that provide the backdrop for a very drastic change of life on earth as we know it.

Students will be playing the role of top level “Scientists” making a presentation to “Government Officials” in hopes of successfully informing them of the possible changes coming to earth.

Each group of students will be given some variables and parameters. The variables will be the changes in the pattern of earth’s motions and/or orientation. The parameters will be a specific home or global location providing a level of specificity for their predictions.

The goal for the “Group of Scientists” is to accurately assess and predict possible ramifications for their global location due to the variables given. They must present their finding to a panel of “Government Officials”

Another group of students will serve as the “Government Officials” Their job is to assess the scientists presentation and ask questions that appropriately challenge the “Scientists”

Students would be assessed on both their presentations as scientists and their challenge as government officials.

Other evidence:

- *Vocabulary Quizzes*
- *Lab Explanations/Reflections*
- *Constructed Diagrams & Charts*
- *Summative pencil and paper Exam*

Stage 3: Learning Activities

SEASONS

- Day 1:** Introduce Essential Questions (KWL), Show Seasons Trailer.ppt, Take Pre Quiz

- Day 2:** (Optional Extension) Present to students or Research the prominent scientists and their theories and discoveries that dominated and or changed the way we viewed the universe. Ex: Earth was once considered flat... Geocentric model of Ptolemy and Aristotle Heliocentric Cosmology with Copernicus & Galileo...etc.

- ❑ **Day 3:** Concept Attainment of Rotation vs. Revolution (T-Chart) Introduce Vocabulary for Seasons and give basic notes on vocabulary. *HW: Complete Vocabulary Assignment*
- ❑ **Day 4:** Review/Share Vocab (Quiz on Day 7). Graphing Activity: Temperatures around the World. [The Real Reason for the Seasons] <http://www.lhsgems.org/GEMSSeasons.html>. HW: Complete Graph.
- ❑ **Day 5:** Review and Discussion of the graph (use a sm. group or class strategy) & Prep. For Day 6 Lab Activity.
- ❑ **Day 6:** LAB Investigation: Direct Vs. Indirect Ray. Students will place temperature probes or thermometers on a globe and shine light on the globe. The goal of this lab is of students to distinguish between direct vs. indirect rays. Formulate questions that will produce this result.
- ❑ **Day 7:** Vocab Quiz, Discuss Review Lab, Show video clip(s) have students take notes and write about their learning. This is your day to focus on “Latitude and Direct vs. Indirect Rays”
- ❑ **Day 8:** Graphing Activity: Days and Nights Around the World. [The Real Reason for the Seasons] <http://www.lhsgems.org/GEMSSeasons.html> *HW: Complete the Graph.*
 - <http://sunearth.gsfc.nasa.gov/sunearthday/03Seasonsweb.pdf>
 - <http://sunearth.gsfc.nasa.gov/sunearthday/seaslabbook14.pdf>
 - <http://sunearth.gsfc.nasa.gov/sunearthday/03Seasonsweb.pdf>
- ❑ **Day 9:** Review and Discussion of the graph (use a sm. group or class strategy) The focus here is that your days/night length changes with season and latitude. Diagram Equinoxes and Solstices.
- ❑ **Day 10:** Review Diagrams. Use modeling, video clips (See Resources Page uTube) and graphics to fill in gaps and holes in student understanding. Use ‘Seasons Chart Fill In’ as an assessment piece. Have students complete front, then do back with the southern hemisphere, further assessment.
- ❑ **Day 11:** Flex Day. Depending on where your students are with the concepts you may need to re-teach or review. By now students should be able to accurately fill in the chart and explain why the answers are what they are. If unsuccessful readdress and reassess.

Teaching the concept of Season with the use of the two graphing activities can be done deductively or inductively. Deductive: give them the facts and setup of the system, diagrams, labels, give it all to them and use the two graphing activities to prove it and assess what they learned. Inductively: Ask them to graph the two sets of data and use them as discussion tools for discovery and modeling. I've done both.... Inductively is much more exciting if you have mastery of the content and can handle clarifying student misconceptions on the fly. If this material is new to you... Stick to the deductive approach. Give the students the correct diagrams and models to begin with and use the graphs as assessment pieces. The above outline is for the inductive route.

LUNAR Cycle- MOON Phases

There are lots of really good activities out there that have students track the moon for a period of time, recording and making observations, I've never don one, but believe they could be very worth the effort. If you want to do one of these start it around Day 2-4. Then when you begin to teach the cycle the students have a significant experience to draw from.

- ❑ **Day 12:** Teach students about lighting and shadows in space. Big Idea: Only half of an object

can be lit at a time if lit by one source of light. Give out Moon vocabulary.

- Day 13:** Moon Phases.ppt, or Interactive web site, with the moon phase shown and explained, have students take notes on the shape and appearance of the moon phases. Try this one (<http://education.jpl.nasa.gov/educators/moonphase.html>)
- Day 14:** LAB- Have students model the moon phase or observe a model of the moon phases.
- Day 15:** Discusses the findings from the lab and clarify the moon Phases. Fun Activity or Assessment: have students eat away at Oreo cookies to construct a model of the Moon's Lunar Cycle.
- Day 16:** Flex Day- Quiz on Lunar Cycle.... Introduce Tides.... Re-teach

Teaching the moon phases is similar to the Seasons... inductive or deductive... I think it is easier to teach it deductively, the names of the phase can really confuse the students. When done inductively they create their own names for the phase in their head and can't seem to replace them, plus they love to mix up the order. In my opinion, deductive is much safer.

TIDES

- Day 17-19:** Tides Lesson from NOAA. Tides Roadmap and Resources
http://oceanservice.noaa.gov/education/kits/tides/supp_tides_roadmap.html

NOAA Tides lesson

http://oceanservice.noaa.gov/education/kits/tides/lessons/tides_upsanddowns.pdf

Tides Tutorial Pages for Students:

<http://oceanservice.noaa.gov/education/kits/tides/welcome.html>

This activity would be most successful with a computer lab, every student with access to a computer and internet. Because of the amount of questions I would recommend using a Jigsaw format to cover the material.

- Day 20:** Assign Performance Assessment
- Day 21-22:** Groups prep for performance assessment. Have access to Computers, Poster Paper, and other project supplies.
- Day 23-24:** Scientist makes presentations Government Officials.
- Day 25:** Pencil and Paper Exam.

Web resources for UbD Earth Sun Moon Phenomena: Seasons, Lunar Cycle, Tides

Seasons Resources

- USA TODAY <http://www.usatoday.com/weather/tg/wseason/wseason.htm>

- Enchanted Learning
<http://www.enchantedlearning.com/subjects/astronomy/planets/earth/Seasons.shtml>
- Classroom Activity- Shadows, Angle of Sun
<http://www.uen.org/Lessonplan/preview.cgi?LPid=626>
- National Oceanic and Atmospheric Administration
<http://www.uen.org/Lessonplan/preview.cgi?LPid=626>
<http://www.crh.noaa.gov/fsd/astro/season.php>
<http://www.wrh.noaa.gov/mso/climate/month/2007/March/Topic%20of%20the%20Month/Why%20do%20we%20have%20the%20seasons.htm>
- Why we have season with a Astronomical Theory of Climate Change & *What is The Milankovitch Theory?*
<http://www.ncdc.noaa.gov/paleo/milankovitch.html>
- uTube: Search for “ What Causes Earth Seasons” Search. There are plenty of good animations.
<http://www.youtube.com/watch?v=DuiQvPLWziQ>
- Severe Global Warming Changes are occurring..... This is not the site I would send students to. The author(s) makes some “strong” statements that kids might have a hard time separating true/false or fact/fiction or Totally wacked out theory. It’s an interesting site nonetheless. (I’m not smart enough to know if this page has accurate information or wacked out theories)
<http://www.divulgence.net/>
http://www.divulgence.net/solar_angle_variables.htm This sub page is pretty good with some links to other pages of interesting content

Moon Phase Resources

- NASA-Moon Phases http://www.nasa.gov/worldbook/moon_worldbook.html
- NASA-JPL Moon Phases Lesson
<http://education.jpl.nasa.gov/educators/moonphase.html>
- Phases of the moon explained and diagramed
<http://lunar.arc.nasa.gov/science/phases.htm>
- How long does each phase of the Moon last?
http://spaceplace.nasa.gov/en/kids/phonedrmarc/2004_march.shtml
- NOAA Moon Phase Page <http://neap.pactide.noaa.gov/hq/astronomical.shtml>

- ❑ A very nice Moon Calendar <http://www.paulcarlisle.net/mooncalendar/>
- ❑ Moon Phase Animation <http://www.astro.wisc.edu/~dolan/java/MoonPhase.html>
- ❑ College level explanation of Moon Phases- U of Tennessee
<http://csep10.phys.utk.edu/astr161/lect/time/moonorbit.html>

Tides

- ❑ Tides Roadmap and Resources
http://oceanservice.noaa.gov/education/kits/tides/supp_tides_roadmap.html
- ❑ NOAA Tides lesson
http://oceanservice.noaa.gov/education/kits/tides/lessons/tides_upsanddowns.pdf
- ❑ Tides Explained <http://csep10.phys.utk.edu/astr161/lect/time/tides.html>

OTHER

- ❑ This is from a University of Tennessee Astronomy class... tons of quality info.
Everything: Planetary Motion, Astronomy, Earth, Moon, Historical views, to all the
Planets. <http://csep10.phys.utk.edu/astr161/lect/index.html>

Performance Assessment

Scenario Cards, Presentation Outline, & Rubric

Scenario Overviews

- I. Earth has been struck by a small Asteroid! After the collision there appears to be a change in its degree of tilt and rate of rotation. Please explain what life on earth will likely be like.
- II. Due to drastic “climate change” the South Pole is melting quickly. Earth is now unevenly weighted and appears to be slowly tipping over. Earth’s tilt is slowly increasing and things are not the same. Please predict what life on earth will be like.
- III. The moon has been struck by an asteroid! We now have two moons, an old large moon, and a new baby one! Re-construct the Lunar Cycle and any changes that may be experience on earth.
- IV. The Sun as suddenly increased in size! The earth is now revolving around the sun much quicker and rotating much slower. We need a new calendar and clock.

For scenarios I & II students will also need to be assigned a city or country so their predictions can be tailored to that location (latitude is the major factor, further from the equator will experience more drastic changes)

Questions that need answers in the presentation

How will the length of a year change?

How will the length of a day change?

How will the length of ‘length of day’ and ‘length of a night’ change?

How will the seasons change?

What will our new climate be like?

What will tides be like?

How will these changes effect: food sources, energy use, travel, timing, our calendar, international trade?

Requirements for Presentation

Students must address the above questions.

Students must construct a visual illustration or model to explain their findings.

Students must present relevant information and be able to address their governments questions

Requirements for Students acting as Government Officials.

Students will evaluate the presentation for accuracy

Each official must ask a challenge question

Earth has been struck by a small Asteroid!

Don't worry you survived. The asteroid was small but still it has caused significant changes to Earth!

WHAT YOU KNOW:

You have discovered that Earth's tilt of 23.5 degrees is gone. Earth appears to be well no longer tilted on its axis.

Also, you believe that earth is not rotation as fast.

You know that this means significant changes to our seasonal cycle, days and nights, climate, and other aspects of life on Earth.

WHAT YOU NEED TO ACCOMPLISH:

Your government is asking your team of Scientist to present your findings and help them come up with solutions to problems that will arise. You have 48 hours before you must present your findings to your government.

ADDRESS THE FOLLOWING QUESTIONS

- How will the length of a year change?
- How will the length of a day change?
- How will the length of 'length of day' and 'length of a night' change?
- How will the seasons change?
- What will our new climate be like?
- What will tides be like?
- How will these changes effect: food sources, energy use, travel, timing, our calendar, international trade? Identify two major problems that will likely be experienced and possible solutions.

The South Pole is Melting and Earth is Tipping Over!

WHAT YOU KNOW:

Ocean levels have been on the slow and steady rise but due to drastic and rapid “climate change” the South Pole is melting even faster now, super fast, like an ice cube on hot pavement. You believe that because of this the earth is going to be unevenly weighted and it will start to tip over. You have discovered that Earth’s tilt of 23.5 degrees is changing. In fact it is increasing and quickly. Currently it is at 28.5 degrees and changing.

You know that this means significant changes to our seasonal cycle, days and nights, climate, and other aspects of life on Earth.

WHAT YOU NEED TO ACCOMPLISH:

Your government is asking your team of Scientist to present your findings and help them come up with solutions to problems that will arise. You have 48 hours before you must present your findings to your government.

ADDRESS THE FOLLOWING QUESTIONS

- How will the length of a year change?
- How will the length of a day change?
- How will the length of ‘length of day’ and ‘length of a night’ change?
- How will the seasons change?
- What will our new climate be like?
- What will tides be like?
- How will these changes effect: food sources, energy use, travel, timing, our calendar, international trade? Identify two major problems that will likely be experienced and possible solutions.

Did you see the moon explode last night? NO... What, we have two Moons?

The Earth's Moon has been struck by an asteroid. You did not see the collision because it was during the full moon and it happened during your day time. Too bad!

WHAT YOU KNOW:

Our moon is not the same. In fact we have two Moons. The original moon is now smaller and missing a chunk off its side. Our second moon appears to be the missing chunk off the original moon. The new moon appears to be revolving around the old moon. You know that this means our old lunar cycle is obsolete. You have been working very hard to determine a new Lunar Cycle and what effects this new cycle will have on Earth.

WHAT YOU NEED TO ACCOMPLISH:

You will present your new Lunar Cycle to your government. You have 48 hours before you must present your predictions to your government.

ADDRESS THE FOLLOWING QUESTIONS

- How are the two objects now moving in space?
- How many Moon Phases will there be?
- What effect will two moons have on tides?
- Will this affect other aspects of life on earth?

The Sun is Gigantic! ... and Summer Was Really Cold This Year

Over the past year the sun has been increasing in size. It looks really cool! However summer break was strange, it was really cold.

WHAT YOU KNOW:

The sun has been increasing in size over the past year. But it has not gotten any hotter. You are certain that the Earth is revolving around the sun much faster... twice as fast in fact! You are also observing that days are really long and the sun is rising and setting strange times, you are pretty sure it is rotating 25% slower, meaning days are longer.

You know that this means significant changes to our seasonal cycle, days and nights, climate, and other aspects of life on Earth.

WHAT YOU NEED TO ACCOMPLISH:

Your government is asking your team of Scientist to present your findings and develop a new calendar and clock to account for the changes. You have 48 hours before you must present your findings to your government.

ADDRESS THE FOLLOWING QUESTIONS

- How will the length of a year change?
- How will the length of a day change?
- How will the length of 'length of day' and 'length of a night' change?
- How will the seasons change?
- What will our new climate be like?
- What will tides be like?
- Construct a new calendar that will match the new length in "year"
- Come up with a new clock that will work with our "new length of day"

NAMEs: _____ DATE: _____ PERIOD: _____
 GROUP YOUR ARE EVALUATING _____

SECTION 1	Vague, Incorrect (0)	Unclear, Somewhat Accurate (1)	Correct & Accurate (2)	Very Clear, Accurate & Detailed (3)
Presentation Content & Quality <ul style="list-style-type: none"> • Changes in Year length • Changes in “Day” • Length of Day • Length of Night • Changes in Seasons • What will tides be like 	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Visual/Graphic /Model <ul style="list-style-type: none"> • Show what has happened • Show why things are happening • Corresponds to what was verbally explained 	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
First Problem and Solutions <ul style="list-style-type: none"> • Is this a possible problem we may face • Is the problem clearly identified • Is the solution to the problem appropriate. 	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Second Problem and Solutions <ul style="list-style-type: none"> • Is this a possible problem we may face • Is the problem clearly identified • Is the solution to the problem appropriate. 	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Total Pints Earned: _____ (48 Possible)	0 Points	____ Points	____ Points	____ Points
Section 2		Points Possible	Student Evaluation	Teacher Evaluation
Presentation: Clarity and Organization		12		
Creativity: How Original are your ideas and Solution		12		
Effort: Seen in Preparation and Presentation		12		
Cooperation/Behavior: working as a group, attention		12		
Extra: Above and beyond necessary requirements		4		
Total Points Possible Earned:		52		
		SECTION 1	SECTION 2	TOTAL (100)
Final Student Evaluation				