**Lesson Plan #1 – Unit #2**

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| **TOPIC/TITLE OF LESSON** | **The Phases of the Moon** | |
| **AUTHOR(S)** | **John Wagner** | |
| **GRADE LEVEL(S)** | **3-5** | |
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| **APPLICABLE PA CORE OR NEXT GENERATION STANDARDS:** | | |
| **MS-ESS1-1**  **MS-ESS1-2**  **MS-ESS1-3**  **HS-ESS1-6**  **3.3.4.B1**  **3.3.4.B2:** SCALES Know the basic characteristics and uses of telescopes. PATTERNS/PHASES Identify major lunar phases. PATTERNS Explain time (days, seasons) using **solar system** motions. | | |
| **LESSON OBJECTIVES:** | | **ASSESSMENT(S) EVALUATE**  **(formative and/or summative)** |
| 1. **Students will understand the phases of the moon.** 2. **Students will recognize that the positions of the sun, the moon, and earth affect the phases of the moon.** | | 1. **Students will complete the online quiz.** 2. **Moon identification on their birthday in the science journal.** 3. **Ticket-out-the-door in the students’ science journals.** |
| **ACTIVATION OF PRIOR KNOWLEDGE (RTOP #1) ENGAGE** | | |
| How do the positions of the sun, the moon, and Earth affect the phases of the moon? The moon phase we see on any given night depends on the positions of the moon, the sun, and Earth in space. The moon receives light from the sun, just as Earth does. Just as half of Earth experiences day while the other half experiences night, one half of the moon is lit by the sun while the other half is dark. As the moon revolves around Earth, we see different parts of the side of the moon that is facing the sun. This makes the moon appear to change shape. Waxing refers to the moon growing larger night by night. The moon is said to be waning when it seems to be getting smaller night by night. It takes the moon about one month to go through its entire set of phases.  Ask, “How many different moon shapes have you seen? Round shapes? Half-circle shapes? Crescent shapes? Why do you think this happens? What affects how much of the moon we see?” Think-Pair-Share to facilitate student discussion and then develop class list of “our best thinking so far.”  Show the students a video clip from youtube: <http://www.youtube.com/watch?v=YdI1aDjWLlY&feature=related> | | |

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| **TEACHING AND LEARNING APPROACHES EXPLORE, EXPLAIN, EXTEND** | |
| **WHAT IS THE TEACHER DOING?**  **RTOP (# 2-10; #9-12; #21-25** | **WHAT ARE STUDENTS DOING?**  **RTOP (#11-19)** |
| Each student will need a light colored sphere of some sort. Ideally it can be placed on the end of a pencil. Try 5-centimeter (2-inch) or greater white Styrofoam balls. Get a larger sphere (15 centimeters or so) for your use as leader. You need a light source to serve as the Sun. A lamp with a bright bulb (400 watts) and the shade removed works fine. A dark room is also required. Finally, the smartboard, computer, projector, and laptop cart is required. | 1. Tell the students that we will be doing an activity that shows the moon phases. 2. Place a lamp in the center of the classroom. Then, model for the students how they will view what the phases of the moon look like using Styrofoam balls and a lamp. 3. Have the students complete the steps that I just showed them on their own while following my directions. 4. With the lamp in the center of the room, have each student place the ball at arm's length between the bulb and their eyes. They should hold the pencil in their left hand. The bulb is the Sun, the ball is the Moon and they are Earth. The view from their eyes is the same for both this exercise and for observations of the real sky. 5. At the start, the "Moon" is blocking the "Sun." (This is actually demonstrating a total solar eclipse which is very rare for any given location on Earth.) Usually the Moon passes above or below the Sun as viewed from Earth. Have the students move their moon up or down a bit so that they are looking into the Sun. As they look up (or down) at their moon they will see that all of the sunlight is shining on the far side, opposite the side that they are viewing. This phase is called "new moon" (like "no moon"). 6. They should now move their hand towards the left, about 45° (1/8) of the way around counterclockwise. Have them observe the sunlight on their Moon now. They should see the right hand edge illuminated as a crescent. The crescent will start out very thin and fatten up as the Moon moves farther away from the Sun. (Note: although the Moon is closer to the Sun during new and crescent phases, it is still 400 times closer to Earth; i.e., the Sun is VERY far away in reality.) 7. When their Moon is at 90° to the left students will see the right half of the Moon illuminated. This phase is called "first quarter." Remember that fully one half of the sphere is illuminated at all times (except during lunar eclipses) but the illuminated portion that we observe changes as the Moon changes position. 8. As they continue to move counter-clockwise past first quarter, the Moon goes into its "gibbous" phase (more than half but less than fully illuminated) which grows as the Moon moves towards 180°. 9. When the Moon reaches the position directly opposite the Sun, as viewed from Earth, the half viewed from Earth is fully illuminated (unless the student's head is causing a lunar eclipse). Of course only half of the Moon is illuminated. It has taken the Moon about two weeks to move from new to full. This growth in illumination is known as "waxing." The Moon chases the Sun across the (day and night) sky. 10. Students should now switch the pencil to their right hand and face in the general direction of the Sun. Starting with the Moon at full, students should continue the Moon's counterclockwise motion. They will observe the reverse of the Moon's phases seen so far with the left portion of the Moon illuminated. 11. After the gibbous phase diminishes, the Moon will reach the 270° position, straight out to the right. This is "third" or "last quarter." It is followed by a thinning crescent and a return to new moon. From full to new the Moon has been "waning" and leading the Sun. The phase cycle takes 29.53 days. Be sure to observe the real Moon! Most newspapers give the Moon phases along with the weather data. 12. Tell the students that they will be taking a quiz on the phases of the moon that we just learned about. 13. Pass out laptop computers. 14. Have the students go to the website: <http://starchild.gsfc.nasa.gov/docs/StarChild/solar_system_level2/moonlight.html>   -This website has an online quiz of the moon phases.   1. Tell the students that when they are done with the quiz that they will click the button that says check my answers. Tell them that when they have completed the quiz and received their answers that they should raise their hands so that I can see their results. 2. When I have recorded the results each student will go to <http://tycho.usno.navy.mil/vphase.html> 3. This website will show a picture of what the moon looked like on any date back into the 1800s. Have the students look up their birthdays to see a picture of what the moon looked like on their birthday. After they see the picture they have to write down in their journals what the phase of the moon was in on their birthday. |
| **WRAP UP RTOP (#14) EXTEND** | |

Refer to the RED text in the headings to see how the 5 E’s correspond to the lesson plan components. It is the teacher’s prerogative where extension activities are addressed.