

# Study Guide – Chapter 5 (Models of the Atom) Part I

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

1. In 1808, John Dalton published his atomic theory in the textbook entitled A new system of Chemical Philosophy.

2. Which one of the following statements is not part of Dalton's Atomic Theory? (Circle the correct letter choice)

- a. Matter is composed of atoms.
- b. Atoms of the same element have the same properties.
- c. Atoms of different elements have different properties.
- d. Atoms change into other atoms in chemical reactions.

3. Which one of Dalton's Atomic Theory statements is crucial in explaining the observations summarized by Proust's Law of Definite Proportions? (Circle the correct letter choice)

- a. Matter is composed of atoms.
- b. Atoms of the same element have the same properties.
- c. Compounds contain atoms in small, whole number ratios.
- d. Atoms are tiny, indivisible, indestructible particles.

4. Referring to the statements of Dalton's Atomic Theory in the textbook, identify the incorrect portion of statement 1 that Dalton was unaware of at the time.

Atom are "destructible". They can be broken down into protons, neutrons & electrons.

5. Referring to the statements of Dalton's Atomic Theory in the textbook, identify the incorrect portion of statement 2 that Dalton was unaware of at the time.

All atoms of the same element are not identical. They can differ in number of neutrons (isotopes)

6. J.J. Thomson identified cathode rays using a cathode ray tube. Through his experiments he was able to

determine that cathode rays have a negative charge and are deflected by

electric and magnetic fields. Using physics equations, he was able to determine

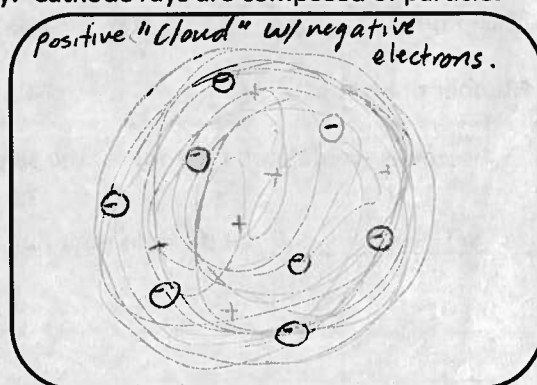
the Charge to mass ratio of the particles in the ray. Cathode rays are composed of particles

that later became known as electrons.

7. Based on J.J. Thomson's findings, he developed an early model

of the atom known as the Plum Pudding Model.

Sketch a diagram of this model in the space to the right.



8. In 1911, Robert Millikan determined the Charge on an electron using his famous Oil Drop experiment. Its numerical value is  $-1.602 \times 10^{-19} \text{C}$ .

9. Using the results of the Millikan experiment, the mass of the electron was calculated to be  $9.11 \times 10^{-28} \text{g}$ .

10. In 1909, Hans Geiger, under the direction of Ernest Rutherford performed the gold foil experiment in which a thin sheet of gold foil was bombarded with alpha particles. These particles are actually helium nuclei (2 protons / 2 neutrons). The results of this experiment prompted Rutherford to declare, "It was almost as incredible as if you fired a 15-inch shell at a piece of tissue paper and it came back and hit you", referring to the fact that he was not expecting the alpha particles to be deflected back.

11. The results of the gold-foil experiment led to the discovery of the nucleus of the atom.

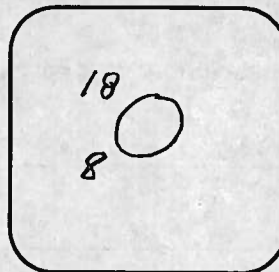
12. The proton has a positive charge that is equal in magnitude but opposite in sign to that of the electron. However, the proton is 1836 times more massive.

13. Rutherford could not account for the total mass of the atom because at the time he was not aware of neutrons, which were later discovered by James Chadwick in 1932. These particles have zero charge, and have a mass that is only slightly larger than that of a proton.

14. Briefly describe the components of the "nuclear" model of the atom:

Small nucleus containing protons & neutrons w/ electrons outside the nucleus.

15. Write the atomic symbol for oxygen-18 in the box to the right using the  ${}^A_Z X$  notation given in the textbook.



Determine the following:

Mass number: 18

Atomic number: 8

Number of Protons: 8

Number of Neutrons: 10

Number of electrons: 8

16. Isotopes are defined as atoms of the same element (type) that have the same number of Protons but differ in their number of neutrons.

## Study Guide – Chapter 5 (Models of the Atom) Part 2

### and Chapter 6 (Sections 6.4-6.10: Periodic Trends)

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

- The distance between any two consecutive, identical parts of a wave is known as the wavelength.
- The number of "cycles" of a wave that pass by a point per unit time is known as the frequency.
- An electromagnetic wave is a transverse (transverse / longitudinal) wave.  
(sinusoidal)
- An electromagnetic wave has two components; an electric field and a magnetic field at right angles.
- The term that is used to indicate that electromagnetic waves do not need a medium to travel through is known as Self-propagating.
- Rank the following regions of the electromagnetic spectrum in terms of increasing energy with 1 being the least energetic and 7 being the most.

Radio 1 Ultraviolet 5 Microwave 2 Gamma 7 Visible 4 Infrared 3 X-ray 6

- All electromagnetic radiation travels at the same speed of  $3.00 \times 10^8 \text{ m/s} = c$  (give value).
- Blue light has a higher energy than red light.
- As the energy of electromagnetic radiation becomes greater, the frequency becomes higher and the wavelength becomes shorter.
- Einstein showed using the photoelectric effect that light has particle properties and that its energy is carried on the frequency of the wave as opposed to "classical" waves where the energy is carried on the amplitude of the wave.
- Niels Bohr determined that the orbits of electrons around atoms must be quantized meaning that they can only take on certain specific values.
- Colored lines from an electrically excited gas as seen through a spectroscope are actually photons released by excited electrons transitioning down to lower energy levels.
- Louis DeBroglie and Erwin Schrodinger showed that electrons behave like waves of probability when in motion around an atom.

For each of the following elements give: a) The Bohr Model electron configuration, b) The Wave Mechanical Model electron configuration, c) The spectroscopic (s,p,d,) notation, d) The condensed (core) notation, e) The Lewis Dot representation and f) The spectroscopic notation for the element in its charged isoelectronic noble gas state.

**1. Lithium, Li (3)**

Spectroscopic:  $1s^2 2s^1$

Core:  $[\text{He}] 2s^1$

Lewis dot:  $\text{Li} \cdot$

Isoelectronic:  $1s^2$  or  $[\text{He}]$  (1+ state)

**2. Nitrogen, N (7)**

Spectroscopic:  $1s^2 2s^2 2p^3$

Core:  $[\text{He}] 2s^2 2p^3$

Lewis dot:  $\cdot\overset{\cdot\cdot}{\underset{\cdot\cdot}{\text{N}}}\cdot$

Isoelectronic:  $1s^2 2s^2 2p^6$  or  $[\text{Ne}]$  (3- state)

**3. Magnesium, Mg (12)**

Spectroscopic:  $1s^2 2s^2 2p^6 3s^2$

Core:  $[\text{Ne}] 3s^2$

Lewis dot:  $\cdot\overset{\cdot\cdot}{\underset{\cdot\cdot}{\text{Mg}}}\cdot$

Isoelectronic:  $1s^2 2s^2 2p^6$  or  $[\text{Ne}]$  (2+ state)

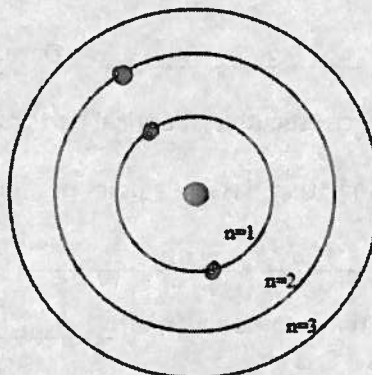
**4. Fluorine, F (9)**

Spectroscopic:  $1s^2 2s^2 2p^5$

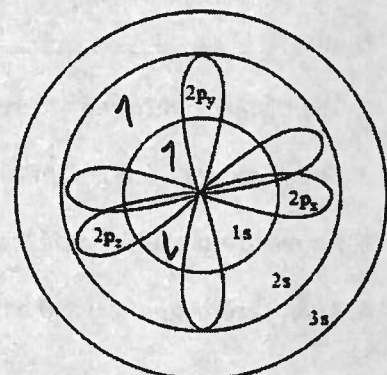
Core:  $[\text{He}] 2s^2 2p^5$

Lewis dot:  $\cdot\overset{\cdot\cdot}{\underset{\cdot\cdot}{\text{F}}}\cdot$

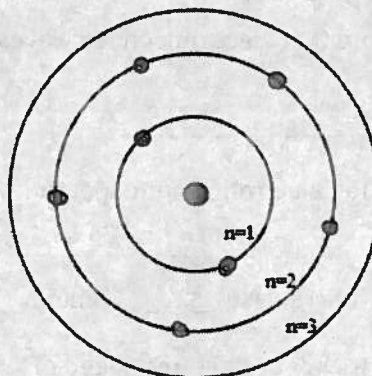
Isoelectronic:  $1s^2 2s^2 2p^6$  or  $[\text{Ne}]$  (1- state)



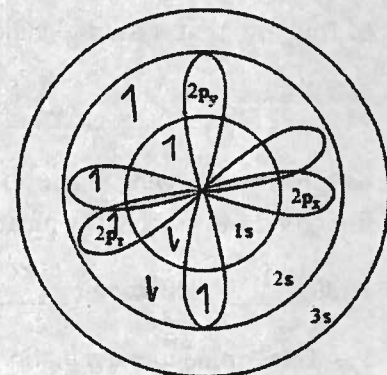
Bohr Model



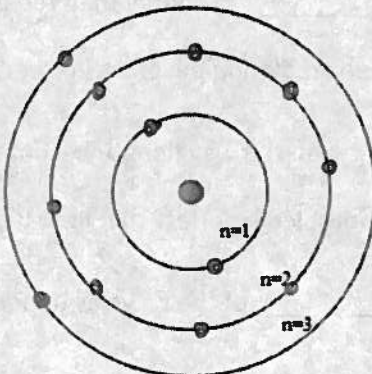
Wave Model



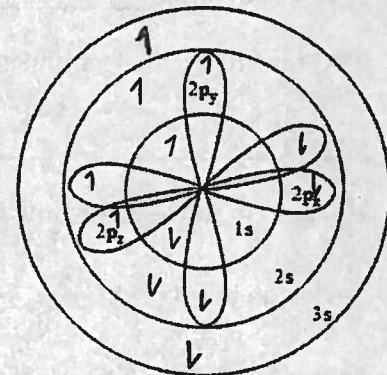
Bohr Model



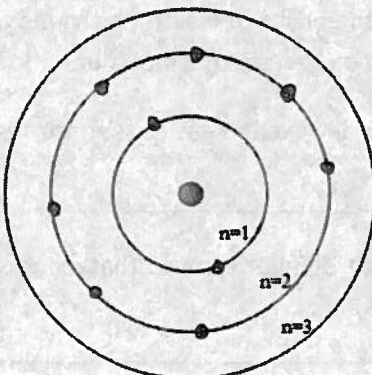
Wave Model



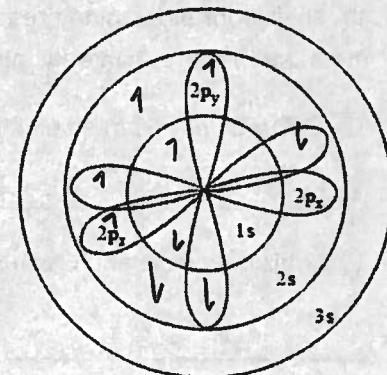
Bohr Model



Wave Model



Bohr Model



Wave Model