

## Electromagnetic Spectrum Drawing

**Objective:**

Create a drawing representing the electromagnetic spectrum.

**Directions:**

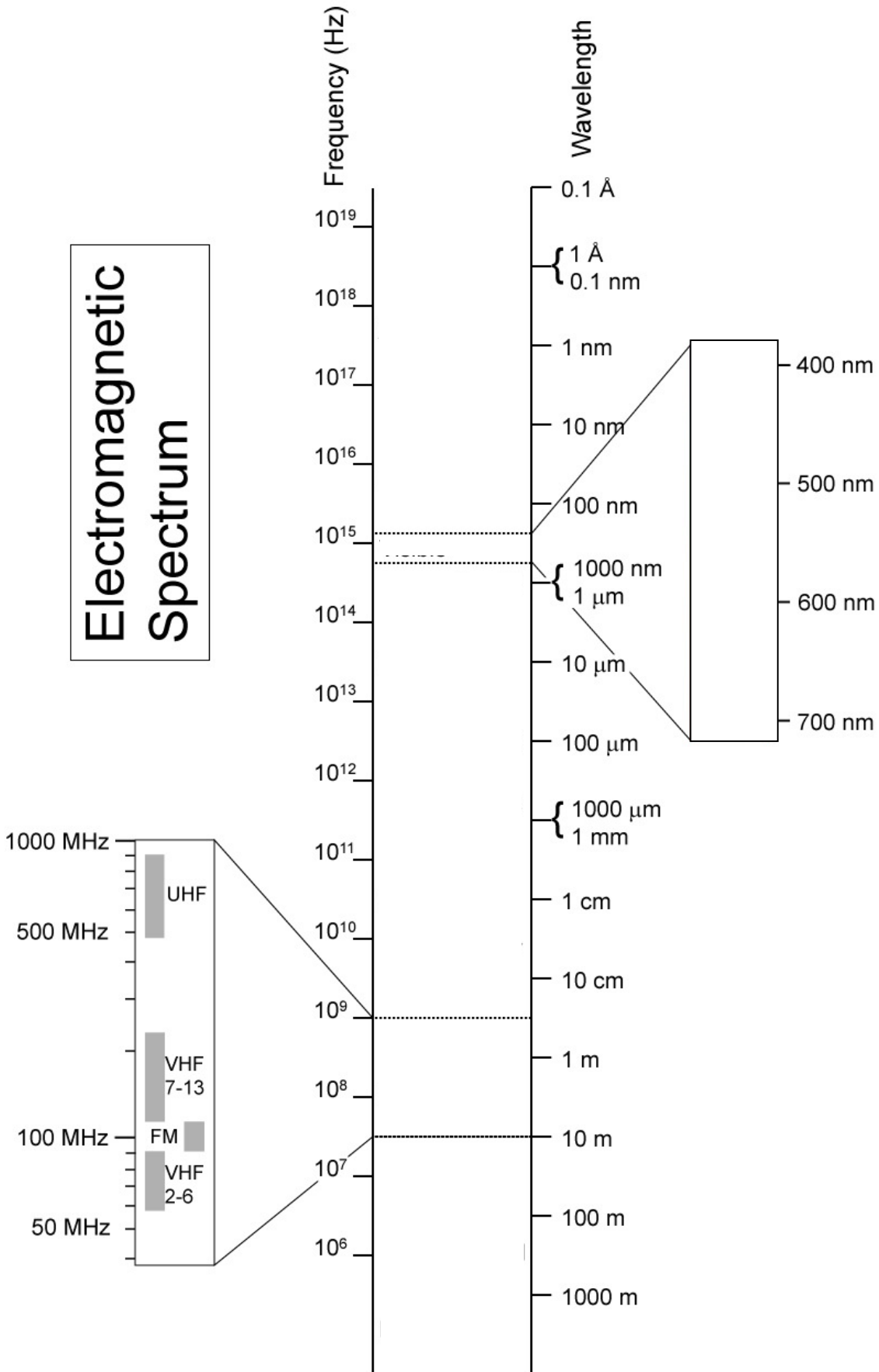
You will use a correct representation of the EM spectrum to create your own spectrum. You must include all parts of the electromagnetic spectrum (waves, frequency, wavelength, and a “comparison” – see the example in your book).

- All parts of the Electromagnetic Spectrum are included
  - Block out the regions of all types of radiation
  - Label the regions of all types of radiation
- Be sure when you include the “visual” portion of the spectrum that you break that down into the component colors (ROYGBIV)
  - Block out the region where the visible range is found
  - You must use color (use the colored pencils)

**Regions to include:**

Region	Wavelength
Gamma Rays	0.1 A and shorter
X-rays	10 nm to 0.01 nm
Ultraviolet	400 nm to 10 nm
Visible	380 to 750 nm
Violet	380–420 nm
Indigo	420–450 nm
Blue	450–495 nm
Green	495–570 nm
Yellow	570–590 nm
Orange	590–620 nm
Red	620–750 nm
Infra-red	750 nm to 1 mm
Microwaves	1 mm to 30 cm
Radio/TV	30 cm to 10 m
Long-waves	10m and longer

# Electromagnetic Spectrum



Name: \_\_\_\_\_ Date: \_\_\_\_\_ Period: \_\_\_\_\_

## Worksheet #2: Light & Atoms

You may need to use the electromagnetic spectrum you drew.

1. An atom emits a light wave with a wavelength of 449 nm. What type or color of light does this represent?
2. Is a wave with a frequency of  $5 \times 10^{16}$  Hz visible?
3. A beam of electromagnetic radiation has a wavelength of 1m. What part of the spectrum is this beam from?
4. Rank these light waves from **highest** to *lowest* energy: x-rays, radio waves, yellow light, UV, red light, violet light.
5. Rank these stellar objects from **hottest** to *coldest* using their frequencies or wavelengths.

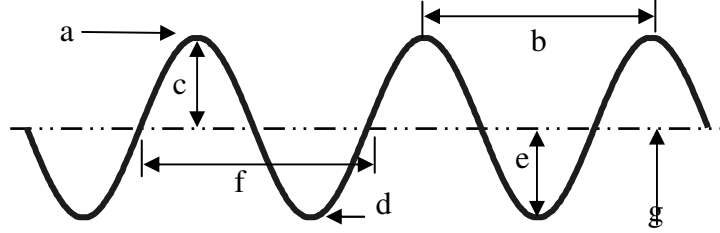
Object	Frequency	Wavelength
A	$10^{16}$ Hz	
B		1 cm
C		100 nm
D	$10^{13}$ Hz	
E	$10^{15}$ Hz	

6. What general range of waves are more dangerous to your skin and body, high frequency or low frequency waves? {hint: high energy bursts usually cause more damage}
7. Atoms that are energized give off many separate colors, but NOT the whole rainbow of colors.
  - a. Why is the number of colors limited to a specific set?
  - a. Why do they give off more than one color?
8. You know the mnemonic "Roy G. Biv" for remembering the visible spectrum. Now create your own mnemonic for remember the entire electromagnetic spectrum : radio, microwave, infrared, visible, ultraviolet, x-ray, gamma ray.

# Light and waves worksheet

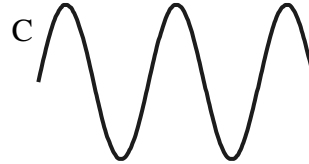
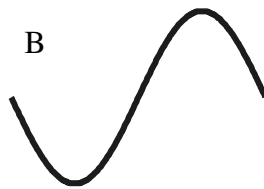
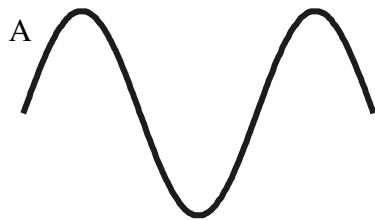
1. The illustration below shows a series of transverse waves. Label each part in the space provided.

- a. \_\_\_\_\_
- b. \_\_\_\_\_
- c. \_\_\_\_\_
- d. \_\_\_\_\_
- e. \_\_\_\_\_
- f. \_\_\_\_\_
- g. \_\_\_\_\_



Fill in the blanks:

2. Waves carry \_\_\_\_\_ from one place to another.
3. The highest point on a transverse wave is the \_\_\_\_\_ while the lowest part is the \_\_\_\_\_.
4. The \_\_\_\_\_ is the height of the wave.
5. The distance from one crest to the next is the \_\_\_\_\_.
6. Below are a number of series of waves. Underneath each diagram write the numbers of waves in the series.



- a. Which of the above has the biggest amplitude? \_\_\_\_\_
- b. Which of the above has the shortest wavelength? \_\_\_\_\_
- c. Which of the above has the longest wavelength? \_\_\_\_\_

7. Express in words and mathematically the relationship between

a. wavelength and frequency:

b. wavelength, frequency and speed of light:

8. Consider a beam of electromagnetic radiation that has a frequency of  $10^{16}$  Hz. This beam would be found in what region of the spectrum?

9. Consider a beam of electromagnetic radiation that has a wavelength of 1 cm. This beam would be found in what region of the spectrum?

10. Light also behaves like a particle. What is this particle called?

11. Where do these particles come from?

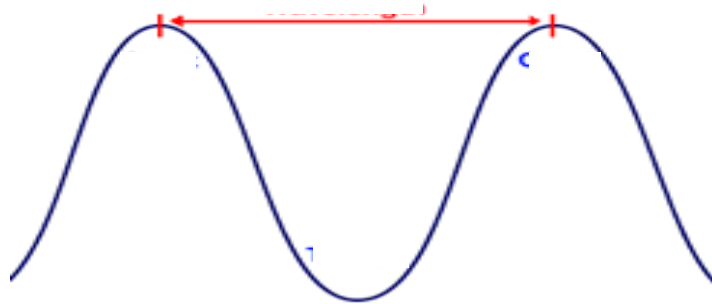
12. How can an emission spectrum be used in astronomy?

### Electromagnetic Spectrum Webquest

Go to the following website and answer the questions that follow: <http://tinyurl.com/EMRadiation>

1. What are some examples of electromagnetic waves?
2. How do these examples differ from each other?
3. What produces electromagnetic waves?
4. Why are these waves also called “electromagnetic radiation”?
5. Why does electromagnetic radiation have a “dual personality”?
6. What are the particles of electromagnetic radiation called?
7. Which of these particles have the highest energy?

Go to the following website and answer the questions that follow: <http://tinyurl.com/PartsOfAWave>



8. What is a crest? What is a trough? Label these on the wave shown above.
9. What is amplitude? Label this on the wave shown above.
10. What is wavelength? Label this on the wave shown above.
11. What is frequency?
12. How is frequency usually described?
13. In what unit is frequency usually stated, and what is the abbreviation for this unit?

Name: \_\_\_\_\_ Date: \_\_\_\_\_ Period: \_\_\_\_\_

### Electromagnetic Spectrum Webquest

Go to the following website and answer the questions that follow: <http://tinyurl.com/WavelengthFrequency>

14. At what speed do electromagnetic waves travel?

15. How are frequency and wavelength related?

Go to the following website and answer the questions that follow: <http://tinyurl.com/PBSSpectrum>

16. What carries electromagnetic radiation?

17. How fast do these particles travel?

18. How are these particles characterized and how are these characteristics defined?

Click on "**Begin the Tour**" and answer the questions below.

19. How are human-made radio waves generated?

20. How is the radio portion of the spectrum divided?

Click "**Next: Microwave**"

21. What are the uses for microwave?

22. Why did creating microwaves pose a challenge to engineers during the 1930s?

23. How do microwave ovens heat food?

24. What wavelengths do stars emit?

25. How are we able to see pictures of the stellar objects that are in wavelengths other than visual?

Click "**Next: Infrared**"

26. What is infrared radiation also called?

27. Do all objects give off infrared radiation, and where does this radiation come from?

28. How is the amount of infrared radiation an object emits related to the objects temperature?

**Electromagnetic Spectrum Webquest**

29. What happens if an object, like a radiator, continues to heat up?
30. What can you clearly make out when you look at the constellation Orion in infrared?

Click "*Next: Light*"

31. How much of the electromagnetic spectrum is visible light?
32. How long is the wavelength of visible light?
33. What happens when atoms gain energy then lose it again?
34. Earth's atmosphere is transparent to what parts of the spectrum?

Click "*Next: Ultraviolet*"

35. What is a good source of ultraviolet light?
36. What can ultraviolet light be used for?
37. Can humans see ultraviolet? What can?
38. Why do we study the Sun in the ultraviolet spectrum?

Click "*Next: X-rays*"

39. Who discovered X-rays, and why did he name them like he did?
40. What is a good source of x-ray radiation?

Click "*Next: Gamma Rays*"

41. How are gamma rays are created throughout the universe?
42. What are some uses for gama rays?
43. Why are there not many images of astronomical objects in gamma wavelengths?

Name: \_\_\_\_\_ Date: \_\_\_\_\_ Period: \_\_\_\_\_

### **Electromagnetic Spectrum Webquest**

44. How long did it take to create a gamma-ray image of the entire sky as seen from earth?

#### **Assessment:**

1. *Go to [www.classmarker.com](http://www.classmarker.com)*
2. *Login with the username and password assigned to you.*
3. *After you log in, you will see a list of tests available to you.*
4. *Find **Electromagnetic Spectrum 2011**.*
5. *Click on "Start Test" to begin the quiz*