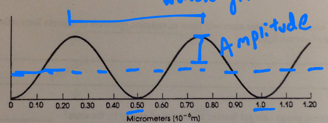
LT 4.1–4.2

1) What are the differences in the way that the Bohr and Quantum-mechanical model view the behavior of electrons? What does the Rutherford model say about them?

Bohr: planetary ; QM = orbitals; Rutherford : around nucleus

Light travels through space by means of waves. Each wave has a frequency (ν), a wavelength (λ), and an amplitude. The figure below represents a light wave. Label the wavelength and amplitude. Then answer the following questions.

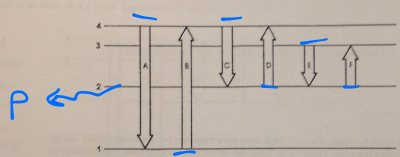


1. Given the distance scale in micrometers, µm (1.0×10^{-6} m), shown in the figure, what is the wavelength in meters per wave?

0.5 µm
$0.5 \cdot 10^{-6}$ m

$\boxed{5 \cdot 10^{-7}\ m}$

The quantum level occupied by an electron in an atom depends on the energy of the electron. Changes in quantum level are related to absorption or emission of energy. The figure below represents the four lowest energy levels of an atom, (n = 1 to 4). The six lettered arrows represent changes in the energy level of an electron.



1. Why do these energy levels mean that the atom will show an emission spectrum of discrete lines rather than a continuous spectrum of emitted light?

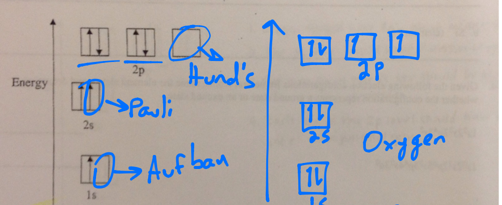
energies are quantized → energy of photon is equal to energy change of electron

2. Which three of the lettered energy changes involve absorption of energy by the atom? B, D, F

3. Which three of the lettered energy changes involve emission of light energy by the atom? A, C, E

LT 4.3–4.5:

3) The following diagram describes (or attempts to describe) an oxygen atom in the ground state. Describe the specific problems that it has and produce a correct diagram on the right.



4) How many orbitals are there in an s, p, d, and f sublevel? 1, 3, 5, 7

↳ orientations

Critical Thinking

If an electron in a hydrogen atom changes from energy level 4 to level 2, it will emit a photon of light with energy (E) of 4.086×10^{-19} joules. Calculate the frequency (ν) of the light emitted and estimate where it appears in the electromagnetic spectrum.

$E = 4.086 \cdot 10^{-19}$ J

$f = ?$

$h = 6.63 \cdot 10^{-34}$ Js

$\boxed{E = h \cdot f}$

$c = \cancel{\lambda} \cdot f$

$$\frac{E}{h} = \frac{\cancel{h} \cdot f}{\cancel{h}} \rightarrow \frac{E}{h} = f \rightarrow \frac{4.086 \cdot 10^{-19}\ J}{6.63 \cdot 10^{-34}\ Js} = 6.167 \cdot 10^{14}\ Hz$$

Blue / violet

LT 4.6

1. State the trend and provide an explanation for the trend (why does the trend exist?).

   a. Atomic Radius as you move left to right across a period (left to right).

      $R_A \downarrow$ $\uparrow$ protons

   b. Atomic Radius as you move down a group.

      $R_A \uparrow$ $\uparrow$ shells

   c. Ionization energy as you move across a period (left to right).

      IE $\uparrow$ $\uparrow$ protons

   d. Electronegativity as you move down a group.

      EN $\downarrow$ $\uparrow$ shielding e^-s

3. In each of the following questions, arrange the atoms in the order requested.

   a. *atomic radius*, <u>least to greatest</u>: Na, Mg, Na^+, P, P^{3-}

      $Na^+ \rightarrow P \rightarrow Mg \rightarrow Na \rightarrow P^{3-}$

   b. *first ionization energy*, <u>least to greatest</u>: S, Cl, Se, F

      $Se \rightarrow S \rightarrow Cl \rightarrow F$

   c. *electronegativity*, <u>least to greatest</u>: Al, P, Si, N

      $Al \rightarrow Si \rightarrow P \rightarrow N$

   d. Circle the element with the *greatest atomic radius*.

      (1) C versus Si (2) C versus F (3) K versus K^+ (4) N versus N^{3-}

   e. Circle the element with the *greatest electronegativity*.

      (1) Ba versus Mg (2) O versus F (3) Ca versus K (5) O versus N