Earth, Moon, and Sun

Earth, Sun, and Moon
Day: Mondays (July 12, 19, 26; August 2, 9)
Time: 8:00 – 9:30 p.m. ET/7:00 – 8:30 CT
Location: http://learningcenter.nsta.org/group/default.aspx?id=esm_oscsu10

FACULTY
Instructor: Toni Ivey, Ph.D.
Office: 232 Willard Hall
Office Phone: 405.744.8005
E-mail: toni.ivey@okstate.edu
Office hours: by appointment

COURSE OBJECTIVES
This course is a special offering for educators through collaboration between Oklahoma State University (OSU), the National Science Teachers Association (NSTA), and the National Aeronautics and Space Administration (NASA). The mission of OSU’s Professional Education Unit (PEU) is to prepare and develop educators who facilitate lifelong learning and enrich quality of life for people in public and other educational settings. In accordance with the mission of the PEU, this course will provide educators with a rich learning environment to continue knowledge about the content and pedagogy of teaching Earth and Space Science.

This course will focus on both the content and pedagogical implications for teaching about the Earth, Sun, and Moon. The content of this course is based on the Earth, Sun, and Moon SciPack which is available through the NSTA Learning Center (http://learningcenter.nsta.org). Additionally, this course is supplemented through educational materials available to educators through NASA’s educational outreach projects.

The topical content of this course focuses mainly on the position and motion of Earth, Sun, and Moon, and on the phenomena that can be explained by their position and motion. Phenomena dealt with in this course include the phases of the Moon, the heating of Earth’s surface by the Sun, and the apparent changes in positions of objects in the night sky. While this course also includes some of the basic details about Earth (the characteristics that make it unique in the solar system, its composition, and its capacity to support life), sophisticated details about the structure and composition of Earth and the Moon and Sun are not included. Furthermore, while this course addresses ideas about Earth’s gravity, universal gravitation and a gravitational explanation of the movement of Earth, Sun, and Moon is covered in other courses.

COURSE MATERIALS
- NSTA SciPack: Earth, Sun and Moon
- Rubric for Evaluating Essential Features of Classroom Inquiry in Instructional Materials by the Council of State Science Supervisors (CSSS) (Available from:
Earth, Moon, and Sun

**TENTATIVE AGENDA**

(** The agenda will be adjusted to meet the needs of the students in the course. An updated, Detailed agenda will be made available each week)

**WEEK 1**

**OBJECTIVES**

The learner will:

- Become familiar with the structure of the short course: Earth, Moon and Sun
- Review the expectations of the short course
- Develop a professional development plan.
- Evaluate a NASA Activity using the Council of State Science Supervisors (CSSS) rubric.

**ACTIVITIES**

**SYNCHRONOUS (ON-LINE)**

- Start with Week 1 Power Point.
  - Course Technology will be addressed by NSTA moderator
  - Overview of Syllabus
  - Overview of Content to be Covered
  - Assessments and Course Deliverables
- What is Inquiry?
  - Introduce and review CSSS Instructional Material Inquiry Rubric – available at http://www.nlistinquiryscience.com/home/node/7
- Use Inquiry Rubric to evaluate NASA Activity
  - Evaluate NASA Activity 1: EPA Climate Change Activity http://epa.gov/climatechange/kids/index.html
  - Students’ perspective
    - Investigate the “Climate Change Kids Site”
    - Use the Inquiry Rubric, to assess this student site.

**ASYNCHRONOUS (OFF-LINE-TO BE COMPLETED BEFORE NEXT ONLINE CLASS)**

- Create a personal profile on the Learning Center
- Complete Sci-pack object: General Characteristics of the Earth
- Read CSSS “Rubric for Evaluating Essential Features of Classroom Inquiry in Instructional Materials.” Answer the following questions.
  - What questions do you still have about teaching through inquiry?
  - What level of inquiry do you use in your classroom?
- Evaluate NASA Activity 1: Climate Change Kids Site” (http://epa.gov/climatechange/kids/index.html)
  - Further investigations into the “Climate Change Kids Site”
    - From the main “Climate Change Kids Site”, click on “Stuff for Teachers”
    - Go to Item number 2 ➔ Click on “EPA’s Climate Change Emission Calculator Kit (Climate Check)”
    - Using the Inquiry Rubric, evaluate this site
  - Complete the following on the Discussion Board:
    - Name one new thing that you learned.
    - Did you find any information surprising?
Earth, Moon, and Sun

- From the content presented, with what do you think your students will have the most difficulty?
- How could this be used as an inquiry activity?

  - Make at least one original posting to the community discussion board about your reading on NASA’s Kepler Mission and respond at least once to someone else’s comment. (Remember... this is a discussion board... let’s have a meaningful conversation)

- Review the Apollo Mission
  - Make at least one original posting to the community discussion board about your readings on the Apollo 11 mission and respond at least once to someone else’s comment about the Apollo 11 mission.

- Start developing a PD Plan and Portfolio Report
WEEK 2

OBJECTIVES

The learner will:

• Recognize basic characteristics of Earth’s surface using system terminology (lithosphere, hydrosphere, cryosphere, atmosphere, biosphere).
• Describe observational evidence used to determine that Earth is a sphere and not flat.
• Model the relative proportions of structural component of Earth including thickness of crust, atmosphere, and depth of hydrosphere.
• Identify the characteristics of Earth that make it habitable for a wide range of plant and animal species.
• Explain the factors that make Earth the only planet in the solar system with liquid water on its surface.

ACTIVITIES

SYNCHRONOUS (ON-LINE)

• Elicit Prior Knowledge
• Characteristics of the Earth
  o Like all planets and stars, Earth is approximately spherical in shape and made up mostly of rock. Three-fourths of Earth’s surface is covered by a relatively thin layer of water (some of it frozen), and the entire planet is surrounded by a relatively thin blanket of air. Life is adapted to specific conditions on Earth. These conditions include the mixture of gases in our atmosphere, the average temperatures that allow water to pass through the phases, the force of gravity experienced at the surface, and the distribution of light from the Sun that filters through the atmosphere.
• Resources for content information:
  o Cryospheric Sciences Program - http://ice.nasa.gov/
  o Types of Plate Motion http://scifiles.larc.nasa.gov/kids/Problem_Board/problems/quake/simulations/index.html
• Are we alone?
  o Imaginary Martians- (preconceptions of extraterrestrials) http://ares.jsc.nasa.gov/ares/education/otherprograms/Data/imaginMartians.pdf
  o Hunt for Alien Earths (Detecting Life) - http://www.pbs.org/wgbh/nova/sciencenow/0402/01.html

ASYNCHRONOUS (OFF-LINE)

• SciPack - Our Moving Earth
• NASA Student Support Activities/SciGuide Lessons
• Reading and reflecting on e-chapter/NSTA article
• Listserv/Community Discussion Forum – Discuss “Earth’s Big Heat Bucket”
Earth, Moon, and Sun

- Continue to develop and contribute to your PD Plan and Portfolio Report

**Week 3**

**Objectives**

The learner will:

- Describe evidence used in determining that Earth rotates once a day on its axis.
- Describe how apparent motions of the Sun, the Moon, and the stars can be explained by the rotation of the Earth.
- Explain the natures of Earth’s orbital path around the Sun.
- Explain how the orbital motion of Earth causes different constellations to be visible at different times of the year.

**Activities**

**Synchronous (On-Line)**

- Our Moving Earth
  - Earth rotates on its axis once per day, making it appear as though the Sun, the Moon, and the stars revolve around Earth each day. Evidence however, demonstrates that it is in fact, Earth that rotates on its axis as it orbits the Sun, just as other planets in our solar system. Earth moves in a nearly circular orbit around the Sun once per year, so that we see different constellations at different times of the years.
- The Coriolis Effect
  - [http://www.nasa.gov/mov/142348main_corioliseffect_hi.mov](http://www.nasa.gov/mov/142348main_corioliseffect_hi.mov)
- Retrograde Motion
- Kepler’s Laws

**Asynchronous**

- Complete SciPack – Motion of the Moon
- Listserv/Community Discussion Forum
- Student Support Activity
  - [Kepler’s Third Law Activity](http://genesismission.jpl.nasa.gov/educate/scimodule/Destination_L1.html)
- PD Plan and Portfolio Report
- **Webography Due!**
Earth, Moon, and Sun

WEEK 4

OBJECTIVES
The learner will:

- Explain how the relative positions of the Sun, Earth, and the Moon produce the moon’s phases
- Describe the motion of the Moon as seen from Earth and space.
- Explain why only a portion of the lit side of the Moon is visible from Earth at any given time.
- Predict the phases of the Moon that occurs when given the relative positions of the Moon and Earth with respect to the Sun.
- Select one of the primary phases of the Moon and predict when that phase will rise and set.
- Describe how the relative position of the Sun, Earth, and Moon produce lunar and solar eclipses.
- Explain why there are not solar and lunar eclipses every month when the Moon is new or full.

ACTIVITIES

SYNCHRONOUS (ON-LINE)

- Motion of the Moon
  - The Moon orbits Earth approximately once per month, causing the pattern of moon phases. Although half of the Moon’s surface is always illuminated by the Sun and half is always shaded, the portion on the illuminated surface that we see changes as the Moon orbits the Earth
- Common preconceptions/misconceptions regarding phases of the Moon
  - A Private Universe
  - Making our students’ thinking visible
- Investigating Moon Phases and Eclipses

ASYNCHRONOUS

- Listserv/Community Discussion Forum
- SciPack - Earth’s Seasons
- NASA Student Support Activities/SciGuide Lessons
  - Play with the NASA Resources listed in the Power Point
- Online discussion: Report on 2 of the websites, How can you (or your students) use these websites?
- Continue to develop and contribute to your PD Plan and Portfolio Report
WEEK 5

OBJECTIVES

The learner will:

- Explain that seasons are caused by the tilt of Earth’s axis to the plane of its orbit.
- Explain the nature of Earth’s elliptical orbit and give the approximate dates of aphelion and perihelion.
- Identify which points in Earth’s orbit around the Sun corresponds to each of our four seasons.
- Explain how the changes in the angle of incoming solar radiation result in differential heating of Earth’s surface and corresponding difference in temperature and climate.
- Identify why the seasons in the Southern Hemisphere are the opposites of those in the Northern Hemisphere.

ACTIVITIES

SYNCHRONOUS (ON-LINE)

- The Sun and the Earth’s Seasons
  - The Sun is the major source of energy for phenomena on Earth’s surfaces. The seasons are caused by the tilt of Earth’s axis with respect to the plane of its orbit around the Sun. Because the angle and direction of tilt does not change as Earth orbits the Sun, during half of the year the north polar region tilts toward the Sun, resulting in increased heating (summer) and away from the Sun during the other half of the year, resulting in cooling (winter). The seasons are reversed in the Southern Hemisphere.
  - Common preconceptions regarding seasons
  - How long is a day activity?

ASYNCHRONOUS

- SciPack-Complete Final Sci Pack Assessment
- Complete the Post-Assessment
- Complete your PD Plan and Portfolio Report
- Instructional Unit is due!!
EXAMS AND MAJOR ASSIGNMENTS

1. Class Attendance and Active Participation (20% of course grade)
   You will participate in online discussion, surveys, and other activities each week responding to others and posting your comments/questions. Participant dialogue is crucial to the learning process. The sharing of thoughts and experiences and the reflection on what others share will be an important aspect of the course. We want to cater to your learning needs throughout the course, and to do this it is expected that you will take an active part in discussions of the readings and complete the participant feedback surveys at the end of each week’s online session.

2. Webography of NASA resources (20% of course grade)
   You will develop a Webography or a review of 5 NASA resources. This review will be annotated to include a screen shot of the resource, description of the resource, the intended audience, and classroom application possibilities. You will also evaluate the level of inquiry (using the NASA sponsored CSSS Inquiry Rubric) and provide suggestions about how to improve the inquiry learning potential for each NASA resource. More details will be provided during class. For more details, refer to the Webography Template provided.

3. Instructional Unit (20% of course grade)
   You will develop an instructional unit for use in your classroom utilizing NASA and NSTA resources. Although the instructional unit topic is of your own choosing, it should be related to the course content. Your unit will guide your application (actual instruction) of this course material and will include components such as lesson plans and pre/post-test assessment plans. For more details about this assignment, refer to the Instructional Unit Template provided.

4. PD Plan and Portfolio Assignment (20% of course grade)
   You will develop a PD Plan and Portfolio through the http://learningcenter.nsta.org website. More details in class.

5. Completion of SciPack and SciPack Final Assessment (20% of course grade)
   You will complete the Earth, Sun & Moon SciPack and the SciPack final assessment as a part of this course.

GRADING PROCEDURES
Your course grade will be determined on a point system as described in the Scoring Rubrics provided. Letter grades will be assigned according to the following percentages: A – 90-100 points, B – 80-89 points, C – 70-79 points, D – 60-69 points, and F – 59 points and below. All course work requirements must be submitted by Monday, August 16, which is one week after the final live session. You must contact your instructor or course moderator if you are unable to meet this deadline for any reason.

POLICY ON ATTENDANCE
Attendance at all sessions and participation in on-line discussion is necessary and important. If an emergency arises you need to contact your instructor or course moderator to discuss how to make up the class session prior to missing a class session.
INSTRUCTIONAL UNIT TEMPLATE

1. Overview/Introduction of the Unit
   A. Abstract (1 paragraph)
   B. Target Audience (class/grade level)
   C. Prerequisite Knowledge and Skills (prior student knowledge recommended)
   D. Duration (days/weeks)
   E. Essential Questions (1-2 questions at the heart of the unit that promote inquiry)
   F. Materials and Equipment
   G. Safety Procedures
   H. Standards (State/National)
      i. Process/Inquiry Standards
      ii. Content Standards
   I. Learner Outcomes (3-4 learning objectives)
      i. At the end of this unit, students should be able to . . .

3. Background Information (2-3 paragraphs explaining the science content behind your unit)

4. Lessons Plans
   A. 3-5 lesson plans
   B. Include title, learning objectives, instructional procedures, materials, and resources for each lesson

5. Unit Assessment
   A. Pre-test
   B. Post-test

6. References

WEBOGRAPHY TEMPLATE

1. Title
2. URL
3. Screen Shot
4. Description of Site
5. Intended Audience
6. Classroom Application
7. Features of Inquiry
8. Inquiry Modifications (see CSSS Rubric)