**Light Unit Plan** 

**By: Melissa Coton**

**Term 3, 2018**

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| **Curriculum level: 2/3****Age: Year 5/6** | **Title/Context: Power of light** **Time for unit: 4–8 lessons** | **Key understandings:*** Physics of light
* Impacts of light pollution
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| **Curriculum Achievement Objectives** ***– from the Nature of Science strand*****Nature of science: Investigating in science*** Appreciate that science is a way of explaining the world and that science knowledge changes over time.
* Identify ways in which scientists work together and provide evidence to support their ideas.

**Nature of science: Understanding about science*** Build on prior experiences, working together to share and examine their own and others’ knowledge.
* Ask questions, find evidence, explore simple models, and carry out appropriate investigations to develop simple explanations.

**Nature of science: Communicating in science*** Begin to use a range of scientific symbols, conventions, and vocabulary.
* Engage with a range of science texts and begin to question the purposes for which these texts are constructed.

**Nature of science: Communicating in science*** Use their growing science knowledge when considering issues of concern to them.
* Explore various aspects of an issue and make decisions about possible actions.
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| **Curriculum Achievement Objectives** ***–* *from the contextual strand/s*****Physical World:Physical inquiry and physics concepts*** Explore, describe, and represent patterns and trends for everyday examples of physical phenomena, such as … light.

**Planet Earth and Beyond: Astronomical systems*** Investigate the components of the solar system.

**Living World: Ecology*** Explain how living things are suited to their particular habitat and how they respond to environmental changes, both natural and human-induced.
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| **Capability Focus****Gather and interpret data**: making observations of stars and constellations; identifying and judging levels of light pollution. **Critique data**: identifying the strengths and weaknesses of the citizen science data collection method; asking how reliable is the data collected; what factors impact the reliability of data?; how reliable are our own data collection methods? **Engage with science**: visit from an expert about the Martinborough Dark Skies Initiative; Wellington Astronomical Society observation evening (TBC).  |
| **Learning Outcomes:** *(from both the Nature of Science Strand and the Contextual Strand/s)*Children will:* develop an understanding of the physical nature of light and how our ability to generate light has changed our society
* recognise that light appears to travel in straight lines
* use the idea that light travels in straight lines to explain that objects are seen because they give out or reflect light into the eye
* explain that we see things because light travels from light sources to our eyes or from light sources to objects and then to our eyes
* develop an understanding of basic principles of telescopes
* develop an understanding of how living things respond to light pollution (human-induced environmental change)
* identify specific constellations in the night sky and make judgements based on a scientific scale about their magnitude and clarity
* gather data to contribute to Globe at Night, a global online citizen science (OCS) project
* critically evaluate the reliability of the data they gather and the data shared globally through the OCS.
* use their knowledge to write letters to businesses (Summerset development, etc.) outlining our concerns and what we can do to reduce light pollution; reducing light pollution in our own homes and at school.
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| **Māori and Pacific considerations:**Students will gather traditional stories from their own cultures to share. We will explore significant constellations for Māori and other cultures. Link with Matariki – students will identify and observe the Matariki star cluster and explore how astrological observations are used to measure time.  |
| **Integration with:****Social studies:*** Understand how people view and use places differently.
* Understand how people make decisions about access to and use of resources.

**Literacy – listening, reading and viewing:** * Making meaning from a range of sources, e.g. listening to presentations from scientists etc., reading related articles and stories and viewing videos and clips.

**Literacy – speaking, writing and presenting:** * Conveying ideas and information in a variety of ways, e.g. planning questions for scientists and to guide their personal explanation writing, taking notes from a variety of sources, writing letters for different audiences.

**Maths – statistics:*** **Gathering and presenting data** –cost of lightbulbs, area and perimeter of light given out around school.

**Enviroschools:*** Māori perspectives – planting by the stars and phases of the moon.

**Art:*** Explore artists (Van Gogh) and musicians (Holst) who use stars and planets.

**Local connection:** Summerset building project and hospital, long and short tail bats, kiwi etc.  |
| **Lesson structure and sequence****Week 1–2****WALT: investigate the properties of light****Prior knowledge brainstorm*** Why is light important to us?
* How many different sources of light are there?
* What would life be like without light?
* Which cultures and religions celebrate light?
* What is light made of?

 Work through the five activities in the ‘Enlighten Me’ kit. Students develop their understanding of: * reflection – light bounces off reflective surfaces (mirrors)
* light travels in a straight line; the direction of light can be changed through reflection (lasers and mirrors)
* explore the laws of reflection (make periscopes)
* light is made of a spectrum of colours and can be split (prisms)
* difference between primary and secondary colours (colour wheel).

Article for shared reading: [Light and telescopes](https://www.sciencelearn.org.nz/resources/1625-light-and-telescopes) – Science Learning Hub Watch ‘[Tools for the astronomer](https://www.sciencelearn.org.nz/videos/918-tools-for-the-astronomer)’ video of Professor Denis Sullivan – different types and sizes of telescopes and methods for measuring light. Prior knowledge links: digital photography, telescopes, colour spectrum, rainbows. Question: Why is relying on eyesight (‘eyeballing things’ in the video) not a good way for scientists to measure things? [Redshift](https://www.youtube.com/watch?v=pCwGa4rVfGc) (YouTube clip)Light waves emitted by stars: red and blue shift demonstration  | **Organisation/questions/****sources/resources**‘Enlighten Me’ box, [Hutt Science](https://huttscience.co.nz/)  |
| **Week 3****Light concepts****Videos to watch** [Science and colour of light](https://www.youtube.com/watch?v=9Vsl0Iom3S0) (YouTube)[What is light?](https://www.youtube.com/watch?v=IXxZRZxafEQ) (YouTube)[What is light?](https://www.youtube.com/watch?v=BUYeQa_-ojk) (YouTube) [Light](https://www.youtube.com/watch?v=d7yTlp4gBTI) (YouTube)[Refraction](https://www.youtube.com/watch?v=KgqV975EtA0) (YouTube)[Science of rainbows](https://www.youtube.com/watch?v=5pYnC-ONdXQ) (YouTube)Stop during videos and model note taking. **Concepts to be developed through a jigsaw activity** Each group creates a poster to display information gathered during activity. **Speed of Light****Reflection**BBC BiteSize Interactive – [How we see things](http://www.bbc.co.uk/bitesize/ks2/science/physical_processes/how_we_see_things/play/) (use mirrors and angles to illuminate different objects) **Amplitude**Intensity Brightness Magnitude (link to Globe at Night – astronomical magnitude scale) **Light Waves**Colour Spectrum **Model refraction through a prism** **Hologram activity to model light travelling in straight lines**  | Resources:Texts to use: Over the Rainbow - Sarah Bainbridge (*Connected* 2016 Level 3 – Picture This)[Physics Hypertextbook](https://physics.info/light/)–Sources of light (Dense - will need to print out and cut down)[Ducksters](http://www.ducksters.com/science/light.php) – Speed of light and refraction [Ducksters](http://www.ducksters.com/science/light_spectrum.php) – Light spectrum **Articles for Week 3 reading rotation:** **Whole class share read:** Northern Lights (*School Journal* Part 3 Number 1 May 2005)**Unicorns:** Living in a Colourful World – Bronwyn Wall (*Junior Journal* 51) **Phoenix:** Tunç Tezel: Star Man – David Chadwick (*School Journal* Level 2 May 2016 **Griffins:** Night Light – David Hill (*School Journal* Level 2 May 2016)**Dragons:** Haritina Mogosanu: Storyteller – Clare Knighton (School Journal Level 3 May 2017)Becoming a Martian – Gavin Mouldey (*School Journal* Level 3 May 2017) |
| **Week 4****Light pollution** Guiding questions for discussion about the impact of artificial light on people and animals:* How do we know it’s time to sleep?
* What did we do before we could use fire?
* How do animals know when it’s time to sleep?
* Do all animals sleep at night?
* What do you think might happen to animals when it’s suddenly lighter at night?

Watch: [Losing the Dark](http://www.darksky.org/resources/losing-the-dark/) (International Dark Sky Association, 6:11) **Vocabulary:*** Circadian rhythms
* Nocturnal
* Scatter
* Pollution
* Galaxy
* Astronomy
* Biology
* LED

**What is light pollution?**In pairs, students explore a range of websites. Record key ideas on sticky notes. Present findings to group. Share write an explanation (Week 5). [Cities at Night](http://citiesatnight.org/index.php/light-pollution/) – Very good images and simple explanation [Globe at Night](https://www.globeatnight.org/light-pollution.php) – More sophisticated text – higher-ability pairs **Watch:** [Night Sky Atlas](https://www.youtube.com/watch?time_continue=85&v=1tHF_Lp1-yU) (YouTube) – tracks artificial light (no sound)* Can we identify land masses?
* Why is there a difference between countries, cities and continents?
* Do the differences match population size?
* What else might account for the difference in light pollution?
* Some data for this research was taken from the citizen science project Globe at Night.

Guiding question for impact on visibility and astronomy:* Have you ever been camping away from the city?
* What did you notice at night?
* Were there things that you could see differently than in the city?
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| **Week 5****Introduce online citizen science project** **Discussion:** Prior knowledge: What is light pollution? **What is citizen science?** “Our” project – Globe at Night Watch: [Globe at Night](https://www.youtube.com/watch?v=_kJLfOwzV-4) (YouTube)In pairs or independently, students complete the [Globe at Night Treasure Hunt](#30j0zll) to become familiar with the project website and key terms. (Note – the literacy levels required by the website made this activity too advanced for many of the students.)**Discussion questions:** * What is a data point?
* Why do you think it’s important that the project knows where you are making observations from?
* What is a constellation?
* Why do you think the project asks citizen scientists to observe constellations rather than individual stars?
* What do you think ‘magnitude’ means?
* What does ‘magnitude’ tell you on the interactive?

**Share findings and discuss key vocabulary:*** Constellation
* Magnitude
* Data point
* Observation
* Hemisphere

Watch: [Lost in Light](https://vimeo.com/178841667) (vimeo)Share [five easy star hunting steps](https://www.globeatnight.org/5-steps.php) for next week. |  |
| **Week 6****Homework:** Students locate the Southern Cross (Crux), make observations and record their judgements of the magnitude of the constellation. Students record/take photos of the light pollution around their home and neighbourhood. Hand out the Globe at Night’s activity guide to help students to make and record their observations. **Discussion:** * What might impact the accuracy of our observations?
* How would this affect the global data set?

**Visit:** Expert from the Martinborough Dark Skies Initiative – 6 June 2018.**Developing science capabilities:**‘Gather and interpret data’ ‘Critique evidence’ [Assessment Resource Banks (ARBs)](https://arbs.nzcer.org.nz/): Where will the wood float | Unfortunately, cloudy skies meant that students could not make their own observations. |
| **Week 8** **Critical evaluation of data gathering for OCS project** Look at Globe at Night data maps:* What patterns do you see?
* Is anything missing?
* What?
* Why might this be?

Brainstorm as many things as you can that might affect the data- gathering process.* How reliable do you think data collected in this way is likely to be?

Share the [light pollution map](https://www.lightpollutionmap.info/#zoom=4&lat=5759860&lon=1619364&layers=B0FFFFTFFFF) with the class. Quick recap (data is gathered by satellites) * If you were a scientist interested in light pollution, which map would you use? Why?

**Taking action (inquiry link)** * What can we do to reduce light pollution in our area?

Independently or in pairs, students choose an aspect of light pollution that interests them and broaden their learning about this. Taking action is a key outcome. Students will choose a way to present their learning to a wider audience. Report, poster, movie, letter (council, hospital, Summerset company etc).  |  |

**Globe at Night Treasure Hunt**

1. What does the Globe at Night project aim to do?
2. Who runs the Globe at Night project? (Hint: look at the bottom of the page)
3. How many data points have been collected so far in 2018?
4. How many countries were included in the 2017 Globe at Night data?
5. Follow the link [finding all the Globe at Night Constellations](https://www.globeatnight.org/finding) and explore the interactive.
6. What is a constellation?
7. Which constellations can we currently see in our night sky?
8. Follow the link [magnitudes](https://www.globeatnight.org/light-pollution-interactive.php) and explore this interactive.
9. What magnitude do you think the night sky above your house would be tonight?
10. Check out the [map](https://www.globeatnight.org/map/). Do you notice anything interesting?