Science 8

# Optics 2

Name:
Date:
Block:

1. **Wave Model of Light**
2. **Visible Light**
3. **Electromagnetic Spectrum**

## Wave Model of Light

- A model is a way for scientists to explain what they see.
- The Wave Model of Light pictures light travelling as waves.
- Light waves travel in straight lines.

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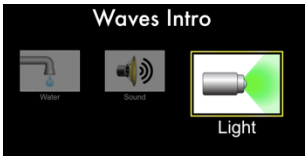
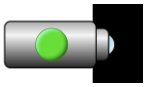
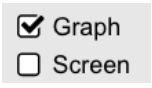
**Activity:** https://phet.colorado.edu/en/simulation/waves-intro




1. Click "light" at the bottom of the page to set up the light wave simulation.
2. Click the green button to turn the light on. 
3. To have a graph, click the checkbox next to "Graph". 

4. After the graph has appeared and stabilized, pause the simulation.
5. Click and drag the measuring tape to the graph. Place the orange "+" sign closest to the measuring tape on top of a wave crest. Next, click and drag the orange "+" sign at the end of the measuring tape to the closest wave crest. 
6. What is the wavelength for green? 500nm
7. Complete the following table:

| Colour | Wavelength |
|---|---|
| Red | 650nm |
| Orange | 625 nm |
| Yellow | 560 nm |
| Green | 520 nm |
| Blue | 430 nm |
| Purple | 373 nm |

longest wavelength

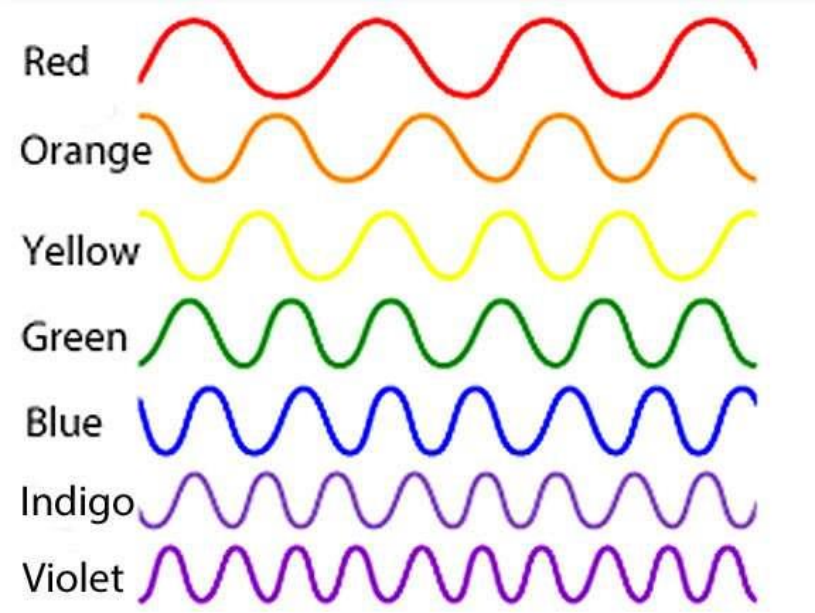
↓

shortest wavelength.

8. Set the colour to whatever you prefer.
9. Next, set to MAXIMUM amplitude. What do you notice about the colour from the light source?

   Bright, vibrant colour.
10. Set to MINIMUM amplitude. What do you notice about the colour from the light source?

    Dull, muted colour



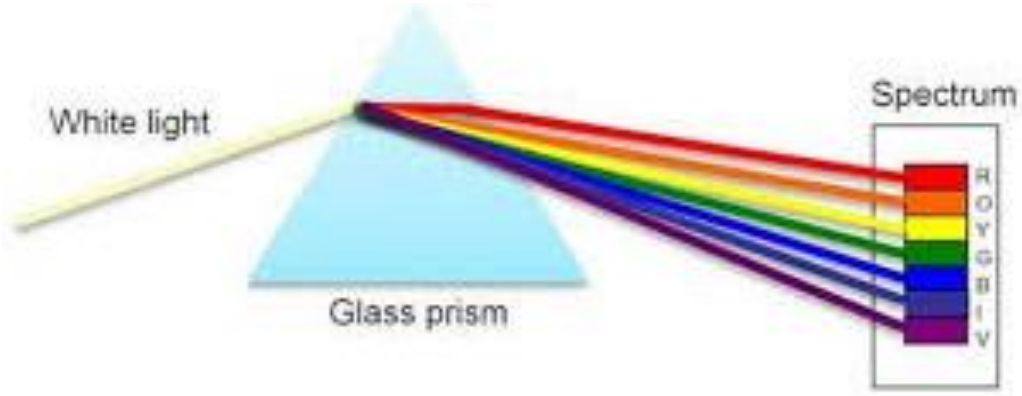

Which colour has the longest wavelength?

Red

Which colour has the shortest wavelength?

Purple (violet)

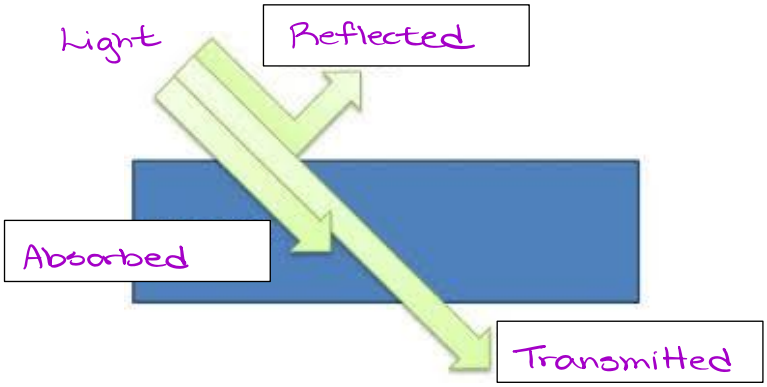
## Different wavelengths = different degree of bending




- A prism is used to separate the colours.
- The different angles of the walls cause the bending of light.
- The longer the wavelength, the less the light will bend. (red)
- The shorter the wavelength, the more the light will bend. (violet)

**Visible Light**

- Reflection occurs when a light wave strikes an object and bounces off. When we see an object, we are actually seeing the light reflected off that object!

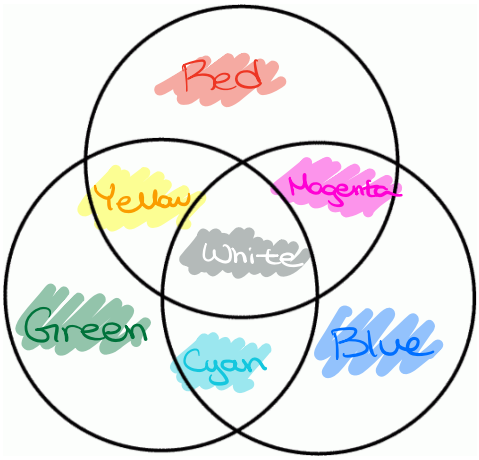



- Some colours are reflected and seen and other colours are absorbed.
  - For example: To see a blue T-shirt, we are seeing:
    The blue light reflected off the shirt and reaching our eyes. All the other colours (ROYGBIV) are absorbed into the shirt.

## How do we see colours?

- Only 3 colours are needed to produce all the colours of the rainbow!

https://phet.colorado.edu/sims/html/color-vision/latest/color-vision_en.html

| Primary colours of PAINT | **Primary colours of LIGHT** |
|---|---|
|  |  |





- When the primary colours of light (red, green, and blue) are combined together, produce the secondary colours of light: yellow, magenta, and cyan.

**Electromagnetic Spectrum**

## Electromagnetic Spectrum: (EMS)

EMS is a range of wavelengths that include visible and non-visible waves and rays

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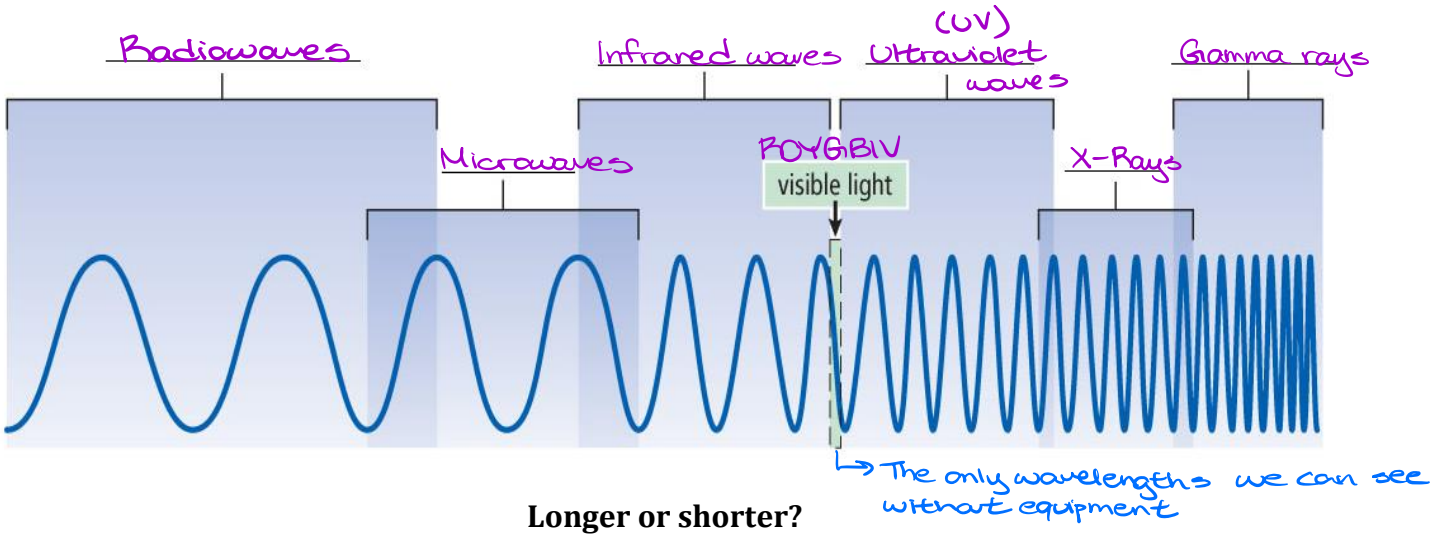


**Longer or shorter?**

long wavelength

short wavelength

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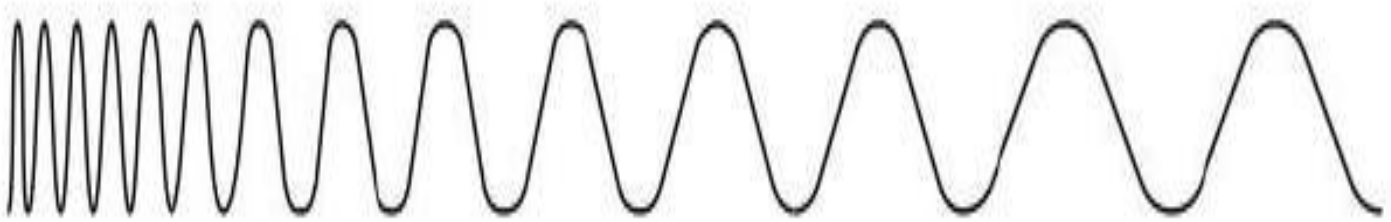
**Higher or lower?**

low frequency

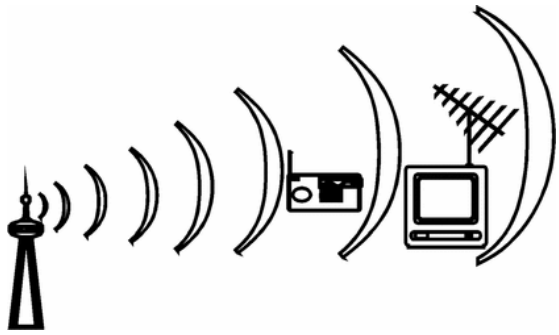
∴ low energy

high frequency

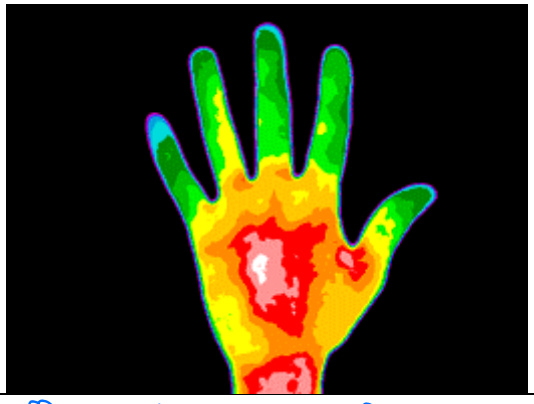
∴ lots of energy



**Complete the following table with a minimum of 2 uses and 2 dangers for each electromagnetic radiation below.**

| **Radio Waves** | |
|---|---|
| Uses:<br>Transmits data using radios, satellites, radar, computer networks<br>- Broadcast radio and TV<br>Dangers:<br>- To make phone calls<br>- Navigation<br>- If absorbed in large amounts, it can produce heat (can lead to burns) | Picture:<br>  |

| **Microwaves** | |
|---|---|
| Uses:<br>- Radar communication (satellites)<br>- Cooking food (microwave ovens)<br>Dangers:<br>- Can heat body tissues (can cause burns) | Picture:<br>  |

| **Infrared Waves** | |
|---|---|
| Uses:<br>- electric heaters<br>- short range communication (remote controls, security systems, thermal imaging)<br>Dangers:<br>- eyes are especially susceptible to infrared heat<br>↳ prolonged exposure can cause damage to eyes. | Picture:<br>  |

* Anything that gives off heat gives off infrared waves!

## Ultraviolet Rays

Uses:

- phototherapy
- tanning
- destroying bacteria
- curing dental fillings
- sterilization of equipment.

Dangers:

- can cause premature aging of skin & sun damage
- can cause eye problems

Picture:

## X Rays

Uses:

- checking fractures (broken bones)
- mammograms
- check airline baggage

Dangers:

- overexposure can lead to a risk of cancer
- high levels of radiation can cause vomiting, bleeding, fainting, blood loss

Picture:

## Gamma Rays

Uses:

- medicine (radiotherapy)
- industry (sterilization & disinfection)
- nuclear industry

Dangers:

- can cause diseases to skin or blood, eye disorders, cancers

Picture: