Day and Night

Year 3

Earth & Space Sciences

Earth's rotation on its axis causes regular changes, including night and day (ACSSU048)

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1.0 Content Page

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2.0 Backward Design Unit Planner Table

Unit Title: Day and Night	**Strand:** Earth and Space Sciences	**Stage:** Year Three
Outcome: Understand the relationships between the Earth, Sun and Moon and how it relates to the day and night that humans experience on Earth.		

Phase	**Activities**
Evaluate	**What do you want the students to know? What representations will provide evidence that they understand the concepts?** By the end of the evaluate stage of this unit students will know: - That day and night is caused by the relationship and movements of the Earth, Moon and Sun - The rotations and revolutions of the Earth and Moon - The Moon orbits the Earth every 27 days (once a month) and orbits the Sun once a year - The Earth revolves (orbits) around the Sun once a year and rotates (spins) around an axis every 24 hours - The Sun stays in a fixed position - The timeframes within the Earth and Moons movements - The size and distance of the planets **What do you want the students to be able to do? How will they demonstrate this?** Students new knowledge and understanding will be evidenced by: • An oral presentation where the students displays their new knowledge through a: - 3D diorama representation of the Sun, Moon and Earth system - Letter to an alien explaining the positions and movements of the Earth and Moon
Elaborate	**What student investigation/s or application of knowledge would extend their understanding? Representations?** During the elaborate stage of this unit students will further investigate the shapes of the Moon we see in the sky to elaborate on the causes of night time as well as what causes day and night from an Indigenous perspective. This will be achieved through the use of hands on material comparisons, Ipad apps and online resources. Students will reflect on their new knowledge in their science journals.

Explain	**What are the current scientific explanations? How best can the students represent their understanding?** During the explain stage students seek further clarification of current scientific explanations of the relationships between the Sun, Earth and Moon by investigating articles and watching videos to enhance their understanding. Students work in small groups to represent the different timeframes of how long it takes the Earth and Moon to orbit the Sun to support what makes day and night. Students will also use hands on materials to make comparisons between the sizes of the Earth, Moon and Sun and the distance between them. Current Scientific Explanations include: - The Earth orbits the Sun once a year which gives us our seasons - The Earth spins on its axis every 24 hours which causes day and night - The Moon orbits the Earth every 27 days (roughly once a month) Students represent their understanding by: - Writing a short, concise summary about the relationship between the Sun, Earth and Moon and their details of their movements
Explore	**What hands-on, shared experiences of the phenomenon are appropriate? Representations?** Students take part in hands-on experience to investigate the relationship between shadows and the position of the Sun at different times of the day. Students explore the cause of the different phases of the Moon. They then explore the movements and relationship of the Sun, Moon and Earth through role play. Students are given the opportunity to explain their understandings by using materials to represent each planet and drawing a diagram to highlight the system. Students represent their new findings through participating in oral presentations, group discussions as well as writing predictions, observations and findings in their science journals.
Engage	**How can we engage students and elicit their prior knowledge? Representations?** During the engage stage the focus is to purely discover what students already think they know about the causes of day and night. In this phase no new information or explanations are provided. To elicit students prior knowledge them will - Investigate images of the Sun, Moon and Earth as well as different parts of the day (night time, day time, Sunrise, Sunset) - Discuss ideas about the causes of day and night and how it occurs - Form a 'Investigation Questions' poster about what they would like to learn

3.0 Unit at a glance table

Unit at a glance *-Day and night*		
Phase	**Lesson**	**At a glance**
Engage	**1. Space & Earth**	What causes day and night? Teacher captivates student's interest about this topic by covering what they know and introducing new ideas.
Explore	**2. Sun up, Sun down** Session 1: Sun up Session 2: Sun down	Students use hands on investigations and activities to explore how the spinning Earth impacts the Sun's position at different parts of the day as well as investigate the cause of the different phases of the Moon.
	3. Rotations and Revolutions Session 1: Role play Session 2: lamp activity	Students partake in hands-on, activity based experiences to explore the Sun-Earth-Moon system and their relating movements. This will include how the rotations and revolutions of the Earth and Moon impact day and night.
Explain	**4. Spinning in space**	Further explanation of current scientific understandings about the relationship of the Sun, Earth and Moon. Students are exposed to timeframes to enhance what they know about day and night
	5. Space Explorers	Students use ICT resources to help put into perspective the actual sizes of the Sun, Moon and Earth as well as the distance in between them.
Elaborate	**6. Moon Shadows**	Students elaborate on what they know about day and night and the movements of the planets to explain the different shapes of the Moon we see in the sky.
Evaluate	**7. Diorama Madness**	Students display their new understandings of what causes day and night through a diorama presentation and explanation of the positions and movements of the Sun, Earth and Moon.

4.0 Australian Curriculum

4.1 Science

Australian Curriculum: Science				
Strand	**Content Descriptor**	**Lesson Number**	**Content**	**Code**
Science Understanding	Earth and space sciences	1-7	Earth's rotation on its axis causes regular changes, including night and day	(ACSSU048)
Science as a human endeavour	Nature and development of science	2,3,5,6	Science involves making predictions and describing patterns and relationships	(ACSHE050)
Science Inquiry Skills	Questioning and predicting	1-7	With guidance, identify questions in familiar contexts that can be investigated scientifically and predict what might happen based on prior knowledge	(ACSIS053)
	Planning and conducting	1,2,3,4,5,6	Suggest ways to plan and conduct investigations to find answers to questions	(ACSIS054)
	Communicating	1-7	Represent and communicate ideas and findings in a variety of ways such as diagrams, physical representations and simple reports	(ACSIS060)

4.2 General Capabilities

General Capabilities			
Outcome: Students will be exposed to the general capabilities of literacy, numeracy, ICT as well as critical and creative thinking. This will be achieved over the course of the lesson as evidenced by participation and exposure to:			
	Literacy	**ICT**	**Critical & Creative Thinking**
ACARA	• Literacy involves students in listening to, reading, viewing, speaking, writing and creating oral, print, visual and digital texts, and using and modifying language for different purposes in a range of contexts • Scientific vocabulary is often technical and includes specific terms for concepts and features of the world	• Students develop ICT capability when they research science concepts and applications, investigate scientific phenomena, and communicate their scientific understandings. • Students employ their ICT capability to access information; collect, analyse and represent data; model and interpret concepts and relationships; and communicate science ideas, processes and information	• In the Science learning area, critical and creative thinking are embedded in the skills of posing questions, making predictions, speculating, solving problems through investigation, making evidence-based decisions, and analysing and evaluating evidence. Students develop understandings of concepts through active inquiry that involves planning and selecting appropriate information, and evaluating sources of information to formulate conclusions
Lesson 1	• Contributing to class discussions • Recording ideas in science journals	• Use of PowerPoint of images to elicit student's prior scientific understandings	• Questioning • Observing and recording the difference between day and night
Lesson 2	• Recording ideas in science journals	• Use of YouTube video http://www.whiteboardblog.co.uk/2012/11/Moon-phases-animation-from-nasa/	• Using Sundials to explain how shadows are created
Lesson 3	• Role-play of the Sun-Earth-Moon system • Oral presentation of the Sun-Earth-Moon system • Recording predictions, observations and findings in science journals	• Use of IWB resource to collect data: http://www.classzone.com/books/Earth_science/terc/content/visualizations/es0408/es0408page01.cfm?chapter_no=04	• Creating a 3D representation and using a diagram to convey ideas
Lesson 4	• Reading articles about the Sun-Earth-Moon system • Writing a summary of current scientific	• Use of documentary YouTube video to provide further explanations of the Sun-Earth-Moon system	• Students create a mind map to highlight important facts about the Sun-Earth-Moon system

	explanations about the Sun-Earth-Moon system		
Lesson 5		• Use of the 'Solar Walk' App for Ipads	
Lesson 6	• Reading literature to elaborate on Indigenous perspectives of the causes of day and night • Recording new understandings in science journals	• Use of websites to collect and analyze information about the phases of the Moon • Use of the 'Solar Walk' App for Ipads	• Creating the phases of the Moon using hands on materials
Lesson 7	• Oral presentation of new understandings to teacher and peers		• Creating a 3D representation of the Sun-Earth-Moon system

4.3 Cross Curriculum Priorities

Cross Curriculum Priorities	
	Aboriginal & Torres Strait Islander Histories & Cultures
Lesson 6	This lesson will feature a short elaboration of what causes day and night according to Aboriginal culture. The teacher will briefly cover parts of the article 'Emu Dreaming' in order to convey new ideas about the Sun-Earth-Moon relationship according to the original owners of this land. The teacher will elaborate on ideas that the Sun is a female and the Moon is a male as well as briefly cover the Aboriginal's fascination with the night sky and what constellations and the milky way meant to their culture. A Helpful resource for Aboriginal Astronomy is : http://www.atnf.csiro.au/research/AboriginalAstronomy/whatis.htm

5.0 Assessment Overview

Assessment	Lessons	5 E	What will be assessed	How it will be assessed
Diagnostic	1-3	Engage Explore	Students ability to: • Elicit their prior knowledge about what causes day and night • Consider the movements of the Earth during the day and position of the Sun in the sky and the impact it has on shadows • Describe the Sun-Earth-Moon system and make links to how this causes day and night	• Observation and anecdotal records of student: ○ Reflections ○ Role-play ○ Diagrams
Formative	4-6	Explain Elaborate	Students ability to: • Explain the rotations and revolutions of the Earth and the Moon • Identify the time frames of the movements of the Earth and Moon • Describe new understandings of what causes day and night • Make comparisons between the size and distance between the Sun, Earth and Moon • Identify and describe the eight key phases of the moon	• Observation and feedback to students on their: ○ Summary of understandings ○ Reflections in their science journals ○ Posters and diagrams
Summative	7	Evaluate	Students ability to: • Re-create the movements of the Earth and Moon around the sun • Describe the rotations and revolutions of the Earth and Moon • Identify and explain the cause of day and night • Present findings to their peers	• Marked against a simple 3 point criteria (See Appendix 10.2)

Description of final culminating assessment task	Date due
<u>3D Representation</u> Students will individually respond to the new content they have been learning about by creating a 3D representation of the Sun-Earth-Moon system. Each student will be required to draw on the prior learning of this unit to help them recreate the movements of the Sun, Earth and Moon and explain the timeframes associated with their rotations and revolutions. Students will be required to present their representation to the class with a short elaboration on how the Sun-Earth-Moon system causes day and night. The 3D representation and presentation will be assessed on: 1. The diorama 2. The presentation skills 3. The explanation (the letter to alien)	Friday 3rd May, 2013

6.0 Teacher Background Information

	Teacher Background Information
Lesson 1	During this lesson no new information is given to the students. However, teachers should be aware of the scientific terms of *Sun, Moon, Earth, day, night, sunlight, light and observe*. This is for the reason to prompt students to consider these terms and their initial understandings regarding the causes of day and night.
Lesson 2 Session 1	During the first explore stage of this unit the students will be exposed to the key terms of *day, direction, length, light, shadows, rotation, Earth and Sun.* The teacher will need to understand that the Earth is rotating around an axis. The Earth's axis is tipped over about 23.5° from vertical and it takes 24 hours for one full rotation (Windows to the universe, 2000b). Teachers must understand that it is the Earth's rotation that gives us day and night because it changes which side of the Earth is facing the Sun.
Lesson 2 Session 2	Teachers must understand and be able to explain night time as a giant shadow caused by the side of the spinning Earth that is not facing the sun. Where the moon is concerned, teachers must be aware that the revolution of the Moon around the Earth makes the Moon appear as if it is changing shape in the sky (Windows to the universe, 2000c). This is caused by the different angles from which earth observers see the bright part of the Moon's surface. Teachers need to be able to explain that these are referred to as the different phases of the moon which are caused by the Moon reflecting the light of the Sun, not generating any light itself (Windows to the universe, 2000c).
Lesson 3	During this lesson teachers must be able to explain the movements of the Earth and the Moon and how it relates to the overall relationship of the Sun-Earth-Moon system. As well as spinning around an axis, the Earth also orbits (revolves) around the Sun in a counter clockwise motion which takes what we refer to as a year (Windows to the universe, 2000a). The Moon orbits the Earth every 27 days, once a month, and is tidally coupled to the Earth's orbit of the Sun (Windows to the universe, 2000c). The moon also rotates once every orbit, so earth observers only ever see one side of the moon. The Sun is a star and stays in a fixed position.
Lesson 4	Teachers must provide students with definitions for the key terms *axis, day, Earth, Moon, night, orbit, revolve, spin rotate and Sun.* They also must provide students with a current scientific explanation of the ideas they have been exposed to during lessons 2 and 3.

Lesson 5	Teachers must be able to identify that the combination of size and distance from the Earth causes the Moon and Sun to appear the same size in the sky to Earth observers. (Windows to the universe, 2000c)
Lesson 6	The Moon passes through eight major shapes during a cycle that repeats itself every 27 days. The phases always follow one another in the same order. The eight common phases include *new moon, waxing crescent, first quarter, waxing gibbous, full moon, waning gibbous, third quarter, waning crescent* (Moon phases, 2010). It is important here to note that 'waxing' means growing which highlights that the illuminated part of the moon is increasing where as 'waning' means shrinking which highlights that the illuminated part of the moon is decreasing (Moon phases, 2010). Alternatively, crescent, gibbous, quarter, new and full refer to the actual shape of the moon.

7.0 Student Misconceptions

	Student Misconceptions
Lesson One-	Students will have different ideas about what causes day and night such as: • the Sun disappears at night • the Sun goes behind hills, clouds, the Moon or the Earth which causes night time • More advanced students may believe the Earth travels around the Sun once a day.
Lesson Two-	• You can't see the Moon in the daytime • The Sun is moving
Lesson Three	• The Moon goes around the Earth in a single day • Night time occurs because the sun goes behind the moon • The Moon creates its own light
Lesson Four	• Earth rotates while the Sun and Moon are fixed • The Sun moves
Lesson Five	• The Sun is the same size as Earth and the Moon • The Sun, Earth and Moon are all close to one another
Lesson Six	• The Moon changes its shape • Clouds/night/something blocks the moon

8.0 Five E Approach—Lessons

8.1- Lesson One

Lesson One: Space & Earth	
Stage of 5 E's: Engage	**Time:** 45 minutes
Overview The purpose of this learning experience is to discover what students already think they know about what causes day and night and prompt them to consider the role that the Sun, Moon and Earth play in the process. This is achieved through questioning, discussing and investigating different ideas with the use of ICT and hands on materials. Students will record their initial ideas and theories about the causes of day and night in their science journals.	
Assessment Focus *Diagnostic*- To assess student's prior knowledge about the causes of day and night.	
Key Outcomes 1. Pose questions about the causes of day and night 2. Discuss ideas about the role of the Moon, Earth and Sun regarding day and night 3. Record and justify initial ideas about day and night	
Required Equipment - Science journals - IWB - Worksheet -Teacher's laptop -PowerPoint of images	
Lesson Procedure	
Step 1	Ask students to look outside the window and discuss if it is day or night and to justify how they know. Prompt students to use the appropriate observation skills (ears, eyes and nose). Ask students to explain how they would know if it was nighttime and what they would see. Also consider if it was nighttime in QLD would it also be nighttime in other parts of the country? The world?
Step 2	As a class, view a PowerPoint of different images of day and night. Students will complete the relevant questions on the worksheet as each image is shown. The PowerPoint includes images of day, night, sunset and sunrise. Students will discuss what has happened to cause this in our sky. (See Appendix 10.3 for images and worksheet)

Step 3	Ask students to write a reflection in their science journals about their own ideas about what causes day and night, new understandings from the activity and any questions they might have.
Step 4	As a class form an 'Investigation Questions' poster based on any questions the students still have which will be explored in future lessons. Display the poster on the classroom wall.

8.2- Lesson Two: Session One

Lesson Two: Sun up, Sun Down		
Stage of 5 E's: Explore	**Time:** 60 minutes	**Session One:** Sun up

Overview

The purpose of this learning experience is for students to investigate the relationship between shadows and the position of the Sun at different times of the day. Through hands on activities students will observe what happens to the length and direction of shadows throughout the day as well as conduct a short experiment about the shadows created by a variety of objects. Students will record their new understandings with illustrations in their science journals.

Assessment Focus

- *Diagnostic*- To assess student's consideration of the relationship between the movements of the Earth and position of the Sun in the sky. Students should be able to explain the impact it has on shadows and what happens to the Sun at night.

Key Outcomes

1. Explain how the Earth spins and the light from the Sun creates different sized shadows based on its position in the sky
2. Understand that the Earth orbits the Sun

Required Equipment

- Science journals
- 10-20cm Stick
- Materials (Ruler, plant, lego people)
- Globe
- Paper
- Torch

Lesson Procedure

Step 1	Gather students outside and mark the shadow outline of the building with chalk. Ask students if they think the shadow with change or remain the same throughout the day. Bring students back inside the classroom and discuss what factors would determine how and when a shadow is made. Ask students to write down how they believe shadows are formed and when they are formed in their Science journals.
Step 2	Explain to students that today they will be creating a Sundial to see if the shadow will change at different intervals throughout the day. Write student predictions on the board. Every half hour one student will go outside and draw the shadow line of a stick that has been placed in a fixed position on the piece of paper. When the student comes back, write observations on the board. Through this process students should

	complete the relevant worksheet (See Appendix 10.4)
Step 3	The teacher will shine a torch on a range of materials at different angles in order for students to understand that light from the Sun causes shadows. Discuss with students what they are seeing and why they think the angles change the shape of the shadow. Also discuss how the position of the torch or the object is important in working out the position of the shadow. Ask students to consider if the lamp was the Sun would it have a similar affect on objects outside such as buildings, trees, people etc.
Step 4	Using a globe and a torch, ask a volunteer to shine the torch on the globe while another volunteer slowly spins the globe. Discuss the idea that the Earth is actually spinning and the Sun is staying in a fixed position. Ask students to consider what this means for the causes of daytime and nighttime. What happens to the Sun at nighttime? Prompt students to understand nighttime as a giant shadow.
Step 5	At the end of the day students will collect the piece of paper which will highlight how the Earth has rotated. Ask students to predict where the shadow would be at 5pm and 5am.
Step 6	Take the students back outside to original chalk outline and ask them what has changed? Based on the knowledge throughout this lesson ask them why they think the shadow had changed and how? Take the students back inside and look at the sundial they have observed throughout the day. Ask students to record this image in their science journals.
Step 7	Students draw an example of a type of shadow they have seen throughout the day in their science journals. They must also write a statement explaining what they have drawn.

8.2- Lesson Two: Session Two

Lesson Two: Sun up, Sun Down		
Stage of 5 E's: Explore	**Time:** 40 minutes	**Session One:** Sun down

Overview

The purpose of this learning experience is for students to investigate the relationship between shadows and night-time as well as for students to understand that the shape of the Moon we see in the sky is a reflection.

Assessment Focus

- *Diagnostic*- To assess student's consideration of what causes the different phases of the Moon and the relationship it has with the Sun-Earth-Moon system

Key Outcomes

1. Identify and describe the cause of the different phases of the Moon
2. Justify what happens to the Sun at night
3. Understand that night time is a giant shadow and the Moon orbits the Earth

Required Equipment

- Science journals
- Images of the Moon
- http://www.whiteboardblog.co.uk/2012/11/Moon-phases-animation-from-nasa/

Lesson Procedure	
Step 1	Begin the lesson by recapping on student's new knowledge of nighttime from the previous lesson. Reflect on the idea that the Earth is spinning which changes the angle Earth observers see the Sun. Prompt students to understand night time as a giant shadow as the Earth is no longer facing the Sun and the Earth is in darkness
Step 2	Show students a picture of a full Moon at nighttime. Ask students *"What do you see?" "How do you know it is night-time?' "Does the Moon always look like this?" "Can you see the Moon during the day?"*
Step 3	As a class, explore the different phases of the Moon over the 27 day cycle. Play the clip from the NASA website on the IWB that highlights the different phases of the Moon for the whole year of 2013. As a class discuss what they have just seen. Ask students *'Do you have any new ideas about what causes night time?' '*

Step 4	Point out to the students that the Moon always keeps the same side to us, but not always the same face. Because of the tilt and shape of its orbit, Earth observers see the Moon from slightly different angles over the course of a month.
Step 5	Ask students to write a short reflection on this new information and any questions they still have.

8.3- Lesson Three: Session One

Lesson Three: Rotations and Revolutions		
Stage of 5 E's: Explore	**Time:** 40 minutes	Session One: Role Play

Overview

The purpose of this learning experience is to explore the movements and relationship of the Sun, Moon and Earth and how they relate to the process of day and night. Through the use of role play students will familiarize themselves with the rotation of the Earth and the Moon as well as the revolution of the Moon around the Earth. The role play activity also includes how the Earth and Moon revolve around the Sun. Students will record their predictions, observations and findings in their science journals.

Assessment Focus

Diagnostic- To assess student's knowledge of the movements of the Sun, Earth and Moon and the timeframes associated with those movements.

Key Outcomes

1. Understand and explain that the:
   - Moon rotates/spins on its axis
   - Moon revolves/orbits around the Earth
   - Moon and the Earth revolve around the Sun.
2. Explain that motion of the Sun, Earth, and Moon are constantly repeated.
3. Make links between the time frames of the Earth and Moon movements and measurements of time (year, month, day)

Required Equipment

- Science journals
- Chalk (Blue, Orange, White) x 10

Lesson Procedure

Step 1	Review the idea that the Earth spins which causes day and night. Ask students, '*What do you see in the sky?' 'What might revolve around the Earth?'* Take students to a large concreted area outside and split into groups of three.
Step 2	In their groups, ask one student to draw the Earth (a 30cm circle coloured with blue chalk) and another student to draw the Sun (90cm circle coloured with orange or red chalk). Ask students to draw the orbit of the Earth around the Sun. Note this scale is not to size but for the purpose of this activity the importance rests upon the orbiting motion
Step 3	Ask another group to draw the Moon (10cm coloured with white chalk). The Moon

	should be about a meter away from the Earth so that students can move about easily. Note: Orbit sizes not to scale for this activity. Remind students that distances in space are vast and that this is a model to help understand motion. Ask that student to draw the Moons orbit around the Earth
Step 4	Explain to students that one student will represent the Sun, one will represent the Moon and the other will represent Earth.
Step 5	Ask students how long it takes for the Earth to spin around- 24 hours. Explain that the Moon rotates much slower—it takes a little more than 27 days for the Moon to rotate all the way around. Ask students, "Which spins faster, the Earth or the Moon?" Explain that the Moon rotates and orbits around the Earth at the same time. Ask the “Moon” how he or she should move. The Moon character will spin and revolve in a counter clockwise direction as seen from above) Remind students that this is not a race and the rate of speed is constant and steady.
Step 6	Ask the “Earth” how he or she should move. Get your Earth and Moon characters moving in rotation/revolution. All three students (Sun, Earth and Moon) should have a go at physically being each object in space.
Step 7	Gather the students back inside and ask them which was the hardest role to play and why? Also get students to draw what they have just demonstrated in their role play in their science journals.

8.3- Lesson Three: Session Two

Lesson Three: Rotations and Revolutions		
Stage of 5 E's: Explore	**Time:** 45 minutes	Session Two: Lamp Activity

Overview

The purpose of this learning experience is to explore the movements and relationship of the Sun, Moon and Earth and how they relate to the process of day and night. Through the use of hands on activities students are given the opportunity to explain their understandings by using materials to represent the Sun, Earth and Moon then drawing a diagram to highlight the system.

Assessment Focus

Diagnostic- To assess student's representations of the Sun Earth and Moon in terms of demonstrating the rotation and revolution of the Earth around the Sun and the Moon around the Earth. Also their reflections on what relationship this has with the causes of day and night.

Key Outcomes

1. Create a 3D representation of the Sun-Earth-Moon system
2. Understand and explain the relationship between the movements of the Sun, Earth and Moon
3. Present findings to the class

Required Equipment

- Science journals
- 5 x large foam balls
- Texta pens
- 5 x medium foam balls
- -5 x torches
- 5 x small foam balls
- 15 x wooden skewers
- 5 x flat pieces of Styrofoam
- http://www.classzone.com/books/Earth_science/terc/content/visualizations/es0408/es0408page01.cfm?chapter_no=04
- http://sciencenetlinks.com/interactives/messenger/psc/PlanetSize.html

Lesson Procedure

Step 1	Begin by reviewing the previous lesson where students created a role play scenario where they were physically representing the Sun, Moon and Earth. Ask them what parts they remember and using their science journals how long did it take for the Earth to rotate around the Sun and how long it took for the Moon to revolve around the Earth.
Step 2	Using the website above, show students how the Earth rotates on its axis creating day and night whilst at the same time revolving the Sun. Discuss with students what the role of the Moon might be based on the role-play in previous lesson. Use the other website to compare the sizes of the Earth, Moon and Sun.
Step 3	Split students into 5 small groups. Using the materials provided, students will

	recreate the Sun-Earth-Moon system. Explain to students they can create their Sun-Earth-Moon system any way they would like or follow the instruction sheet but they must use all the materials provided to them (See Appendix 10.5). Hint: an idea would be to use the skewers to hold items in place. Students are also allowed to look back on what they have previously learnt in their science journals. Have students draw a diagram of the model on big sheets of paper including lines to show which way the Earth and Moon are orbiting and spinning.
Step 4	Students present their 3D representation to the class and explain their findings. Students could arrive at the conclusion to use the torch to represent the Sun, the large ball as the Earth and the small ball to represent the Moon if they do not use the worksheet instructions.

8.4- Lesson Four

Lesson Four: Spinning in Space	
Stage of 5 E's: Explain	**Time:** 45 minutes
Overview The purpose of this learning experience is for students to further investigate current scientific explanations for what causes day and night. Through journal articles and videos, the students will investigate how the Earth spins on its axis while revolving around the Sun and how the Moon orbits the Sun and Earth. In addition to this, students will be exposed to timeframes for each cycle e.g. 24 hours for the Earth to spin, 1 year to revolve around the Sun, 27 day cycle for the Moon.	
Assessment Focus *Formative*- To assess students expanding knowledge of the Sun-Earth-Moon relationship and their ability to summarize and present their understandings in their own words.	
Key Outcomes 1. Explain and justify how the Earth rotates the Sun around an axis 2. Create a summary based on new understandings 3. Explain and justify the orbit of the Moon around the Earth and Sun 4. Read and interpret a range of articles	
Required Equipment - Science journals -Journal articles - http://www.bbc.co.uk/schools/scienceclips/ages/9_10/Earth_Sun_Moon.shtml - IWB - Solar Walk App	
Lesson Procedure	
Step 1	Recap students' knowledge from previous lessons by playing the clip of how the Earth and Moon move around the Sun. As a class discuss what they see- Ask *'How is the Earth moving?' 'How is the Moon moving?' 'Is the Sun moving?'* Have students jot down their thoughts in their science journals.
Step 2	Explain to student's that today we are going to be exploring the reasons why the Earth and Moon move in these particular ways, how fast they are travelling and how long it takes as well as the size of the Sun, Earth and Moon and the distances in between them. As a class view the 'Earth Cycles video' on the Solar Walk app for the Ipad Ask key questions • How is spinning different from orbiting? • Can you describe what causes day and night?

	• Does everyone experience daytime at the same time across the world? • Can you work out how many times the Earth has orbited the Sun since you were born? Create a mind map on the board about the different explanations they just heard.
Step 3	In groups of 3, students will be given an article about the rotation of the Earth and an article about the rotation of the Sun (See Appendix 10.6). Based on their findings, students will write a summary about the Sun-Earth-Moon relationship in their science journals. Students should come to the conclusions that • the spin of the Earth on its axis takes 24 hours • the orbit of the Earth around the Sun takes one year • the orbit of the Moon around the Earth takes 28 days • Day and night on Earth are caused by the spinning of the Earth on its axis. • The shapes of the Moon are a result of reflections from the light of the Sun • The Sun is the largest, followed by the Earth, then the Moon The small groups share their summary of findings with the class.
Step 4	Ask each student to write a new reflection about what they now know about what causes day and night, new understandings about spinning and orbiting based on the questions on our investigation poster formed in lesson on. Allow time for students to discuss and identify any questions they still might have.

8.5- Lesson Five

Lesson 5: Space Explorers	
Stage of 5 E's: Explain	**Time:** 45 minutes
Overview The purpose of this learning experience is for students to use ICT to collect and analyse information about the size or the sun earth and moon as well as the distance between them.	
Assessment Focus *Formative*- To assess student's knowledge based on their perception on the scale size and distance between the sun, earth and moon.	
Key Outcomes 1. To find and compare the sizes of the Earth, Moon and Sun 2. To discover the vast distance between the Sun and Earth as well as the Earth and Moon 3. To discuss why the sun and moon appear to be the same size in the sky	
Required Equipment - Science journals -30 x Ipads with Solar Walk - 7x Exercise Balls -7x Tennis Balls - Interactive Whiteboard -http://www.youtube.com/watch?v=FjCKwkJfg6Y	
Lesson Procedure	
Step 1	Using the Solar Walk Application on the Ipad allow students 5-10 minutes perusal to look through the solar system. Place a specific emphasis on looking at the Earth, Moon and Sun and writing down the sizes of each.
Step 2	Ask students what they found through their perusal and if they noticed the sun, earth and moon all in a close distance to one another like they have seen before in other models. Re-iterate this knowledge by displaying your Solar Walk screen on the interactive whiteboard projector. View the size statistics as well as a brief glance and how far apart the earth, moon and sun are. Which is the biggest? Which is the smallest? Which are closer together?
Step 3	Continuing on with Solar Walk ask students to click onto the extras tab in the bottom right of screen. Ask students to tap the "Size Comparison" tab and to let it play out. Once viewed ask students to explain what they have seen. Also ask students to draw in their science learning journals how they see the Moon, Sun and Earth in relation to their actual size

Step 4	Show students a tennis ball and exercise ball. Explain to students that for this activity the tennis ball represents the moon and the exercise ball represents the sun. In real life the sun and moon look the same size. Ask students how can we make it so they are the same size? Take the students outside and split them into groups of four. Give each group a tennis ball and an exercise ball. Students are to put the tennis ball on a flat surface(desk, bench, etc) while another group member takes the medicine ball further and further back until they look the same size. One group member will have to tell them if they are getting off course and to straighten up. Each group member should have a turn of looking at this sun and moon this way
Step 5	Gather students back inside and ask them to write in their science journals why they now believe the sun and moon look the same size. Remind students the activity that had just taken place and their new found knowledge on sizes of the moon and sun.
Step 6	Finish lesson by showing the YouTube clip above to give the students more clarification on the scientific explanations they have just been provided with.

8.6- Lesson Six

Lesson 6: Moon Reflections	
Stage of 5 E's: Elaborate	**Time:** 60 minutes
Overview The purpose of this learning experience is for students to further elaborate on ideas of night time as a giant shadow and the different sizes of the Moon that we see.	
Assessment Focus *Formative*- To assess student's ability to determine the cause of night time and describe the shape of the Moon we see in the sky as a reflection of the Moon's orbit position around Earth. Students should be able to identify the different phases of the Moon and their names.	
Key Outcomes • Identify and describe the key phases of the Moon • Explain the terms waxing and waning • Recreate the phases of the Moon	
Required Equipment - Science journals - http://www.Moonphases.info/Moon_phases.html - 1 x piece of black paper per student - White crayons - 8 x Oreos per student - 1 x paper plate per student - 1 x plastic spoon per student -Solar Walk app for Ipads	
Lesson Procedure	
Step 1	Begin the lesson by reflecting on the causes of day and night that we have covered so far. Briefly explain to the students the perspective of Indigenous Australians when it comes to the cause of day and night. Read the students relevant segments from the article 'Emu dreaming' (See Appendix 10.8). In particular highlighting the dreamtime story where Indigenous cultures describe the Sun as a female and the Moon as a male.
Step 2	Elaborate on the idea that the revolution of the Moon around the Earth makes the Moon appear as if it is changing shape in the sky. This is caused by the different angles from which we see the bright part of the Moon's surface. These are called "phases" of the Moon. Of course, the Moon doesn't generate any light itself; it just reflects the light of the Sun. The Moon passes through eight major shapes during a cycle that repeats itself every 27 days. The phases always follow one another in the same order.

Step 3	Using the solar walk app for the Ipad, play the students the clip of the moon phases. To provide further elaboration, the teacher shows images of the different phases of the Moon and explains that the Moon orbits the Earth in a counterclockwise direction. Using the website above, provide elaborations on the different phases of the Moon (quarter, new, full, gibbous and crescent) as well as the terms waxing and waning. As you cover the different phases of the Moon, get the children to draw them with white crayons on black paper and underneath label the different Moons they draw. Display posters around the classroom.
Step 4	Students recreate the phases of the Moon through the 'oreo activity'. Using their plastic spoons, students dig out the cream of the oreo cookie to highlight the key different phases of the Moon. Students place them in order around the edge of their paper plate in a counterclockwise motion. Prompt students to draw Earth in the middle of the plate to show what the Moon is orbiting. (See Appendix 10.7 for end result)
Step 5	Students write an individual reflection about the phases of the Moon in their science learning journals.

8.7- Lesson Seven

Lesson 7: Diorama Madness	
Stage of 5 E's: Evaluate	**Time:** 45 minutes
Overview The purpose of this learning experience is for students to demonstrate the knowledge they have acquired throughout the unit through the use of a letter and diorama. These should have a specific focus on describing the movements of the sun, earth and moon as well as describing day and night	
Assessment Focus *Summative*- To assess students overall knowledge of the content taught and learned throughout the unit based on a rubric	
Key Outcomes • Explain the movements of sun, earth and moon • Provide reasoning for the causes of day and night • Represent the content taught throughout the unit through a diorama and letter • Presentation of the diorama to the class	
Required Equipment - Assessment Rubric - Student's presentation letter - Student's diorama	
Lesson Procedure	
Step 1	Ask all students to take a seat on the floor in front of the presentation desk. Explain to students that one at a time they will come up the presentation desk and place their diorama on top. They will hand their written letter assessment piece to the teacher. They will then present what they have learnt through the unit based on what the diorama is representing.

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10.0 Appendix

10.1 Equipment

Equipment	
Lesson 1	• Science journals • Teacher's laptop • IWB - • PowerPoint of images • Worksheet
Lesson 2 Session 1	• Science journals • Globe • 10-20cm Stick • Paper • Materials (Ruler, plant, lego people) • Torch
Lesson 2 Session 2	• IWB • Science journals
Lesson 3: Session 1	• Science journals • Chalk (Blue, Orange, White) x 10
Lesson 3: Session 2	• Science journals • 5 x torches • 5 x large foam balls • 5 x medium foam balls • 5 x small foam balls • Texta pens • 15 x wooden skewers
Lesson 4	• Science journals • Journal articles • IWB • Ipad for teacher
Lesson 5	• Science Journals • IWB • 30 x Ipads • 7 x Exercise Balls • 7x Tennis Balls
Lesson 6	• Science Journals • IWB • Ipad for teacher • 8 x Oreos per student • 1 x Paper plate per student • 1 x plastic spoon per student • 1 x piece of black paper per student • White crayons
Lesson 7	• Assessment Rubric • Student's presentation letter • Student's diorama

10.2 Assessment Rubric

	Evident	Emerging	Unsatisfactory
Letter to Alien (explanation)	• Student provides an **excellent** explanation of the movements of the Moon and Earth • Student **alternates terms** to express and **excellent** understanding (orbiting/revolving, rotating/spinning) • The student **clearly** identifies the cause of day and night	• Student provides a **satisfactory** explanation of the movements of the Moon and Earth • Student uses **simple terms** to express a **satisfactory** understanding • Student **identifies** the cause of day and night	• Student provides an **unsatisfactory** explanation of the Moon and Earth • Student **confuses the terms** orbiting and revolving with spinning and rotating • Student **fails to identify** the cause of day and night
3D Representation	• The student's representation **clearly features** correct planet comparisons • The representation **excellently highlights** the correct movements of the Sun, Earth and Moon	• The student's representation **features** correct planet comparisons • The representation **highlights** the correct movements of the Sun, Earth and Moon	• The student's representation **does not feature** correct planet comparisons • The representation **incorrectly highlights** the movements of either the Sun, Earth or Moon
Presentation	• Student speaks in a **clear** volume and a fluent voice • Student **uses** eye contact and holds the attention of audience throughout the entire presentation	• Student speaks with a **satisfactory** volume and level of variation in tone • Student **attempts** to use eye contact and engage the audience	• Student speaks in a **low** volume and monotone • Student uses **minimal** eye contact and does not engage the audience

10.3 Lesson One Worksheet

Photo One- Sunrise

What can you see?

Do you think it is day or night? Why do you think so?

_____

What time of day do you think this is? Why do you think so?

_____

What questions do you have about this image?

_____

Photo Two: Sunny Day

What can you see?

Do you think it is day or night? Why do you think so?

_____

What time of day do you think this is? Why do you think so?

_____

What questions do you have about this image?

_____

Photo Three- Sunset

What can you see?

Do you think it is day or night? Why do you think so?

_____

What time of day do you think this is? Why do you think so?

_____

What questions do you have about this image?

_____

Photo Four- Night-time

What can you see?

Do you think it is day or night? Why do you think so?

_____

What time of night do you think this is? Why do you think so?

_____

What questions do you have about this image?

_____

10.4 Lesson Two: Session One

INVESTIGATING SHADOWS!

Investigation Question:

What do shadows tell us about the movement of the Earth?

PREDICT

I predict that

_____

_____

EXPLORE

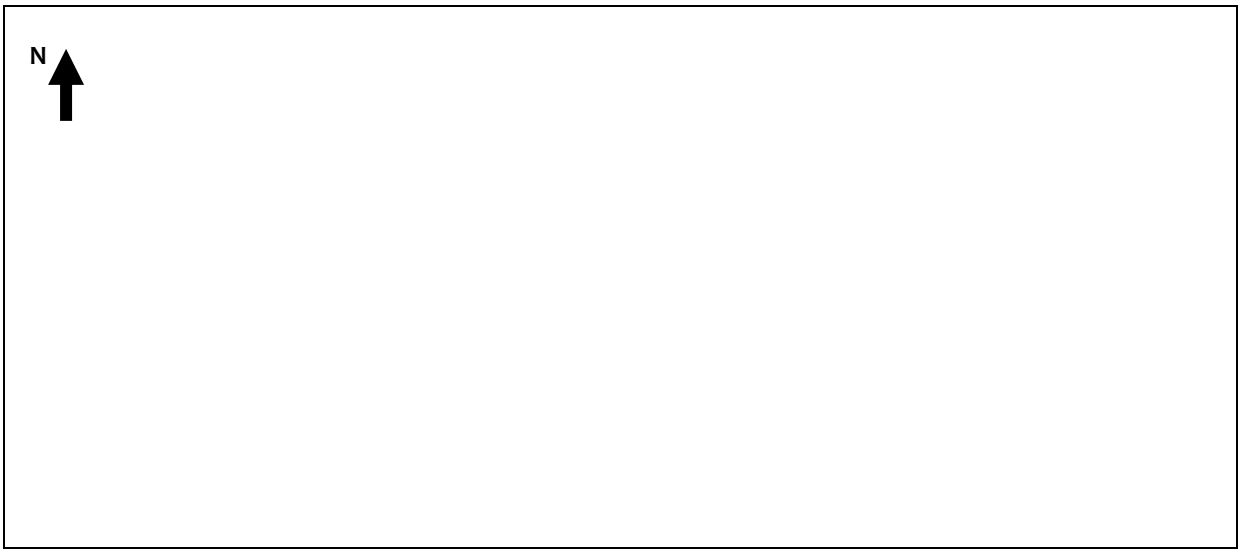
Explore the size of your shadows at different times during the day.

Diagram:

Draw a diagram of the investigation area and label to show:

- the length and direction of each shadow
- the position of the Sun

USE DIFFERENT COLOURS FOR EACH OBSERVATION



Results:

	Time 1:	Time 2:	Time 3:	Time 4:	Time 5:
Time					
Shadow length	**cm**	**cm**	**cm**	**cm**	**cm**
Sun's height	**fists**	**fists**	**fist**	**fist**	**fist**
What else do you observe?					

EXPLAIN

I claim that _____

From this investigation:

What do shadows tell us about the movement of the Earth?

_____

_____

_____

Reflect on your findings

What did you learn from conducting this investigation?

_____

_____

_____

10.5 Lesson Three: Session Two

3D Representation Worksheet

Follow the steps below to help you create your 3D system

1. Insert one end of the skewer into the "Sun" ball and the other end of the skewer into the Styrofoam disk to keep it in place.

2. Place the 'earth' ball on bamboo skewer so that the Earth can be held from above and rotated

3. Break a skewer in half and place it into the 'moon' (small) ball

10.6 Lesson Four Articles

The Moon's Orbit

The Moon's orbit is tilted by 5° to the ecliptic, ie it gets to 5° North and 5° South of the ecliptic. Hence it is as much as 28.5° north or south of the Celestial Equator and as little as 18.5° North or South. This means the Moon can be higher or lower than the Sun. The points where it crosses the Ecliptic are called the Nodes. These points precess (move backwards) with time.

Against the background stars the Moon moves about its own width (0.5°) every hour or a little over 13° per day. The Sun travels 1° per day, so, with respect to the Sun, the Moon travels 12° per day. Each month it moves all the way around the sky and a little more. The Moon moves around the Earth about 13 times in one year.

The Sun is the main offender in disturbances of the Moon's orbit, its gravitational influence being twice that of the Earth on the Moon. The Moon is affected by 150 direct periodic variations and 500 smaller variations in its passage.

The Moon arrives approximately 50 minutes later per day on the meridian (between 38 and 66 minutes). The variations are due to changes in orbital speed, variations in the Sun's apparent speed along the ecliptic and changes in the inclination of the Moon's orbit.

Rising times of the Moon can vary from 13 minutes to 80 minutes on latitude. Greatest delay in rise is near Full Moon close to the Spring Equinox. Least delay in Moonrise is near the Autumn Equinox.

The Moon's distance from the Earth varies by about 5.49%. The Moon is slightly larger and moves faster when it is at perigee.

Due to the constant motion of the Moon about the Earth, Full Moon is only an instant. However, when we view the Moon it does appear full a few days before and after the exact time of the phase. Moon phases are between 6 or 7 days apart due in part to the Moon's elliptical orbit and that the Earth-Moon system is in orbit around the Sun.

http://museumvictoria.com.au/discoverycentre/infosheets/planets/the-moon/

Making Sense of the Research

First of all, let's be sure we're clear on what the earth's axis is. Basically it's an imaginary stick going through the center of the earth, if we define the center as "the point around which it rotates." In other words, picture the earth spinning like a top, straight up and down. Now picture a stick going right through the center of the earth. If the earth weren't tilted, it would rotate like that as it revolved around the sun, and we wouldn't have seasons—only areas that were colder (near the poles) and warmer (near the Equator).

But the earth is tilted, and that's why the seasons happen. When the Northern Hemisphere is pointed toward the sun, it gets more hours of sunlight. Temperatures rise, and you get summer in New York, while it's darker and cooler "down under" in Sydney. Six months later, the reverse is true, and it's the Southern Hemisphere that experiences summer. The 23-degree tilt also explains why changes in daylight during the seasons are very dramatic near the poles (which are flooded with sunlight all day long in summer and get virtually no light in mid-winter) but barely perceptible near the equator (where the sun shines more or less equally throughout the year).

Getting back to why the axis exists, it's mainly the result of the rough-and-tumble environment of the early solar system. Scientists believe that the sun and the eight planets formed by chunks of rock and debris that self-accumulated through gravity. In other words, objects collided and clumped together, which increased their gravitational pull, which in turn drew more objects in, which made the object even more gravitationally powerful, and so on until the solar system looks like a sun and eight fairly neat planets with not much stray junk flying around.

Of course, occasionally these forming objects happen to attract something that's big enough to knock it off-kilter. That's what probably happened to the earth, after it was already large enough to start rotating. Actually, Wilson says it probably took several substantial impacts to whack the earth into the position it's in today.

Incidentally, back in the "old days," the earth used to rotate a lot faster—once every 6 to 10 hours at the start of the solar system—and the moon's gravity has played a big role in slowing us down to 24. It's a good thing too, because a 6-hour day would certainly lead to an awfully hectic work week.

http://sciencenetlinks.com/science-news/science-updates/tilted-earth/

The Moon's Orbit and Rotation

The Earth's Moon is the fifth largest in the whole solar system, and is bigger than the planet Pluto. The Moon has a nearly circular orbit (e=0.05) which is tilted about 5° to the plane of the Earth's orbit. Its average distance from the Earth is 384,400 km. The combination of the Moon's size and its distance from the Earth causes the Moon to appear the same size in the sky as the Sun, which is one reason we can have total solar eclipses.

It takes the Moon 27.322 days to go around the Earth once. Because of this motion, the Moon appears to move about 13° against the stars each day, or about one-half degree per hour. If you watch the Moon over the course of several hours one night, you will notice that its position among the stars will change by a few degrees. The changing position of the Moon with respect to the Sun leads to lunar phases.

Have you ever heard the term the 'far-side' of the Moon? Because of the effect on the Moon of tidal forces due to the Earth, the same side of the moon always faces the Earth. In other words, it takes the Moon the same amount of time to rotate around once as it does for the Moon to go around the Earth once. Therefore, Earth-bound observers can never see the 'far-side' of the Moon. Tidal forces cause many of the moons of our solar system to have this type of orbit.

http://www.windows2universe.org/the_universe/uts/moon1.html

The Earth's Rotation

The Earth is rotating around an axis (called its **rotational axis**). Some objects rotate about a horizontal axis, like a rolling log. Some objects, such as a skater, rotate about a vertical axis. The Earth's axis is tipped over about 23.5° from vertical.

How do we define up and down in space? What would "vertical" mean? For the Earth, we can think of vertical as straight up and down with respect to the plane in which the Earth orbits the Sun (called the ecliptic).

Earth's rotational axis points in the same direction relative to the stars, so that the North Pole points towards the star Polaris. Think of the Earth as a spinning top, tipped over to one side. Over very long time periods (thousands of years) the direction of Earth's axis slowly changes due to precession.

The Earth rotates around once in 24 hours - that's a rate of 1000 miles per hour!. The time it takes for the Earth to rotate completely around once is what we call a day. It's Earth's rotation that gives us night and day.

The combined effect of the Earth's tilt and its orbital motion result in the seasons.

The Earth's Orbit

Like all planets in our solar system, the Earth is in an elliptical orbit around our Sun. In Earth's case, its orbit is nearly circular, so that the difference between Earth's farthest point from the Sun and its closest point is very small. Earth's orbit defines a two-dimensional plane which we call the ecliptic.

It takes roughly 365 days for the Earth to go around the Sun once. This means that the Earth is rushing through space around the Sun at a rate of about 67,000 miles per hour! The time it takes for the Earth to go around the Sun one full time is what we call a year.

The combined effect of the Earth's orbital motion and the tilt of its rotation axis result in the seasons.

10.7 Lesson Six Activity

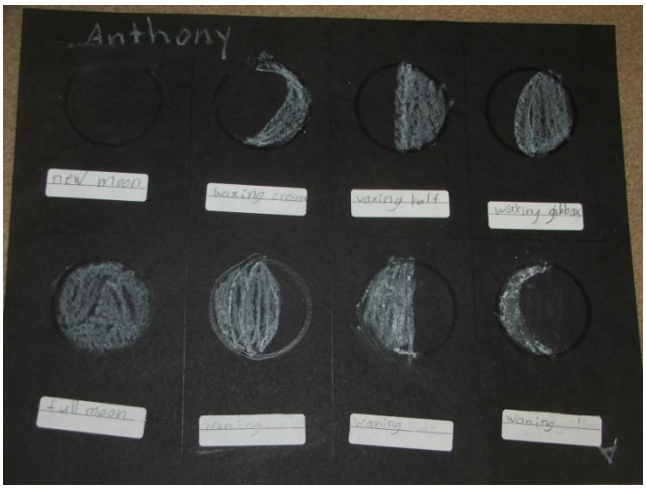


Photo One: Black paper and white crayon activity

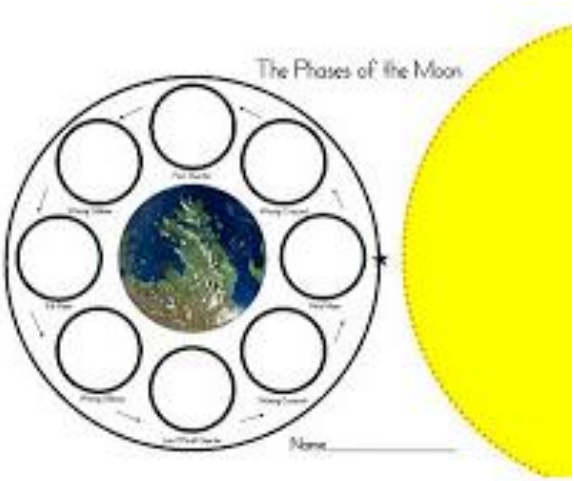


Photo Two: Template for Oreo activity

Photo Three: Final result of Oreo activity

10.8 Emu Dreaming Article