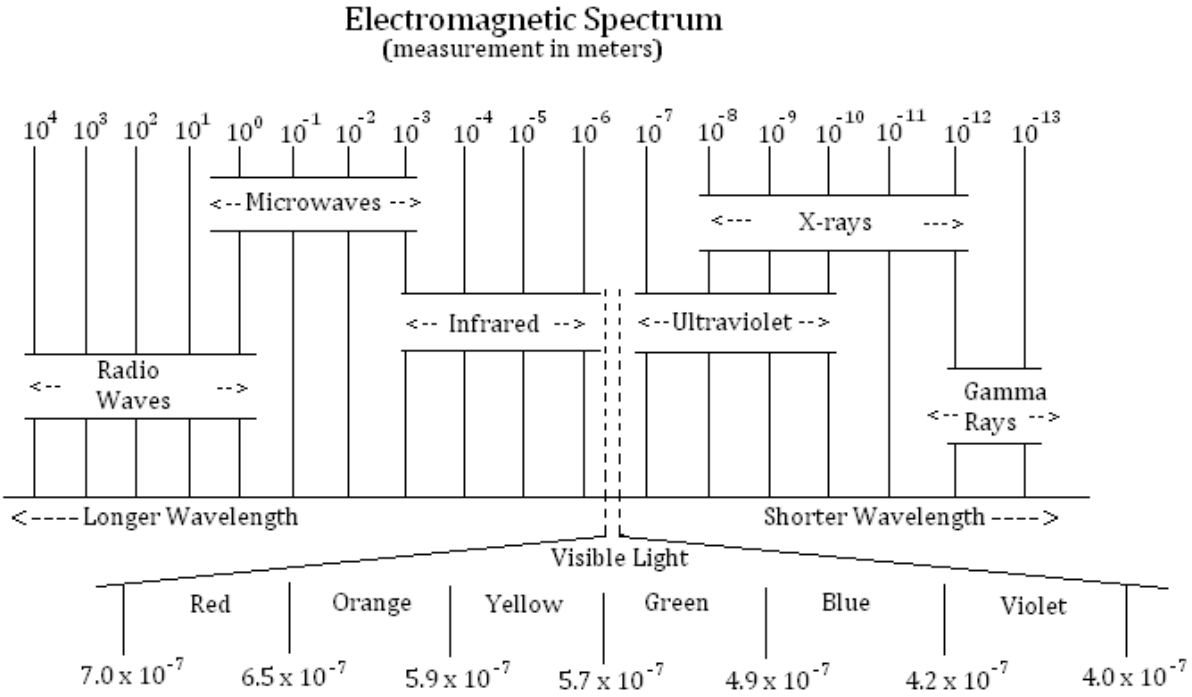

EM SPECTRUM, WAVELENGTH, FREQUENCY, AND ENERGY WORKSHEET

1.) Look at the EM spectrum below to answer this question.
As you move across the visible light spectrum from red to violet…
- (A) Does the wavelength increase or decrease?
- (B) Does the frequency increase or decrease?
- (C) Does the energy increase or decrease?

2.) A beam of microwaves has a frequency of 1.0×10^{9} Hz. A radar beam has a frequency of 5.0×10^{11} Hz. Which type (microwave or radar)…
- (A) has a longer wavelength?
- (B) is closer to visible light on the EM spectrum?
- (C) is closer to x-rays in frequency value?

3.) What is the frequency of an EM radiation wave if its wavelength is 3.6×10^{-9} meters?

4.) A beam of EM radiation has a wavelength of 4.257×10^{-7} cm. What is its frequency?

5.) A photon of light has a wavelength of 3.20×10^{5} meters. Find…
- (A) the frequency
- (B) the energy
- (C) the region of the EM spectrum/type of radiation

6.) A photon has an energy of 4.00×10^{-19} J. Find…
- (A) the frequency
- (B) the wavelength
- (C) the region of the EM spectrum/type of radiation

7.) A bright line spectrum contains a line with a wavelength of 518 nm. Determine…
- (A) the wavelength in meters
- (B) the frequency
- (C) the energy
- (D) the color

*8.) Cobalt-60 is an artificial radioisotope that is produced in a nuclear reactor for use as a gamma ray source in the treatment of certain types of cancer. If the wavelength of the gamma radiation from a cobalt-60 source is 1.00×10^{-3} nm, calculate the energy of a photon of this radiation.

PROPERTIES OF LIGHT WORKSHEET

Part 1 - Select the best answer

1. Which has a longer wavelength, orange or violet light?
2. Which has a higher energy, x-rays or gamma rays?
3. Which has a lower frequency, radio waves or green light?
4. Which has the shortest wavelength, violet or ultraviolet light?
5. Which has lower energy, infrared light or x-rays?

Part 2 - Fill in the blanks

6. _____ formed a theory to explain the structure of an atom by revising physical theories.
7. As the energy level increases, the amount of energy an electron will possess _____.
8. Electrons give off energy in finite amounts called _____ when returning to the ground state.
9. When this energy is released in the form of light it is called a _____.
10. The speed of light = _____ (give number and units)
11. The symbol for wavelength is _____.
12. In the equation $c = \lambda \cdot \nu$, c represents _____, ν represents _____, and λ represents _____.
13. In the equation $c = \lambda \cdot \nu$, λ and ν are _____ proportional.
14. In the equation $E = h \cdot n$, h represents _____ and E represents _____.
15. In the equation $E = h \cdot \nu$, E and ν are _____ proportional.
16. Bohr chose the element _____ to prove his theory.

Part 3 - True or False

17. Electrons may regularly occupy spaces between energy levels.
18. The varying wavelengths on the electromagnetic radiation spectrum travel at different speeds.
19. Atoms release energy when electrons jump to higher energy levels.

ELECTRON ARRANGEMENT WORKSHEET

1. What is an electron cloud?
2. Name the three major divisions within an electron cloud with respect to the energy of an electron.
3. What letter represents the principal quantum number?
4. What does the principal quantum number tell about an electron?
5. What formula is used to determine the maximum number of electrons that can occupy any energy level?
6. What is the maximum number of electrons for each of the following?
   (A) 1st energy level (B) 4th energy level (C) n = 3 (D) n = 5
7. Energy levels are divided into _____.
8. How can we determine the possible number of sublevels in any energy level?
9. Name the four primary sublevels in order of increasing energy.
10. Circle the sublevel that represents the lowest energy in each pair.
    (A) 1s or 2s (B) 2s or 2p (C) 4f or 4d (D) 3d or 4s (E) 7s or 5d
    (F) 6s or 4s (G) 4p or 5p (H) 3s or 3d (I) 2p or 3s
11. Sublevels are divided into _____.
12. Each orbital can hold up to _____ electrons.
13. Sketch the shapes of the orbitals for the sublevels listed.
    (A) s: (B) p_x: (C) p_y: (D) p_z:
14. How many orbitals are in each sublevel?
    (A) s _____ (B) p _____ (C) d _____ (D) f _____

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Unit 4 Review Worksheet

Section I - Problems Given: $E = h \cdot \nu$ $h = 6.626 \times 10^{-34}$ J·s
$c = \lambda \cdot \nu$ $c = 3.00 \times 10^{8}$ m/s

1. What is the frequency of a wave with a wavelength of 3.5×10^{-4} m?
2. What is the energy of a photon with a frequency of 5.41×10^{17} Hz?
3. What type of electromagnetic radiation is described in question 2?

Section II - Electromagnetic Spectrum

4. Label both ends of the spectrum with high/low frequency, high/low energy, and long/short wavelength

radio waves microwaves infrared light ROYGBIV ultraviolet light x-rays gamma rays

5. Which has a higher energy, gamma or x-rays?
6. Which has a shorter wavelength, radio or ultraviolet?
7. Which has a lower frequency, yellow or green light?
8. In the equation $E = h \cdot \nu$, energy and frequency are _____ proportional.
9. In the equation $c = \lambda \cdot \nu$, wavelength and frequency are _____ proportional.
10. The symbol for wavelength is ____.
11. Electrons give off energy in the form of a _____ when returning to the ground state.
12. Which scientist proposed the idea that electrons travel around the nucleus in fixed paths?
13. When an electron moves from the ground state to the excited state, energy is _____.
14. Bohr chose the element _____ to prove his theory.
15. The dual wave-particle nature of electrons describes how the electrons in atoms can behave as _____ and _____.

Section III - Electrons

16. What is an electron cloud?
17. Who proposed the uncertainty principle?
18. Who is credited with the idea that electrons are placed in the lowest energy level first?
19. What rule requires that each of the "p" orbitals (at a particular energy level) receive one electron before any of the orbitals can have two electrons?
20. What is the maximum number of electrons in any orbital?
21. The principal quantum number, n, indicates the _____.
22. The maximum number of electrons in an energy level can be determined by the equation _____ That means the maximum number of electrons in the 3rd energy level is _____.
23. The number of sublevels in any energy level can be determined by _____.
24. The number of orbitals in an energy level can be determined by the equation _____. So, the 3rd energy level has _____ orbitals. (_____ is/are "s" orbitals, _____ is/are "p" orbitals, and _____ is/are "d" orbitals)
25. List the four sublevels according to increasing energy.
26. The "s" sublevel is shaped like a _____ and has _____ orbitals.
27. A "p" sublevel is shaped like a _____ and has _____ orbitals.
28. The "d" sublevel has _____ orbitals and the "f" sublevel has _____ orbitals.

Section IV - Electron configuration, noble gas configuration, valence electrons, orbital notations

29. What is the electron configuration for phosphorus?
30. How many total electrons are in a neutral atom of phosphorus?

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31. Write the noble gas configuration for phosphorus.
32. What is the highest occupied energy level for phosphorus?
33. What is the atomic number of phosphorus?
34. Draw the orbital notation for phosphorus.
35. How many electrons are in the highest occupied energy level of phosphorus?
36. How many inner-shell electrons does phosphorus have?
37. In which orbitals are the inner-shell electrons located?
38. Draw the electron dot diagram for phosphorus.

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