COPPELL ISD SUBJECT YEAR AT A GLANCE

CHEMISTRY

GRADE LEVEL	UNITS
10	1-15

Program Transfer Goals

- Ask questions, recognize and define problems, and propose solutions.
- Safely and ethically collect, analyze, and evaluate appropriate data.
- Utilize, create, and analyze models to understand the world.
- Make valid claims and informed decisions based on scientific evidence.
- Effectively communicate scientific reasoning to a target audience.

PACING

1st 9 Weeks			2nd 9 Weeks			3rd 9 Weeks					4th 9 Weeks			
Unit 1 1.5 wks	Unit 2 2 wks	Unit 3 1.5 wks	Unit 4 2 wks	Unit 5 3 wks	Unit 6 5.5 wks	Unit 7 1.5 wks	Unit 8 2 wks	Unit 9 2.5 wks	Unit 10 2 wks	Unit 11 2 wks	Unit 12 2 wks	Unit 13 2 wks	Unit 14 1.5 wks	Unit 15 1.5 wks

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Assurances for a Guaranteed and Viable Curriculum

Adherence to this scope and sequence affords every member of the learning community clarity on the knowledge and skills on which each learner should demonstrate proficiency. In order to deliver a guaranteed and viable curriculum, our team commits to and ensures the following understandings:

Shared Accountability: Responding to the Needs of All Learners

- High levels of learning for all students.
- The district and course formative assessments aligned to the standards for this course support educators and learners in monitoring academic achievement and leveraging interventions.

Shared Understanding: Curriculum Design

- The district curriculum design weaves together the elements of content, skills and assessments in order to adhere to curriculum design at the macro and micro level, ensuring vertical alignment.
- The district curriculum incorporates standards, scope and sequence, enduring understandings, essential questions, performance assessments, and recommended resources.

Interdependence: Curriculum Units

Members of the learning community utilize the curriculum units, plan collaboratively, and reflect on results for continuous improvement.

The district curriculum units may be found: http://tinyurl.com/Coppell-Curriculum

Unit 1: Introduction to chemistry and scientific processes

Timeline: 1.5 Weeks - 1st 9 weeks

Unit Summary: Chemistry is the study of the nature and make up of matter and that there are patterns and trends in chemistry.

Students will know…

- Chemical substances have specific hazards summarized on SDS sheets
- Science has processes and limitations including the tentative nature of hypotheses

Students will be skilled at…

- Demonstrating safe lab practices
- Demonstrating use and conservation of resources and proper disposal
- Distinguishing between hypotheses and theories
- Planning and implementing investigative procedures using appropriate equipment safely
- Collecting data and measuring with accuracy and precision using lab equipment
- Organizing, analyzing, evaluating, making inferences, and predicting trends from data
- Communicating valid conclusions supported by data
- Analyzing, critiquing, and evaluating scientific explanations using empirical evidence
- Drawing inferences based on data related to promotional materials for products and services
- Evaluating the impact of research on scientific thought, society and the environment

Unit 2: Matter

Timeline: 2 Weeks - 1st 9 weeks

Unit Summary: Physical and chemical properties can be used to describe and classify matter. Pure substances (elements and compounds) as well as mixtures can be recognized and classified.

- **Transfer Goal:** [Insert transfer goals from the UbD unit]

Students will know…

- Physical properties can be observed without changing the chemical composition of a substance while chemical properties cannot.
- Physical changes do not result in the creation of a new substance, while chemical changes do.
- Chemical changes at the molecular level result in observable evidence at the macro level.
- Some properties of a substance are Intensive and can be used as identifiers while others are extensive and vary from sample to sample.
- Matter can be classified into pure substances (elements or compounds) and mixtures (heterogeneous or homogeneous) based upon the particle arrangement at the molecular level.

Students will be skilled at…

- Differentiating between physical and chemical changes and properties.
- Identifying extensive and intensive properties.
- Comparing solids, liquids, and gases in terms of compressibility, structure, shape, and volume.
- Classifying matter as pure substances or mixtures through investigation of their properties.

Unit 3: Atomic Structure

Timeline: 1.5 Weeks - 1st 9 weeks

Unit Summary: Our understanding of the atom has evolved over time. Models of the atom are used to help understand the properties of elements and compounds.

Students will know…

- Modern atomic theory was developed through experimental design and conclusions, including Dalton's Postulates, Thomson's discovery of electron properties, Rutherford's nuclear atom, and Bohr's nuclear atom.

Students will be skilled at…

- Using isotopic composition to calculate average atomic mass of an element
- Identifying the masses, charges, and locations of the major components of the atom

Unit 4: Periodic Table

Timeline: 2 Weeks - 1st 9 weeks

Unit Summary: The periodic table is organized to reflect patterns of chemical behavior rather than a random or chronological list of elements. Recognize the trends in physical and chemical properties as one moves across a period or vertically through a group.

Students will know…

- The development and layout of the periodic table
- Relation between the structure of an atom and the periodic table
- Levels of reactivity based on electrons
- Periodic trends

Students will be skilled at…

- Predicting physical and chemical properties using the periodic table.
- Explaining the use of chemical and physical properties in the historical development of the Periodic Table
- Using the Periodic Table to identify and explain the properties of chemical families, including alkali metals, alkaline earth metals, halogens, noble gases, and transition metals; and
- Using the Periodic Table to identify and explain periodic trends, including atomic and ionic radii, electronegativity, and ionization energy.
- Identifying periods and groups on the periodic table
- Identifying metals, metalloids, and non-metals on the periodic table
- Predicting the common charges on the representative elements from the periodic table.

Unit 5: Electron Configurations and Quantum Mechanics

Timeline: 3 Weeks - 1st 9 weeks into 2nd 9 weeks

Unit Summary: Our understanding of the atom has evolved over time. Models of the atom are used to help understand

the properties of elements and compounds. Electrons and their location determine the chemical nature of the elements.

Students will know…

- Modern atomic theory was developed through experimental design and conclusions.
- The color of light is related to wavelength, which is in turn inversely related to both energy and frequency. Energy and frequency are directly related.
- Flame tests and atomic spectra give us clues about electrons' probable locations within the electron cloud
- Electron configurations allow us to represent that information and give us insights into how and why an element reacts the way it does.

Students will be skilled at…

- Distinguishing between and describing patterns in electron configurations for representative elements, transition elements, inner-transition elements, and noble gases.
- Demonstrating an understanding of the electromagnetic spectrum and the mathematical relationships between energy, frequency, and wavelength of light
- Expressing the arrangement of electrons in atoms through electron configurations and Lewis valence electron dot structures.
- Explaining the importance of quantized electron energy and its relationship to atomic emission spectra.

Unit 6: Bonding and Nomenclature

Timeline: 5.5 Weeks - 2nd 9 weeks

Unit Summary: Ionic bonds, metallic bonds, and covalent bonds arise from different circumstances and have different characteristics and properties that are a result of their different types of bonding.

Students will know…

- Different types of bonds result in different properties and can be used to classify.
- A completely full outer energy level is more stable than a partially full outer energy level.
- Ionic bonding is commonly found between metals and nonmetals.
- Ionic bonds result from the transfer of electrons from atom to atom, creating positive and negative ions, which are then attracted to each other. To be stable, there must be a net neutral charge.
- Covalent bonds result from the sharing of electrons between atom, typically nonmetals. Compounds made with covalent bonds only are called molecules.
- Covalent bonds can involve equal or unequal sharing. Equal sharing results in a nonpolar bond while unequal sharing results in a polar bond. Unequal sharing is a result of one atom in the bond having a higher electronegativity than the other.
- Molecules take up a three-dimensional shape, which can be explained by the repulsion between their unpaired electrons. This molecular shape affects the properties of the compound itself.
- A molecule that has polar bonds but is symmetrical is a nonpolar molecule, while an asymmetrical molecule with polar bonds is also a polar molecule.
- Metallic bonding is the result of delocalized electrons surrounding a group of metal cations and is found in elemental metals.
- There is a systematic method of naming compounds to ensure effective communication. Ionic compounds, molecular compounds, and acids all have their own rules.

Students will be skilled at…

- Demonstrating an understanding of how atoms form ionic, metallic, and covalent bonds.
- Naming ionic and covalent compounds.

- Constructing electron dot formulas to illustrate ionic and covalent bonds;
- Describing the nature of metallic bonding and apply the theory to explain metallic properties such as thermal and electrical conductivity, malleability, and ductility;
- Classifying molecular structure for molecules with linear, trigonal planar, or tetrahedral electron pair geometries with Valence Shell Electron Pair Repulsion (VSEPR) theory.
- Determining if a molecule is polar (contains a dipole moment)

Unit 7: Dimensional Analysis and Significant Figures

Timeline: 1.5 Weeks - 3rd 9 weeks

Unit Summary: Mathematics and computational thinking contribute to our understanding and explanation of chemistry.

Students will know…

- Using problem solving techniques, such as dimensional analysis, can help in planning calculations and help prevent computation errors
- The equipment and methods used to measure data affects the reliability or validity of findings.
- Scientists use the significant figures system to modify calculated numbers to reflect the equipment and/or methods used to generate them.
- Error is a part of the scientific process.

Students will be skilled at…

- Using critical thinking and problem solving
- Applying dimensional analysis to solve problems
- Calculating percent error
- Determining the appropriate number of significant figures
- Collecting data and measuring with accuracy and precision
- Expressing and manipulating chemical quantities using scientific notation, dimensional analysis, and significant figures

Unit 8: The Mole

Timeline: 2 Weeks - 3rd 9 weeks

Unit Summary: Because atoms of different elements have different masses, mass of a substance alone does not provide adequate information. It is necessary to have a common unit based on the quantity of particles present. A chemical formula gives us information about the composition of the compound and this information is needed for any calculations involving the compound.

Students will know…

- 1 mole of anything is equal to 6.02×10^{23} of that item
- 1 mole of any gas at STP has a volume of 22.4 L
- STP (standard temperature and pressure) is 1 atm and 0°C
- The percent composition of a compound is the percentage by mass of each element in a compound.
- An empirical formula expresses the ratios between the quantities of the atoms of each element in a compound.
- A molecular formula expresses the exact quantities of the atoms of each element in a compound.

Students will be skilled at…

- Finding molar mass of an element
- Calculating molar mass of a compound
- Converting between particles (atoms, ions, molecules), moles, liters (gases at STP only) and mass for both elements and compounds.

- Finding the percent composition of a compound from its chemical formula
- Finding the empirical formula of a compound from its percent composition
- Finding the empirical formula of a compound from lab data
- Finding the molecular formula of a compound from its empirical formula and molar mass
- Finding the molecular formula of a compound from its percent composition and molar mass
- Finding the molecular formula of a compound from lab data including molar mass

UNIT 9: CHEMICAL REACTIONS

TIMELINE: 2.5 WEEKS - 3RD 9 WEEKS

Unit Summary: Chemical changes at the molecular/atomic level result in observable changes at the macro level and can be classified into broad categories, which can be used to recognize trends and predict products of proposed reactions. All chemical reactions involve the transfer or energy.

Students will know…

- Reactions can be classified into types:
    - Synthesis
    - Decomposition
    - Single Replacement
    - Double Replacement (ion swap, acid-base, precipitation)
    - Combustion
    - Oxidation-Reduction
- Classifying reactions allows us to use general trends to predict products of a reaction and whether that reaction will occur.
- Activity Series must be used to predict whether a single replacement reaction will occur.
- Solubility rules can be used to predict whether a double replacement reaction will occur.
- Acid-base reactions are a special case of double replacement reactions.

Students will be skilled at…

- Describing the evidence that a chemical reaction has occurred
- Writing and balancing equations using appropriate symbols
- Predicting products
- Classifying chemical reactions by type
- Using an activity series to predict whether a single replacement reaction will occur
- Using solubility rules to predict whether a double replacement reaction will occur and determine the precipitate formed.
- Determining the oxidation number of any atom in an element, ion, or compound
- Differentiating between oxidation and reduction, and between oxidizing agent and reducing agent

UNIT 10: STOICHIOMETRY

TIMELINE: 2 WEEKS - 3RD 9 WEEKS

Unit Summary: All matter changes involve the conservation of mass. There are many ways atoms combine, but all reactions occur on an atom-to-atom (and hence mole-to-mole) basis. The amount of reactants available will limit the amount of product produced.

Students will know…

- Changes that occur during chemical reactions may be quantified.
- The relationship between the coefficients in a balanced chemical equation are directly equivalent to the proportion of reactants/products in moles.
- The reactant that will be consumed in a reaction first is the limiting reactant.

Students will be skilled at…

- Performing stoichiometric calculations, including determination of mass, volume, and/or particle relationships between reactants and products
- Explaining what a limiting reactant is and why it affects the final product amount.
- Calculating the percent yield of a reaction.

Unit 11: Gases

Timeline: 2 Weeks - 3rd 9 weeks

Unit Summary: The properties and behavior of gases (as well as solids and liquids) can be understood and explained through the kinetic molecular theory. Volume, temperature, pressure, and moles of a gas are related to each other.

Students will know…

- Pressure is the result of gas particle collisions.
- The kinetic molecular theory is a model that helps us define and understand the behavior of the molecules in different states of matter.
- The properties of a gas have mathematical relationships to each other.
- Temperature is a measure of particle kinetic energy.

Students will be skilled at…

- Explaining on a molecular level changes in pressure, volume, and temperature of a gas
- Calculating the changing properties (pressure, volume, temperature) of a gas using the following laws:
    - Boyle's Law
    - Charles' Law
    - Avogadro's Law
    - Dalton's Law of Partial Pressures
    - Ideal Gas Law
- Performing stoichiometric calculations for gases not at STP using the ideal gas law

Unit 12: Solutions

Timeline: 2 Weeks - 4th 9 weeks

Unit Summary: The properties and behavior of a solution are influenced by the concentration of the solution as well as the identify of the solute and solvent. The solubility of a substance is affected by the conditions of the environment.

Students will know…

- Multiple factors, including intermolecular forces, temperature, and pressure, affect solubility and rate of dissolution.

- Concentration can be expressed in terms of molarity.
- Concentrated solutions can be diluted to form solutions of lesser yet exact concentrations.
- Solubility curves show how much solute can be dissolved in a specific solvent at a given temperature.
- Solubility rules allow chemists to make general predictions about whether ionic compounds will or will not dissolve in water.
- Water has a unique role in chemical and biological systems due to its polarity and ability to dissolve many substances.
- Electrolyte solutions conduct electricity while nonelectrolyte solutions do not.
- Unsaturated, saturated, and supersaturated are terms that express describe the relative amount of solute dissolved in solution to the maximum amount possible at that temperature.

Students will be skilled at…

- Demonstrating understanding of the factors that influence the behavior of solutions.
- Applying general rules regarding solubility through investigations with aqueous solutions.
- Calculating the concentration of solutions in units of molarity
- Using molarity to calculate the dilution of solutions
- Distinguishing between types of solutions such as electrolytes and nonelectrolytes and unsaturated, saturated, and supersaturated solutions.
- Investigating factors that influence solubilities and rates of dissolution such as temperature, agitation, and surface area
- Explaining the process of solvation at the molecular level.

Unit 13: Acids and Bases

Timeline: 2 Weeks - 4th 9 weeks

Unit Summary: Describe the properties of acids and bases, and identify the products of a neutralization reaction. Acids and bases are weak or strong based upon their dissociation in water.

Students will know…

- Acid and base properties are based on their chemical composition.
- Acids and bases neutralize each other.
- The products of an acid-base neutralization are an ionic salt and water.
- pH is a measure of the concentration of H+ in solution.
- pOH is a measure of the concentration of OH- in solution.
- A change of 1 pH/pOH represents a ten-fold increase or decrease in H+/OH- concentration.
- Titrations can be used to determine the molarity of an unknown solution.
- Indicators are compounds that change color in different environmental conditions.
- Indicators can be used to provide general information about a solution.

Students will be skilled at…

- Distinguishing between acids and bases.
- Distinguishing between Arrhenius and Bronsted-Lowry definitions
- Predicting products in acid base reactions that form water
- Using the hydrogen or hydroxide ion concentrations to calculate the pH or pOH of a solution and vice versa
- Using indicators to identify acid, base, and neutral substances in a lab experiment or among common household items
- Performing a titration to determine the concentration of an unknown acid or base solution

Unit 14: Thermochemistry

Timeline: 1.5 Weeks - 4th 9 weeks

Unit Summary: Energy is conserved in chemical reactions and heat can be transferred from one substance to another.

Students will know…

- All substances have a specific heat capacity, which is an intensive property
- Change in temperature of a substance is dependent upon heat loss/gain, mass, and specific heat capacity.
- Endothermic reactions take in energy while exothermic reactions release energy.

Students will be skilled at…

- Identifying the form of energy (kinetic, potential, chemical, thermal) given a reaction pathway.
- Calculating energy changes (ΔH) that occur in chemical reactions using potential energy graphs
- Classify and/or representing reactions as exothermic or endothermic based on potential energy graphs or thermochemical equations.
- Calculating heat transfer in an object by using heat, mass, temperature change, and/or specific heat.
- Using calorimetry to track heat transfer

Unit 15: Nuclear Chemistry

Timeline: 1.5 Weeks - 4th 9 weeks

Unit Summary: Investigate the different types of radiation and the positives and negatives of different energy sources.

Students will know…

- Radiation can come in different forms such as alpha, beta, and gamma radiation.
- Fusion is the combination of two lighter element nuclei into one nuclei.
- Fission is the break-up of a larger element nuclei into smaller separate nuclei and free subatomic particles.
- Radiation is encountered in everyday life (medical, natural radioactive deposits)

Students will be skilled at…

- Describing the characteristics of alpha, beta, and gamma radiation
- Balancing nuclear equations
- Comparing fission and fusion reactions.
- Articulating the positives and the negatives of nuclear energy.