Moon Area School District Curriculum Map

Course: Academic Chemistry
Grade Level: 10^{th}-12^{th} Grade
Content Area: Science
Frequency: Full-Year Course

Big Ideas

1. Decisions we make affect our level of safety in a lab situation.
2. The branches of chemistry extend to many aspects of our daily lives.
3. Scientific inquiry involves asking scientifically-oriented questions, performing experiments, drawing and revising conclusions, connecting explanations to scientific knowledge and theory, and communicating explanations.
4. Mathematics is a tool used by scientists to model objects, events, and relationships in the natural world.
5. Changes in matter are accompanied by changes in energy.
6. Matter is neither created nor destroyed in a chemical reaction, the atoms simply rearrange.
7. Chemical reactions change the identity of a substance and can be recognized by various signs.
8. All matter is composed of atoms.
9. Atoms are divisible into 3 subatomic particles.
10. Light and electrons have dual wave/particle nature.
11. In modern atomic theory, electrons are treated as waves and they are located in regions of high probability.
12. The periodic table is a working arrangement of elements; known and unknown.
13. The position of an element determines its properties.
14. Chemical bonding occurs because of attractive forces between particles.
15. A universal nomenclature system is essential to facilitate the sharing of knowledge between scientific communities.
16. Intermolecular forces determine the properties of compounds.
17. Changes in matter involve the rearrangement and/or reorganization of atoms and/or the transfer of electrons.
18. Rates of chemical reactions are determined by details of the molecular collisions.
19. The mole is a number representing a large quantity. It provides a direct relationship between the observable macroscopic properties and the submicroscopic atoms that are not visible.
20. Quantities of matter in a chemical reaction can be calculated using mathematical relations between reactants and products.
21. Temperature and pressure conditions determine the state of matter.
22. The behavior of gases in the real world can be approximated by mathematical relations between pressure, temperature, volume, and amount.

Essential Questions

1. What does safety demand of us in chemistry?
2. Why is it important to study chemistry?
3. How do chemists solve problems?
4. How does a degree of uncertainty affect conclusions?
5. How would you gather data in order to calculate the density of a regular objected? Irregular object?
6. How do you calculate density when you have the appropriate data?
7. Why is the mole an important measurement in chemistry?
8. How can scientists quantize the atoms and molecules that make up matter without being able to see them?
9. How is Avogadro's number used to find the molar mass of each element?
10. How do potential and kinetic energy differ?
11. How can chemical potential energy be related to heat lost or gained in chemical reactions?
12. How is the amount of heat absorbed or released by a substance calculated as its temperature changes?
13. How is a calorimeter used to measure energy that is absorbed or released?
14. How is the amount of heat absorbed or released by a substance calculated as its temperature changes?
15. How is a calorimeter used to measure energy that is absorbed or released?
16. How is matter characterized?
17. How do changes affect the properties, identities, and interactions of matter?
18. Which physical properties and changes can be used to identify an unknown substance?
19. How are chemical properties and changes used to identify a substance?
20. What is the molecular motion of solids, liquids, and gases?
21. How does the energy change during a phase change?
22. How is it possible that all matter is composed of atoms?
23. What are the position, charge, and relative size of the subatomic particles?
24. How is an element's identity determined?
25. How do various atomic models compare with current scientific evidence?
26. How does the abundance of various isotopes affect an element's atomic mass?
27. What happens when electrons in atoms absorb or release energy?
28. How do various atomic models compare with current scientific evidence?
29. What is the orbital configuration of a neutral atom?
30. How does an atom's electron configuration affect its chemical properties?
31. How can an element be identified by light emission and the movement of electrons?
32. Would the periodic table be as meaningful if it was organized differently?
33. How can periodic trends be explained?
34. What characteristic of the atom is used to organize the periodic table?
35. What characteristics of the atom determines the row placement of an element?
36. How does the element's position on the periodic table affect the following: number of valence electrons? Ionization energy? Atomic radii? Electronegativity? Reactivity
37. How are metals, metalloids, and nonmetals positioned on the periodic table?
38. Why do elements bond in nature?

39. How is an ionic compound formed and named?
40. What is the different between the formation of an anion and a cation?
41. How do we write formulas and names to represent both binary and tertiary ionic compounds?
42. How is a covalent compound formed and named?
43. How is the octet rule applied to atoms that bond covalently?
44. How are Lewis structures used to represent covalent bonds?
45. What causes some bonds to be polar?
46. What are the properties of ionic, polar, covalent, and nonpolar covalent compounds?
47. What is the difference between physical and chemical change?
48. What is a chemical reaction?
49. What are the different types of chemical reactions?
50. What are the indicators that a chemical reaction has taken place?
51. Why must chemical equations be balanced?
52. How can you predict the products of a chemical reaction?
53. How does the Law of Conservation of Matter allow you to determine the empirical/molecular formula of a compound?
54. How does stoichiometry predict quantities of products from given amounts of reactants?
55. How does a limiting reactant effect a chemical reaction?
56. How are thermochemical equations for chemical reactions and other processes written?
57. How is the heat that is absorbed or released in a chemical reaction calculated?
58. How is Hess's law applied to calculate the enthalpy change for a reaction?
59. What is the difference between spontaneous and non-spontaneous?
60. Why do only certain factors determine the physical state of matter?
61. How is energy lost or gained during changes of state?
62. How does the Kinetic Molecular Theory explain properties of solids, liquids, and gases?
63. How do gases respond to changes in temperature, pressure, and volume?
64. Why is an ideal gas useful even though ideal gases do not exist?

Primary Resource(s) & Technology:

Textbook: Buthelezi, T.; Dingrando, L.; Hainen, N.; Wistrom, C.; Zike, D. *Chemistry: Matter and Change*, Glencoe/McGraw-Hill; 2008.

Technology: Microsoft Teams, Promethean Boards, Student Laptops

Pennsylvania and/or focus standards referenced at:

www.pdesas.org
www.education.pa.gov

Big Ideas/EQs	Focus Standard(s)	Assessed Competencies (Key content and skills)	Timeline
BI 1, 2, 3 **EQ** 1, 2, 3		• Describe what chemistry is and its scope. • Identify and apply the scientific process. • Identify and apply basic safety procedures and identify basic equipment.	1 Week
BI 4 **EQ** 4, 5, 6, 7, 10, 11, 12, 13, 14, 15		• Identify and use appropriate units of measurement and the sources and implications of uncertainty in measurements. • Explain and do calculations with the mole. • Explain what energy is and distinguish between potential and kinetic energy. • Relate chemical potential energy to the heat lost or gained in chemical reactions. • Calculate the amount of heat absorbed or released by a substance as its temperature changes. • Describe how a calorimeter is used to measure energy absorbed or released. • Explain the meaning of enthalpy and enthalpy change in chemical reactions and processes.	5 Weeks
BI 6, 12, 13 **EQ** 16, 17, 18, 19, 22, 32, 34, 35, 36, 37		• Classify the different kinds of matter. • Explain how matter may identified, classified, and changed. • Summarize and apply the Law of Conservation of Matter and Energy. • Describe the origin and organization of the modern Periodic Table.	4 Weeks
BI 8, 9, 10, 11 **EQ** 23, 24, 25, 26, 27, 28, 29, 30, 31, 33, 34, 36		• Trace the history of the development of the modern atomic theory and model. • Determine the composition of any atom, ion, or isotope. • Explain how electrons are organized around the nucleus. • Explain the source and common use of atomic spectra. • Explain periodicity.	4 Weeks
BI 14, 15, 16, 19 **EQ**		• Compose a proper formula for a compound. • Differentiate properties of metallic, ionic, and covalent solids.	6 Weeks

7, 8, 9, 38, 39, 40, 41, 42, 43, 44, 45, 46		• Recognize various shapes that molecules can exhibit. • Distinguish among ionic, polar, and nonpolar covalent bonds. • Describe and name ionic compounds (binary and tertiary). • Describe and name covalent compounds (binary). • Determine the percent composition of a compound. • Determine the empirical and molecular formulas of a compound.	
BI 6, 7, 17, 18, 20 **EQ** 47, 48, 49, 50, 51, 52, 53, 54, 55		• Write and balance simple equations. • Classify chemical reactions and predict the products. • Explain the quantitative relationship that exists between reactants and products in a chemical reaction. • Describe a limiting reactant. • Calculate percent yield.	4 Weeks
BI 5 **EQ** 10, 11, 12, 20, 21, 56, 57, 58, 59		• Explain the meaning of enthalpy and enthalpy change in chemical reactions and processes. • Write the thermochemical equations for chemical reactions and other processes. • Describe how energy is lost or gained during changes of state. • Calculate the heat absorbed or released in a chemical reaction.	4 Weeks
BI 5, 21, 22 **EQ** 60, 61, 62, 63, 64		• Why do only certain factors determine the physical state of matter? • How is energy lost or gained during changes of state? • How does the Kinetic Molecular Theory explain properties of solids, liquids, and gases? • How do gases respond to changes in temperature, pressure, and volume? • Why is an ideal gas useful even though ideal gases do not exist?	3 Weeks