

Light & Sound electromagnetic spectrum

Physical Science Topic 33

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Previous Concepts

Recall from prior lessons:

Scientists us the SI system of measurements - Scientists often use "powers of 10" in numbers 10⁻³ (m) millimeter $10^{0}(m)$ meter $10^{3}(m)$ kilometer

Previous Concepts

- A science model can be
 - Physical
 - math-based
 - computer-based
 - Conceptual
- Models are often much larger or much smaller than "life-sized."



This Lesson (Lab)

- This topic introduces the **relationship** of color and frequency.
- You practice using scientific notation to better understand wave-length (*frequency*).
- Your team constructs a **model** using various colors of paper to depict wave-length.

Wave Length (frequency) Examples

All of these electromagnetic waves travel at the speed of light in a vacuum. Wave lengths are often expressed using "powers of 10."



Instructions for Team Lab

Step-by-Step



represent pe strips

Now, do the fun part.

Use the colored paper to represent the colors of the visible light.

NOTE: Use black paper to represent ultraviolet and the white paper to represent infrared.

Ste

1

2

p-by-Step	
	in the
Do some math. Convert the wavelengths of each color	you have a
listed. Convert from meters to nanometers. To do this, you	
will multiply each value by 10°.	ength and
Remember that one billion nanometers is the same thing as one meter.	-
10 ⁹ is one billion – or 1,000,000,000.	
	e waves?
For example, the wavelength of the color violet	
is 4×10^{-7} meters long. To convert this number into nanometers, multiply by <u>10</u> 9 .	vave than
4 x 10 -7 (m) multiplied by 10 ⁸ (nm/m) equals <u>4 x 10² (nm)</u> .	we were to he strip
<u>4 x 10²</u> is the same thing as <u>4 x 100</u> , so <u>400 nm</u> .	
Do some more math. 400 nm is simply too short to see.	
There is no way to cut-out a piece of construction paper that is only 400 nm long. So, for your model, you will sublidue all the numbers by one million!	erby High School, KS)
multiply an the numbers by the minion:	
NOTE: Doing this step is simple. You just have to replace nm with mm.	
After performing step 1 for all of the colors, switch out the metric unit of nanometers with millimeters.	
For example, switch nm on 400 (nm) to (mm)	

resulting in 400 (mm)

Adapted Material. Attribution and gratitude to Rachel Hovey (Derby High School, KS)

Complete the Table

Wave	Wavelength in meters	Calculation 1	Conversion Wavelength in nanometers	Model Scale Wavelength in millimeters
Infrared	1 x 10 4	(1 x 10 ⁻⁶)(10 ⁹) = 1 x 10 ³	1,000 nm	1,000 mm
Red	7.5 x 10 -7			
Orange	6.3 x 10 ⁻⁷			
Yellow	5.8 x 10 ⁻⁷			
Green	5.3 x 10 ⁻⁷			
Blue	4.5 x 10 ⁻²			
Violet	4.0 x 10 ⁻²	{4 x 10 -7}(10 *) = 4 x 10 2	400 <u>nm</u>	400 mm
Ultraviolet	3.0 × 10 ⁻⁸			

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