Unit 3 - The Electron

Content Area: **Science**
Course(s):
Time Period: **Marking Period 1**
Length: **10 days**
Status: **Published**

Summary

The electron is a subatomic particle that surrounds the nucleus of an atom. It is quintessential to one of the most important aspects of chemistry-- reactions. There are various ways to draw electrons surrounding the nucleus, such as the Lewis Dot diagram and Bohr Model. The current model of the atom, known as the quantum model, is highly successful for predicting the probability of an electron's location. In this unit, the behavior and properties of the electron will be studied in great detail, including where they are located outside of the nucleus and their organization (electron configuration and orbital notation), which plays a role in determining how reactive the element is.

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1	Make sense of problems and persevere in solving them
L.SS.9–10.1	Demonstrate command of the system and structure of the English language when writing or speaking.
2	Reason abstractly and quantitatively
HS-PS1-1	Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms.
HS-PS1-2	Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties.
HS-PS1-3	Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles.
3	Construct viable arguments and critique the reasoning of others
HS-PS1-4	Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy.
HS-PS1-5	Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs.
L.KL.9–10.2	Apply knowledge of language to make effective choices for meaning, or style, and to comprehend more fully when reading, writing, speaking or listening.
L.VL.9–10.3	Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on grades 9–10 reading and content, including technical meanings, choosing flexibly from a range of strategies.
HS-ETS1-2	Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
HS-ETS1-4	Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.

Essential Questions/Enduring Understandings

Essential Questions

- How are the electrons arranged outside of the nucleus?
- How can we depict the arrangement of electrons around the nucleus?
- What is the quantum mechanical model, and how does it help predict the location of electrons?
- What role does the arrangement of electrons around the atom play in the stability of that atom (in terms of reactivity)?

Enduring Understandings

- The electrons are located outside of the nucleus in what is referred to as an "electron cloud".
- Electrons are generally depicted surrounding the nucleus via a Lewis Dot diagram or Bohr model.
- Electrons are not stationary, but rather constantly moving around the nucleus. However, the location of an electron can be predicted through probability.
- The quantum mechanical model is the most effective model for predicting the location of an electron.
- The arrangement of particles in the nucleus determines the stability of the atom but the arrangement of electrons around the nucleus determines its chemical reactivity.

Objectives

Students Will Know

- Students will know the methods of describing the arrangement of electrons around atoms.
- Students will know the basics of the quantum mechanical model.
- Students will know how to draw the Bohr model and lewis dot structure of an element.
- Students will know how to identify the number of valence electrons an element has based on the Bohr model and Lewis dot structure.
- Students will know how to apply the aufbau principle, Pauli’s Exclusion Principle, and Hund’s Rule in the development of electron configurations and/or orbital notations.
- Students will know the effect of gaining and losing electrons (creating ions) on electron configurations/orbital notations for various elements.

Students Will Be Skilled At

- Students will be skilled at drawing Bohr models and Lewis dot structures of different elements.
- Students will be skilled at identifying the number of valence electrons each element has.
- Students will be skilled at identifying cations or anions based on electrons gained/lost.
- Students will be skilled at analyzing electron configurations (and/or orbital notation) to determine the chemical stability of the element.
- Students will be skilled at writing the long-hand electron configuration and short-hand (noble gas configuration) for any element.

Learning Plan

- Preview essential questions and connect them to the concepts we will cover in the unit.
- Discuss the quantum mechanical model and its benefits.
- Study Bohr models and draw them for individual elements.
- Compare and contrast the Bohr model to the Lewis dot structure of an element.
- Study lewis dot structures and draw them for individual elements.
- Interpret Bohr models and Lewis dot structures and identify the number of valence electrons an element has.
- Observe the effects of an element gaining/losing electrons to form ions.
- Study the electron configuration and orbital notation of elements and how the periodic table's modern design offers a clue.
- Write electron configuration and noble gas configuration of various elements.
- Link the electron configuration and orbital notation of elements to their chemical reactivity.

Assessment

Summative Assessment

- Unit Quizzes
- Unit Tests
- Lab Reports

Formative Assessment

- Do Now Questions
- Exit Ticket Questions
- Whole Class Discussion Participation
- Small Group Discussion Participation

- Individual Student Questions/Responses
- Independent Tasks
    - Draw Bohr models and Lewis dot structures of various elements.
    - Distinguish between cations & anions.
    - Write electron configurations and identify elements based off them.
    - Write orbital notations and identify elements based off them.
- Lab Experiments

Benchmark Assessment

- CP Chemistry Midterm Exam

Alternative Assessment

- Use electron configuration/orbital notation of various elements to determine their reactivity.
- Analyze what happens when electrons "jump up" energy levels.
- Determine if an element is paramagnetic or diamagnetic based on its orbital notation.
- Analyze Bohr models to determine if the model depicts a neutral element or an ion for specific elements.
- Analyze the arrangement of the periodic table in relation to electron configuration.

Materials

- SAVVAS Experience Chemistry 2021 Textbook Volumes 1 & 2
- Guided notes
- Teacher handouts
- Supplementary worksheets
- Lab Handouts (Visible Spectra Lab, Magnetic Properties of Matter Lab)
- Bohr Model template
- Simulations:
    - Periodic Table electron configuration & orbital notation [https://ptable.com/?lang=en#Electrons/OxidationStates]
    - Atomic electron configurations simulation [https://elearning.cpp.edu/learning-objects/atomic-electron-configurations/]
    - Valence & Electronegativity Simulation [https://see.phenomena.app/?app=-MosQAYWcrZXTSvu2FMg]
    - Electron Orbitals Simulation [https://see.phenomena.app/?app=-MoD-ElTHIrW3GWn3xoC]
    - “Build an Atom” [https://phet.colorado.edu/en/simulation/build-an-atom] (up to Ne)

- Safety Supplies (specifics to when they are required included in lab handouts)

Integrated Accommodation and Modifications, Special Education students, English Language Learners, At-Risk students, Gifted and Talented students, Career Education, and those with 504s

https://docs.google.com/spreadsheets/d/1mfe42JCam4Rlgd626vidMg54nDZ1ic055qKKGLvhcPg/edit?usp=sharing