NOTES FOR TEACHERS

# BREAKING IT DOWN

with Dr. Michelle Dickinson

# SCIENCE OF LIGHT

Welcome to Breaking It Down with Dr Michelle Dickinson.

This worksheet is to help you to support your teaching after your students have watched the 'Science of Light' episode. It contains a summary of the science knowledge, experiment instructions, topics for further inquiry, and links to the NZ curriculum at levels 3-4.

Use this sheet alongside the video for the Light episode of "Breaking It Down with Dr Michelle Dickinson" to help with your teaching around the science of light. During the episode, Dr Michelle Dickinson will cover the basic science of light, talk to an expert researcher, and conduct an experiment which children can follow along with in real time.

**For this session, your class will each need:**

- **Pencil**
- **Paper**
- **Clear glass of water**
- **Notebook to write down their observations**

| NZ CURRICULUM STRAND: PHYSICAL WORLD | |
|---|---|
| **Achievement Aims** | **Learning Outcomes** |
| Physical inquiry and physics concepts:<br>Explore, describe and represent patterns and trends for everyday examples of physical phenomena, such as movement, forces electricity and magnetism, light, sound, waves, and heat. | • Understand properties of light including wavelength and frequency<br>• Understand behaviour of light including reflection, refraction, scattering and absorption<br>• Demonstrate refraction with a simple experiment |

**BREAKING IT DOWN:**
The Science of Light

Light is all around us, even in the dark. Waves of light travel from their source, such as the Sun, fire or electric lights, bounces off everything around us and then into our eyes, which is how we see objects. Shadows form when light can't pass through an object. The speed of light is 300 million metres per second!

Light is a wave, which means that we can measure the wavelength of light by measuring the distance between the peaks of each wave, and measure the frequency by recording how many waves arrive at a sensor within a certain time-frame.

Light which comes from the Sun and most light sources is a mixture of lots of different wavelengths and frequencies together. Each of these different frequencies corresponds to one colour within the visible light spectrum (i.e. the rainbow!), and when they are all mixed together, we see the light as white.

When white light passes through airborne raindrops, the frequencies separate out and we see them as a rainbow with seven distinct colours - in order of lowest to highest frequency, those colours are red, orange, yellow, green, blue, indigo and violet.

When light hits a surface, it can be absorbed (taken in), refracted (pass through) or reflected (bounced back). The wavelengths which are absorbed are not seen, but the wavelengths which bounce back and into our eyes decide which colours we see. Flat, shiny surfaces are very good at reflecting light, but sometimes rough surfaces can scatter light beams as they pass through. We see those as sunbeams, for example through clouds or trees. Refraction is when light passes through something and continues on into our eyes. This happens with transparent and translucent objects such as water and glass.

Lasers are narrow beams of light which travel a long distance. We have used lasers to measure the distance between the moon and the earth! Lasers are also present in our everyday lives, such as barcode scanners at the supermarket, which work on the principles of reflection and absorption.

## EXPERIMENT INSTRUCTIONS — Refraction in Action!

- Observe the pencil, and note that it's the same width along its length
- Drop the pencil into the glass of water.
- Observe how the underwater part of the pencil appears wider than before and a little bent - this is because of refraction!
- Write the letters "w o n" on the paper
- Place the paper several centimeters behind your glass, look at the words through the glass again keeping the glass away from the face and observe that the word is reversed so it reads "n o w" through the water.

## EXPLORE FURTHER

(Use these prompts to start a discussion or further inquiry on the topic of light)

- Since a star's light takes so long to reach us, how do we know if the star is still there?
- Why do some objects make shadows and some don't?
- Why is the sky blue?
- Can air make a shadow?
- Does the back of a rainbow look the same as the front?
- How are double rainbows made, and could there be triple or even quadruple rainbows?
- What does it mean to be "colour-blind"?
- How do contact lenses and glasses work, and why do some people need them?

## FURTHER EXPERIMENTS

Demonstrate refraction with this simple coin-in-a-cup experiment

Make rainbow patterns with a CD and a torch

Explore coloured shadows — thanks to our sponsors the Dodd-Walls Centre for this one!

Thank you to our Sponsors

**If you have any questions, please contact info@nanogirllabs.com or check out Nanogirl's Lab – a new science adventure at home every weekday!**