

## Lesson Plan

Assessment	AFL, observations, peer assess.
Cross-curricular	Health, Phys.Ed., Technology

### Big Ideas

- A wide range of technologies utilizes the properties of light and colour.
- The behaviour of light depends on the materials with which it interacts.

### Learning Goals

- What are some forms of colour blindness?
- What is electromagnetic radiation and different kinds of EM radiation?
- Ways that EM radiation is used in our daily lives
- Which EM radiation is safe and which is dangerous?

### Materials

VCR or television remote controls (one per group if possible)  
 Computer webcam or podium camera  
 Devices for Internet access (personal or school)  
 Devices with cameras (personal cell phones or school devices)  
 The Hidden World – EM (Frayer Model and Frayer Model Notes)  
 The Hidden World Visuals

### Safety Notes

Do not shine lights in people’s eyes.

### Specific Expectations

#### SNC2P

**E1.2** describe the role of selected optical technologies in the transmission of information, and analyse their impact on society (e.g., cellphones, optical fibre cables, satellite dishes)

**E2.1** use appropriate terminology related to light and optics

**E2.5** investigate how various objects or media reflect, transmit, or absorb light

**E3.2** identify and label the visible and invisible regions of the electromagnetic spectrum, and identify the colours that make up visible white light

**E3.8** explain how the properties of light or colour are applied in the operation of an optical device

#### SNC2D

**E1.2** analyse a technological device that uses the properties of light (e.g., microscope, retro-reflector, solar oven, camera), and explain how it has enhanced society

**E2.1** use appropriate terminology related to light and optics

**E3.1** describe and explain various types of light emissions (e.g., chemiluminescence, bioluminescence, incandescence, fluorescence, phosphorescence, triboluminescence; from an electric discharge or light-emitting diode [LED])

**E3.2** identify and label the visible and invisible regions of the electromagnetic spectrum

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## Description

In this lesson students will learn about different forms of electromagnetic radiation, and the devices that are powered by EM radiation.

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## Introduction

- Open up Slide 1 of the PowerPoint ‘The Hidden World Visuals’.
  - On personal devices, in computer lab, or on classroom iPads students will go <http://www.color-blindness.com/> and click on the Ishihara 38 Plates Color Blindness Test and run through the test.
  - When they finish, students should go to [http://cataract-surgery.info/colour\\_blindness\\_test.html](http://cataract-surgery.info/colour_blindness_test.html) to investigate their answers and learn about what others see.
  - Go through slides 2-3
  - As a class go to <http://www.color-blindness.com/> and click on the Colour Blindness Simulation Tool. The teacher should upload an image (preferably of something in the class or school) and click through the different simulated views.
  - Teacher says, “Think that differences from our eyes are weird? What about differences from our brains?” Then play this video to the 2:15 mark <https://www.youtube.com/watch?v=evQsOFQju08>
  - You can also watch the Science North video on Optics, available in French and English.
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## Action

- Students will form small groups (2-4) and be given one of the Frayer Model templates from ‘Frayer Model’ to complete.
- Once the students have had enough time, all groups will move to the next Frayer Model template, and add to what the previous students wrote.
  - Keep timing short (~3mins) and continue until students have rotated through all pages.
- Go through slides 4-8 with the class, matching up the Frayer model pictures with further information.
- Slide 9: Verbally describe that all of these waves are forms of radiation and are essentially the same phenomenon, but with varying energy levels and lengths of waves (wavelengths).
  - Highlight inverse relationship between energy level (frequency) and wavelength.
- Slides 10-11: Discuss Ionizing Radiation
- Show the following video to the 1:55 mark <https://www.youtube.com/watch?v=uJ3ea9fa6CA>

Now for the real mind-bender!

- Take a television or VCR remote control and walk around the classroom, pointing it at students and pushing the buttons.
  - Ask them what they see (should be nothing).
  - They may ask if the remote actually works (don't answer).
- Using a webcam or podium camera, shine the remote at the camera and project the image for the class to see.

- Amazing! The camera can pick up the remote control's signal (it's infrared) but our eyes can't see it.
- Return to slide 9 and discuss how anything outside of the 'visible' part of the spectrum can't be seen by human eyes.
  - To further emphasize how these EM waves differ, show the video here of a 'clear' filter that blocks UV radiation.  
<https://www.youtube.com/watch?v=cjFXKyMVsn8>

Time for some Investigation! (conduct if most students have phones or iPods with cameras or school devices with webcams/cameras are available).

- Give each group of students a remote control and some sticky notes.
  - Students will use their own (or school supplied) cameras to look at the remote control and record observations on the sticky notes (one observation per note).
- Get the students to stick their notes on the front board, covering up any sticky note that has an identical observation. Students may observe:
  - Most Apple product cameras (iPhones) don't pick up infrared while other phones will.
  - Infrared may appear different colours on different cameras.
  - Different remotes may produce different colour on the camera.
  - Pushing different buttons produces the same brightness.
  - Etc.
- Lead a class discussion about the similarities and differences in student observations.

### Consolidation/Extension

- Go through slide 12 with the class and leave it up.
- Give each group a copy of slide 13 (Applied) or 14 (Academic).
- Give each student a copy of 'Frayer Model Notes'. In their groups students will discuss and consolidate their understanding in a Frayer Model note.

Further Extension (health):

- Have students look at the warning label that tanning booths must display in Ontario.  
[http://www.health.gov.on.ca/en/public/programs/tanning/docs/uvr\\_sign\\_health.pdf](http://www.health.gov.on.ca/en/public/programs/tanning/docs/uvr_sign_health.pdf)
- Write an opinion piece about governments banning teenagers from using tanning booths.