Electromagnetic Spectrum 1
Part 1: Colors
In this lesson, we will focus on six colors:
Red, Orange, Yellow, Green, Blue, Violet

You can remember the colors in order using the acronym:
ROY. G. BV
(Indigo, which is slightly between blue and violet, we aren't going to worry about here.)

Each color is caused by an **electromagnetic wave**.
What makes each color is the *wavelength* and *frequency* of that electromagnetic wave.

Remember 3 things about wavelength and frequency:

1. Wavelength and frequency are *inversely proportional*.
When wavelength is longer, frequency is shorter.
When wavelength is shorter, frequency is longer.

2. Red has the longest wavelength and violet has the shortest wavelength.
As you move from red to violet, wavelength gets shorter.

3. Violet has the highest frequency and red has the shortest frequency.
As you move from violet to red, frequency gets lower.

[Note that, when talking about wavelength, we say it is "longer" or "shorter," but when discussing frequency we say it is "higher" or "lower."]

Red	Longest wavelength	Lowest frequency
Orange		
Yellow		
Green		
Blue		
Violet	Shortest wavelength	Highest frequency

Problem 0: Copy the six colors from longest wavelength to shortest wavelength.
(It's repetitive, but copying does help people build memory).

Questions:

Questions about wavelength:

1. Which has a longer wavelength: red or violet?

2. Which has a longer wavelength: blue or yellow?

3. Which has a longer wavelength: green or orange?
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4. Which has a longer wavelength: yellow or violet?

5. Which has a longer wavelength: violet or blue?

6. Which has a longer wavelength: green or blue?

Questions about frequency:

7.Which has a higher frequency: red or violet?

8.Which has a higher frequency: green or red?

9.Which has a higher frequency: orange or blue?

10.Which has a higher frequency: violet or blue?

11.Which has a higher frequency: red or green?

12.Which has a higher frequency: yellow or green?

In the questions below, fill in the blanks to describe the waves:

13. Compare RED WAVES and BLUE WAVES:

_____ has a longer wavelength but _____ has a higher frequency.

14. Compare YELLOW WAVES and BLUE WAVES:

_____ has a longer wavelength but _____ has a higher frequency.

15. Compare VIOLET WAVES and GREEN WAVES:

_____ has a longer wavelength but _____ has a higher frequency.

16. Compare ORANGE WAVES and RED WAVES:

Orange waves have a _____ wavelength but a _____ frequency than red waves.

17. Compare BLUE WAVES and GREEN WAVES:

Blue waves have a _____ wavelength but a _____ frequency than green waves.

18. Compare YELLOW WAVES and VIOLET WAVES:

Yellow waves have a _____ wavelength but a _____ frequency than violet waves.

In the questions below, use the words "Wavelength" and "Frequency" to describe the difference between the waves. You should write sentences that sound like those written above:

19. Using the terms wavelength and frequency, compare red waves and green waves.

20. Using the terms wavelength and frequency, compare violet waves and blue waves.

21. Using the terms wavelength and frequency, compare orange waves and green waves.

22. Using the terms wavelength and frequency, compare yellow waves and violet waves.

23. Using the terms wavelength and frequency, compare blue waves and green waves.

24. Using the terms wavelength and frequency, compare red waves and violet waves.

Part 2: The Electromagnetic Spectrum

The electromagnetic spectrum consists of seven different types of electromagnetic waves:
Radio Waves, Microwaves, Infrared Waves, Visible Light Waves, Ultraviolet Waves, X-Ray Waves, and Gamma Ray Waves

You can remember these, in order, using the acronym:
Raging Martians Invade Venus Using X-Ray Guns

What makes each electromagnetic wave different are two things: it's *wavelength* and its *frequency*:

1. Wavelength and frequency are *inversely proportional*.
When wavelength is longer, frequency is lower.
When wavelength is shorter, frequency is higher.

2. Radio waves have the *longest wavelength*. Gamma Ray waves have the *shortest wavelength*. As you progress from radio waves to gamma ray waves, wavelength becomes shorter.

3. Gamma ray waves have the *highest frequency*. Radio waves have the *lowest frequency*. As you progress from radio waves to gamma ray waves, frequency becomes higher.

Radio Waves	Longest wavelength	Lowest frequency
Microwaves		
Infrared Waves		
Visible Light Waves		
Ultraviolet Waves		
X-Ray Waves		
Gamma Ray Waves	Shortest wavelength	Highest frequency

Use this information to answer the questions below:

Problem 0: Copy the seven electromagnetic waves from longest wavelength to shortest wavelength. (It's repetitive, but copying does help people build memory).

Questions about wavelength:

1. Which has a longer wavelength: radio waves or gamma ray waves?

2. Which has a longer wavelength: ultraviolet waves or infrared waves?

3. Which has a longer wavelength: X-Ray waves or microwaves?

Questions about frequency:

4. Which has a higher frequency: radio waves or visible light waves?

5. Which has a higher frequency: microwaves or gamma ray waves?

6. Which has a higher frequency: infrared waves or X-Ray waves?

Using the concepts above, fill in the questions below:

7. Compare X-Ray waves with Visible Light waves:

_____ has a longer wavelength but _____ has a higher frequency.

8. Compare Infrared waves with Visible Light waves:

_____ has a longer wavelength but _____ has a higher frequency.

9. Compare Ultraviolet waves with Radio waves:

_____ has a longer wavelength but _____ has a higher frequency.

10. Compare Microwaves and Radio waves:

Microwaves waves have a _____ wavelength but a _____ frequency than Radio waves.

11. Compare X-Rays and Gamma Ray waves:

X-Rays waves have a _____ wavelength but a _____ frequency than Gamma Ray waves.

12. Compare Ultraviolet waves and Visible Light waves:

Ultraviolet waves have a _____ wavelength but a _____ frequency than Visible Light waves.

In the questions below, use the words "Wavelength" and "Frequency" to describe the difference between the waves. You should write sentences that sound like those written above:

13. Using the terms *wavelength* and *frequency*, describe the difference between visible light waves and infrared waves.

14. Using the terms *wavelength* and *frequency*, describe the difference between microwaves light waves and ultraviolet waves.

15. Using the terms *wavelength* and *frequency*, describe the difference between X-Ray waves light waves and radio waves.

16. Using the terms *wavelength* and *frequency*, describe the difference between visible light waves and gamma ray waves.

17. Using the terms *wavelength* and *frequency*, describe the difference between microwaves and visible light waves.

18. Using the terms *wavelength* and *frequency*, describe the difference between radio waves and gamma ray waves.