

Chemistry I
Chapter 4-Study Guide

1. Light is said to have a "dual nature". What does that mean? What makes up the two parts?
2. What is the one main type of wave that is not a form of electromagnetic radiation?
3. Draw a wave. Label a crest, a trough, the amplitude, and the wavelength.
4. Define frequency (including units).
5. What is the relationship between wavelength and frequency of light (include the equation).
6. What is the relationship between energy and frequency of light (include the equation). What is "ROY G. BIV" Which color has the highest energy? Which color has the lowest energy?
7. How are photons related to the brightness of a light?
8. How is the size of the photon related to light?
9. Briefly describe the photoelectric effect. Who originally did the experiment? Who explained the experiment? Why was the experiment important?
10. How is light produced?
11. What is the "ground" state and what is an "excited" state?
12. What are the two ways an electron can go from the ground state to the excited state?
13. How does the electron transition from the excited state to the ground state?
14. Why is the present day model of the atom called the "quantum theory"?
15. Why do elements produce sets of lines (bright line spectra) rather than rainbows when they are heated?
16. What is an orbital? How many electrons can be in any one orbital? What must be true about their spin?
17. What is the shape of an "s" orbital? How many "s" orbitals can be on an energy level? What is the first energy level that can have an "s" sublevel? How many electrons total can be in the "s" sublevel?
18. What is the shape of an "p" orbital? How many "p" orbitals can be on an energy level? What is the first energy level that can have an "p" sublevel? How many electrons total can be in the "p" sublevel?
19. What is the shape of an "d" orbital? How many "d" orbitals can be on an energy level? What is the first energy level that can have an "d" sublevel? How many electrons total can be in the "d" sublevel?
20. What is the shape of an "f" orbital? How many "f" orbitals can be on an energy level? What is the first energy level that can have an "f" sublevel? How many electrons total can be in the "f" sublevel?
21. Draw arrow diagrams, electron configurations, and noble gas configurations for any given element. Be able to apply (not memorize) Hund's Rule, Aufbau Principle and the Pauli Exclusion Principle.

22. Know where the "s" , "p" , "d" , and "f" sections are on the periodic table.
23. Know the 4 quantum numbers and how they are related to one another. In other words, if $n=3$, what are the possible values of " l "? What does each value of " l " represent? If " l " = 2, what are the possible values of m_l ? What do the values of m_l represent?
24. Be able to give the 4 quantum for any electron in any atom. Ex. What are the 4 quantum numbers for the outermost three electrons (valence electrons) in the aluminum atom?
25. Be able to calculate the energy of the photon (joules), the frequency (hz), and the wavelength (nm) for the light emitted when an electron in a hydrogen atom transitions from the 7th to the 2nd energy levels.

Chapter 4 Study Questions (possible short answer questions)

1. A) What is a photon? B) How is the energy of the photon related to the frequency of light? C) What is the relationship between photons and the amplitude of monochromatic light?
2. Why are there energy sublevels? (In other words, why do electrons on the 3s sublevel have a lower energy than electrons on the 3p sublevel?)
3. In terms of quantum numbers, A) why is it impossible to have a 3f sublevel? B) why are there 5 orbitals on the "d" sublevel?
4. A) What does it mean that light has a dual nature? B) What part is the wave part? C) What part is the particle part?
5. What are the contributions of the following scientists and mathematicians
 - A) James Clerc Maxwell
 - B) Max Planck
 - C) Henrich Hertz
 - D) Albert Einstein (relating to light)
 - E) Niels Bohr
 - F) Louis DeBroglie
 - G) Erwin Schrodinger
6. What is the significance of ROY G BIV ? Which color has the greatest energy? Which has the longest wavelength?
7. What is fire?