Title of Unit: Chemistry Foundations: This unit covers: Introduction to Periodic Table and Introduction to the existence of different atomic models, Scientific Method, Measurement, Errors in Measurement, Significant Figures, Dimensional Analysis, Moles Determination (As the first part of Stoichiometry), Physical & Chemical Change, and Introduction to Atomic Structure

Grade Level/Course: 10-12 **Approximate length of unit: 20 blocks (6 Weeks)**

HCS Competencies (STAGE 1) HS 13 to 16

Performance Indicators (STAGE 1)

Note: The following performance indicators will be dealt with in the first unit at an introductory level and in the light of NSTA's Position Statement on Science, http://www.nsta.org/about/positions/natureofscience.aspx

Primary Performance Indicators:

SC1. Obtain, evaluate, and communicate information about the use of the modern atomic theory and periodic law to explain the characteristics of atoms and elements. (It will be introduced that periodic table is constructed based on atomic structure. Modern atomic theory (Originally proposed in 1913, by Neils Bohr, a student of Rutherford 's, developed a new model of the atom. He proposed that electrons are arranged in concentric circular orbits around the nucleus. This model is patterned on the solar system and is known as the planetary model. This was a more accurate and useful model. Bohr's model was an important step in the development of modern atomic theory).

a. Evaluate merits and limitations of different models of the atom in relation to relative size, charge, and position of protons, neutrons, and electrons in the atom. (Will be discussed at preliminary level of introducing the fact that various models of the atom exist and there has been a steady progression in the understanding of the structure of the atom. Each successive model was trying to address the lacunae in the previous model; Of course, even Bohr's model (considered revolutionary and a more accurate model) was further improvised by successors.

b. Construct an argument to support the claim that the proton (and not the neutron or electron) defines the element's identity (confined to introductory level; detailed treatment will follow in Unit 3).

c. Construct an explanation based on scientific evidence of the production of elements heavier than hydrogen by nuclear fusion (Evolutionary approach of science)

f. 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 (confined to introductory level; detailed treatment will follow in Unit 3).

SC2. Obtain, evaluate, and communicate information about the chemical and physical properties of matter resulting from the ability of atoms to form bonds (confined to introductory level; detailed treatment will follow in Unit 3).

c. Construct an explanation about the importance of molecular-level structure in the functioning of designed materials. (Clarification statement: Examples could include why electrically conductive materials are often made of metal, flexible but durable materials are made up of long chained molecules, and pharmaceuticals are designed to interact with specific receptors.) (confined to introductory level; detailed treatment will follow in Unit 3).

Supporting Performance Indicators:

- **Science Characteristics Standards:** SCSh 1 to SCSh 9
- Use information, technology and appropriate tools strategically to innovate and solve problems collaboratively and interdependently
- Use information, technology and appropriate tools strategically to innovate and solve problems collaboratively and interdependently
- Demonstrate organized, purposeful, and precise communication in English and at least one other language

Students perform effectively on teams that set and achieve goals, conduct investigations, solve problems, and create solutions (e.g., by using consensus-building and cooperation to work toward group decisions).

Learning Targets: At the end of the learning unit, students will be able to vouch with confidence:	Activities	DoK Level	Resources	Assessment
1. I can explain how Chemistry functions as the Central Science 2. I can list the branches of chemistry 3. I can show to my peers an overall view of the components of my chemistry curriculum.	Familiarization: Chemistry is Central Science Branches of Chemistry Map of Chemistry Course	**1 to 2**	Welcome to Chemistry https://www.youtube.com/watch?v=cZu-3VrgVSM Top 10 Highly Paid Careers in Chemistry https://www.youtube.com/watch?v=KBcE4bjDSrs Branches of Chemistry https://www.youtube.com/watch?v=vrr9aTP36nE Map of Chemistry https://www.youtube.com/watch?v=P3RXtoYCW4M **University of Chemistry and Technology, Prague – UCT Prague** http://www.foodsmartphone.eu/Consortium.html Chemistry is Central Science https://www.youtube.com/watch?v=wy-nbWfxBHw	The following are not graded tasks but indispensable Drawing the Bubble Map on Chemistry: Central Science https://drive.google.com/a/henry.k12.ga.us/file/d/1ORqN-9lXvSFm-NBmiiYxQsSVVHjkA_SL/view?usp=sharing Drawing the Flow Chart on Branches of Chemistry https://drive.google.com/a/henry.k12.ga.us/file/d/1vFPUOc96zlCXjb2tV9-X8OpLzKQbesS0/view?usp=sharing Fun Trivia based on https://www.thoughtco.com/fun-and-interesting-chemistry-facts-604321
4. I can articulate why lab safety is important very important in a chemistry course 5. I can explain why safety is always related to behavior and habits 6. I can enumerate what the important lab safety rules are.	• Lab Safety Videos • Lab Safety Symbols Video • MSDS Video • Tour around the lab & drawing the map of the lab • Trivia on Lab Safety Rules	**2 to 3 in Progression**	https://www.youtube.com/playlist?list=PLSDzkoiE_ydHoZyGFST16VavKYVikEWGD **https://www.youtube.com/watch?v=FT2XKstPyN0** https://www.youtube.com/watch?v=a4_G-Pr0JQ0 https://drive.google.com/a/henry.k12.ga.us/file/d/0B5VtOlv4o_JGY0FKb2ctbDdyMGM/view?usp=sharing https://sites.google.com/a/oswego.edu/gublo/home/jeopardy http://www.edquest.ca/component/content/article/110	SA 1: Lab Safety Test at socratve: https://socrative.com/ SA2: Safety Symbols Test at **http://www.proprofs.com/quiz-school/story.php?title=es-com-assess-1-safety-symbols**

	• Lab Safety Practice Quiz			
7. I can demonstrate how a scientific theory is developed 8. I can explain why only certain laws are supported by theories 9. I can justify why an observation is considered the basis of the Scientific Method. 10. I can justify how a universal observation becomes a Law 11. I can illustrate what a Hypothesis is and how it is developed 12. I can discuss the components of Experimental Design. 13. I can describe what I understand by the term "Data" and how the data are collected and documented. 14. I can illustrate how data are analyzed and inferences are drawn. 15. I can enumerate the implications of Intellectual Property Rights and Copyright Laws. 16. I can explain why Lab Reports are considered a very important requirement in scientific work.	The Scientific Method Review and Extension	**3 & 4**	http://www.nsta.org/about/positions/natureofscience.aspx https://study.com/academy/lesson/what-is-scientific-investigation-definition-steps-examples.html **Forensic Science Technicians** https://www.mynextmove.org/profile/summary/19-4092.00 **Writing Center: Scientific Lab Report** https://writingcenter.unc.edu/tips-and-tools/scientific-reports/	SA 2: Tasks 4 to 14 are a Part of Summer Assignment (74 Pts). Denominations of the 80 Pts are posted on the last page of the Summer Packet.
17. I can draw with appropriate color coding, visually represent different formats of the periodic table and highlight the significance of each table.	Anchoring the Foundations in Chemistry: Coloring and Modeling of Periodic Table	**2**	https://schoolwires.henry.k12.ga.us/cms/lib/GA01000549/Centricity/Domain/7223/Summer%2017-18-%20Assignment%20for%20Honors%20and%20regular%20Chemistry.pdf	
18. I can identify the chemical apparatus by name	Apparatus Lab	2	Apparatus Lab Handout https://www.slideshare.net/rekharajaseran/chemical-apparatus	SA 3: Chemical Apparatus Quiz http://www.sciencegeek.net/Chemistry/taters/labequipment.htm

19. I can differentiate between qualitative and quantitative measurements 20. I can carry out qualitative and quantitative measurements in a lab investigation 21. I can discuss how counts are different from measurements. 22. I can I can draw a Metric Ladder with ease. 23. I can demonstrate by mathematical operations the process for converting between different metric units. 24. I can convert exponential numbers to scientific notation 25. I can convert scientific notation to exponential number.	Qualitative and Quantitative Measurements -PBL Task with embedded inquiry lab Counts, Mole, Measurements, Metric Ladder, and Scientific Notation - PBL task with Embedded Labs Metric Ladder Trivia	3 & 4	Basics of Qualitative and Quantitative Measurements Thinking Sheet https://www.slideshare.net/rekharajaseran/basics-of-qualitative-and-quantitave-measurements https://www.slideshare.net/rekharajaseran/foundations-in-chemistry-counts-mole-metric-ladder-and-scientific-notation Scientific Notation Quiz https://www.quia.com/quiz/113578.html?AP_rand=530335836 Review Resource for Dimensional Analysis https://www.chemteam.info/SigFigs/SigFigs.html Re-teaching, Revision, and Re-testing options will be provided for Metric Conversions, Scientific Notation, Sigfig, and Moles Determination.	SA4: Qualitative and Quantitative Lab Report Summarization 14 Pts. Surface area work out – 4 Pts Volume work out – 2 Pts Unit for area work out – 2 Pts Unit for Surface area work out – 4 Pts Unit for volume work out – 2 Pts SA5: Metric Conversion Quiz FRQ (50 Pts) Use the given blank table to construct the metric ladder. You must indicate the following on the metric ladder: Steps (2 Pts), name of the metric prefixes (15.5), symbol of the metric prefixes (15.5), value of each step in the ladder (8 Pts), conversion factor for upward movement (2 Pts), conversion factor for downward movement (2 Pts), what are the unique things about 10^{th} step on the down side (4 Pts), and what is unique about kilo in the metric system (1 Pt). Total 50 Pts.
26. I can discuss the common human errors in measurements with examples. 27. I can I can distinguish between Precision and Accuracy. 28. I can show how errors are estimated in a measurement 29. I can report technically the sigfigs in the given numbers 30. I can report technically the final result of math operations in correct sigfigs.	Precision, Accuracy, Percent Error, and Sigfig Rules	3	https://drive.google.com/a/henry.k12.ga.us/file/d/0B5VtOIv4o_JGdEVXMDZmSmRyNEE/view?usp=sharing	Practice Tests: Precision, Accuracy, and Percent Error Quiz at https://www.quia.com/quiz/1863743.html?AP_rand=2049917313 http://www.kentschools.net/ccarman/cp-chemistry/practice-quizzes/quiz-2-2/
31. I can design and perform a lab investigation to determine the thickness of aluminum foil 32. I can design and perform a lab investigation to determine the density of different regular objects 33. I can design and perform a lab investigation to find the volume of an irregular object by the water displacement method.	Labs & Post-Lab Inquiries Lab Design thinking	3 & 4	Thickness of Aluminum Foil Lab https://drive.google.com/a/henry.k12.ga.us/file/d/1vKaPLc7schZ668NVfkpmhH0Ucw9KKmdQ/view?usp=sharing Density of Regularly Shaped Solid Objects https://drive.google.com/a/henry.k12.ga.us/file/d/1ExP7dIPNzf4B3fitHOOMPWJoDim1_y1K/view?usp=sharing Intelligent Crow https://www.youtube.com/watch?v=ZerUbHmuY04	SA6: Post-Lab Inquiries for Labs 2 to 4; these are embedded in the Lab Reports each; links are given under Resources. SA7: Design a lab investigation for determining the density of an irregular shaped solid object, which is insoluble in water. You may want to get insights from the video on intelligent crow.

34. I can delineate the significance of mole as a count in chemistry. 35. I can compute the Molecular Mass of a substance. 36. I can design a lab investigation to find the number of moles in a substance. 37. I can explain the word "Stoichiometry"	Formula Mass Computation; Mole determination from mass and formula mass Mole Lab - Pre-Lab Inquiries	3	https://www.saddleback.edu/faculty/jzoval/worksheets_tutorials/ch3worksheets/ws_molar_mass.pdf https://drive.google.com/a/henry.k12.ga.us/file/d/1oO-qRN-JGuIs_a3Xvo6HXn719-HQHI9a/view?usp=sharing	SA8: Formula Mass Quiz at http://www.softschools.com/quizzes/chemistry/molar_mass/quiz1120.html (20 Pts) SA9: Mole determination from formula mass and mass at http://www.sciencegeek.net/Chemistry/taters/Unit4MoleConversion.htm (20 Pts) with student interviews on stoichiometry awareness.
38. I can differentiate between a physical change and a chemical change	Physical and Chemical Changes	2 to 3	https://www.youtube.com/watch?v=BOr76Zx48QM https://www.youtube.com/watch?v=37pir0ej_SE https://www.youtube.com/watch?v=jb4CMnT2-ao Virtual Lab http://www.glencoe.com/sites/common_assets/science/virtual_labs/E03/E03.html	FA1 http://glencoe.mheducation.com/sites/0078617650/student_view0/chapter3/section2/self-check_quiz-eng_.html FA2 https://www.quia.com/quiz/303980.html
39. I can illustrate an atom with its parts. 40. I can trace the Timeline of Different Models of the Atom 41. I can summarize the principles that I consider determine the electronic configuration of elements. 42. I can describe how elements heavier than hydrogen were formed by nuclear fusion	Atomic Structure Foundations Simple to complex: Evolution of Elements	3	https://www.slideshare.net/rekharajaseran/valence-shell-of-the-atom https://www.texasgateway.org/sites/default/files/resources/documents/EvolutionOfAtomicModel.pdf https://www.youtube.com/watch?v=dNp-vP17asI https://www.youtube.com/watch?v=NSAgLvKOPLQ Astronomical Alchemy: The Origin of the Elements https://www.youtube.com/watch?v=8-xd1rdDxN4 Where does gold come from? https://www.youtube.com/watch?v=jf_4z4AKwJg Building Blocks of Matter https://www.youtube.com/watch?v=4goTeFVD89w	FA 3: http://www.sciencegeek.net/Chemistry/Review/AtomicStructure/ (This quiz is recommended as a self-check for students to test their strength of background knowledge; based on the performance of the students in this quiz, instructional design and delivery for atomic structure and electronic configuration will be adjusted in subsequent chapters). FA4: Atomic Models and Orbitals Drawing (30 Pts): This task will be revisited a couple of times in other chapters. FA5: Nuclear Fusion Quiz http://www.funtrivia.com/playquiz/quiz283787207d630.html

Note: Metric conversions, Sigfig, Mole determination, etc. are math-rich contents. Often, these require reteaching and extensive support; therefore, more time than projected in the Unit Plan. Also screening of all lab safety videos, MSDS videos, and safety symbols video, requires one full period.

Atomic Structure (Basic) and Physical & Chemical Changes are pre-requisite concepts for chemistry course. They are being formatively assessed (FA1 and FA2) in Items 37 and 38 to adjust the instruction in subsequent chapters.

Student performance in Formative Assessments FA3 and FA4 will also be used to drive instruction as these are dealt with in detail in subsequent chapters.