COPPELL ISD SUBJECT YEAR AT A GLANCE

SUBJECT: AP CHEMISTRY

GRADE LEVEL 11-12

UNIT 1 OF 15

Program Transfer Goals What kinds of long term independent outcome accomplishments are desired?

Students will be able to independently use their learning to…

- 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.
- Successfully complete a first year College Chemistry course

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PACING

First Nine Weeks	Second Nine Weeks	Third Nine Weeks	Fourth Nine Weeks

Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Unit 7	Unit 8	Unit 9	Unit 10	Unit 11	Unit 12	Unit 13	Unit 14	Unit 15

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: CHEMISTRY FUNDAMENTALS

TIMELINE: 3 WEEKS - 9WK1

Unit Summary: Review of first year Chemistry concepts, math & reactions including spectroscopy and writing lab reports

- **Transfer Goal:**
    - The student can use representations and models to communicate scientific phenomena and solve scientific problems
    - The student can use mathematics appropriately
    - The student can engage in scientific questions to extend thinking or to guide investigations
    - The student can plan and implement data collection strategies in relation to a particular scientific question
    - The student can perform data analysis and evaluation of evidence
    - The student can work with scientific explanations and theories
    - The student is able to connect and relate knowledge across various scales, concepts, and representations in and across domains

*Students will **know** …*

- how atoms, molecules, and elements combine to form elements, compounds, and mixtures
- polyatomic ions and solubility rules
- lab safety
- Expectations and format of a formal lab report
- applications of stoichiometry- empirical formulae, percent composition, mass spectroscopy, combustion analysis
- the value and use of the mole
- how to determine the formula of a compound
- how a mass spectrometer physically analyzes an unknown compound

Students will be skilled at…

- Correctly and efficiently using a spectrophotometer
- Experimentally determining a calibration curve using spectroscopy and Beer's Law
- Writing, balancing, predicting products and applying stoichiometry to various reactions
- Using various lab skills or mathematical applications to determine the composition of an unknown substance or mixture
- Error analysis
- Serial dilutions
- Combustion analysis of an unknown organic compound

UNIT 2: AQUEOUS CHEMICAL REACTIONS

TIMELINE: 2 WEEKS - 9WK1

Unit Summary: Survey of various mathematical and lab skills involved with utilizing solutions after they have been created

- **Transfer Goal:** The student can use representations and models to communicate scientific phenomena and solve scientific problems

- The student can use mathematics appropriately
- The student can engage in scientific questions to extend thinking or to guide investigations
- The student can plan and implement data collection strategies in relation to a particular scientific question
- The student can perform data analysis and evaluation of evidence
- The student can work with scientific explanations and theories
- The student is able to connect and relate knowledge across various scales, concepts, and representations in and across domains

Students will know…

- details of the solvation process and factors that affect it
- Application of solubility rules to selective precipitation
- How to recognize and ID components within redox reactions

Students will be skilled at…

- redox titrations
- applying solubility rules to metathesis reactions
- writing net ionic equations, given word equations or balanced chemical equations
- drawing molecular models of the solvation, redox, and neutralization processes
- balancing redox reactions under acidic and basic conditions

UNIT 3: ELECTROCHEMISTRY

TIMELINE: 3 WEEKS- 9WK1

Unit Summary: The study of the interchange of chemical and electrical energy using REDOX reactions

- **Transfer Goal:**
- The student can use mathematics appropriately
- The student can engage in scientific questions to extend thinking or to guide investigations
- The student can plan and implement data collection strategies in relation to a particular scientific question
- The student can perform data analysis and evaluation of evidence
- The student can work with scientific explanations and theories
- The student is able to connect and relate knowledge across various scales, concepts, and representations in and across domains

Students will know…

- how to proficiently apply "OIL RIG" to determine electrodes' identity and properties
- the activity series and how it dictates the direction of reactions
- how to make qualitative and quantitative predictions about galvanic or electrolytic reactions based on half-cell reactions and potentials and/or Faraday's laws
- Free Energy is a necessary component of electrochemistry

Students will be skilled at…

- creating voltaic and electrolytic cells
- writing line notations to describe electrochemical cells
- construct voltaic cells with given components
- Justifying the choice of equation type (net ionic, ionic, molecular) in terms of utility for the given circumstances

- Choosing appropriate electrodes based on reduction potentials to meet requested parameters (voltage, time, etc)

UNIT 4: THERMOCHEMISTRY & THERMODYNAMICS

TIMELINE: 2.5 WEEKS- 9WK2

Unit Summary: The study of the interchange of chemical and electrical energy using REDOX reactions

- **Transfer Goal:**
- The student can use mathematics appropriately
- The student can engage in scientific questions to extend thinking or to guide investigations
- The student can plan and implement data collection strategies in relation to a particular scientific question
- The student can perform data analysis and evaluation of evidence
- The student can work with scientific explanations and theories
- The student is able to connect and relate knowledge across various scales, concepts, and representations in and across domains

*Students will **know** that…*

- the difference between endo and exothermic reactions
- Laws of Thermodynamics
- Gibbs' equation
- the Haber process
- Hess' law

*Students will be **skilled** at…*

- drawing and analyzing enthalpy level diagrams
- determining thermodynamic favorability
- analyzing contributions of various enthalpies
- analyzing reactions in terms of favorability, entropy, free energy, and enthalpy
- Calculating enthalpies of formation, neutralization, and combustion
- Determining if a process or characteristic (entropy, enthalpy, etc) is a state function

UNIT 5: ATOMIC STRUCTURE & PERIODICITY

TIMELINE: 1.5 WEEKS - 9WK2

Unit Summary: The study of the interchange of chemical and electrical energy using REDOX reactions

- **Transfer Goal:**
  - The student can use representations and models to communicate scientific phenomena and solve scientific problems
  - The student can use mathematics appropriately
  - The student can engage in scientific questions to extend thinking or to guide investigations
  - The student can plan and implement data collection strategies in relation to a particular scientific question
  - The student can perform data analysis and evaluation of evidence

- The student can work with scientific explanations and theories
- The student is able to connect and relate knowledge across various scales, concepts, and representations in and across domains

*Students will **know** that…*

- the trends of atomic size, electronegativity, electron affinity and ion size
- the sequence of atomic models
- Aufbau principle, Hunds' rule, Pauli Exclusion principle
- E= nhv & energy quantization equation
- Orbital shapes and energies

*Students will be **skilled** at…*

- graphing the trends
- predicting physical properties of unknowns
- interpreting PES graphs
- calculating wavelengths, energies, and velocities for a variety of atom/light interactions
- writing electron configurations for various elements

UNIT 6: BONDING

TIMELINE: 1.5 WEEKS - 9WK2

Unit Summary: The study of the interchange of chemical and electrical energy using REDOX reactions

- **Transfer Goal:**
  - The student can use representations and models to communicate scientific phenomena and solve scientific problems
  - The student can use mathematics appropriately
  - The student can engage in scientific questions to extend thinking or to guide investigations
  - The student can plan and implement data collection strategies in relation to a particular scientific question
  - The student can perform data analysis and evaluation of evidence
  - The student can work with scientific explanations and theories
  - The student is able to connect and relate knowledge across various scales, concepts, and representations in and across domains

Students will know…

- London dispersion forces are omnipresent between all atoms and molecules
- Localized electron models predict molecular shapes
- Forces of attraction between particles are important in determining many macroscopic properties of a substance, including how the observable physical state changes with temperature

Students will be skilled at…

- Creating localized electron models of molecules
- Identifying characteristics and properties of covalent, ionic, and metallic solids
- Predicting hybridization of molecules based on VSEPR shape
- Calculating formal charge and bond order

UNIT 7: ATOMIC STRUCTURE & PERIODICITY

TIMELINE: 2 WKS - 9WK2

Unit Summary: The study of the interchange of chemical and electrical energy using REDOX reactions

- **Transfer Goal:**
    - The student can use representations and models to communicate scientific phenomena and solve scientific problems
    - The student can use mathematics appropriately
    - The student can engage in scientific questions to extend thinking or to guide investigations
    - The student can plan and implement data collection strategies in relation to a particular scientific question
    - The student can perform data analysis and evaluation of evidence
    - The student can work with scientific explanations and theories
    - The student is able to connect and relate knowledge across various scales, concepts, and representations in and across domains

Students will know…

- London dispersion forces are omnipresent between all atoms and molecules
- Localized electron models predict molecular shapes
- Forces of attraction between particles are important in determining many macroscopic properties of a substance, including how the observable physical state changes with temperature

Students will be skilled at…

- Creating localized electron models of molecules
- Identifying characteristics and properties of covalent, ionic, and metallic solids
- Predicting hybridization of molecules based on VSEPR shape
- Calculating formal charge and bond order

UNIT 8: GASES

TIMELINE: 1.5 WEEKS- 9WK3

Unit Summary: The study of the interchange of chemical and electrical energy using REDOX reactions

- **Transfer Goal:**
    - The student can use representations and models to communicate scientific phenomena and solve scientific problems
    - The student can use mathematics appropriately
    - The student can engage in scientific questions to extend thinking or to guide investigations
    - The student can plan and implement data collection strategies in relation to a particular scientific question
    - The student can perform data analysis and evaluation of evidence
    - The student can work with scientific explanations and theories
    - The student is able to connect and relate knowledge across various scales, concepts, and representations in and across domains

Students will know…

- Real and ideal gases are significantly different and behave significantly differently
- Boltzmann distributions describe particle movement within a gaseous sample

Students will be skilled at…

- Quantifiable analysis of given gases under various conditions
- Gas stoichiometry calculations

UNIT 9: SOLIDS, LIQUIDS & SOLUTIONS

TIMELINE: 2 WKS - 9WK3

Unit Summary: The study of the interchange of chemical and electrical energy using REDOX reactions

- **Transfer Goal:**
    - The student can use representations and models to communicate scientific phenomena and solve scientific problems
    - The student can use mathematics appropriately
    - The student can engage in scientific questions to extend thinking or to guide investigations
    - The student can plan and implement data collection strategies in relation to a particular scientific question
    - The student can perform data analysis and evaluation of evidence
    - The student can work with scientific explanations and theories
    - The student is able to connect and relate knowledge across various scales, concepts, and representations in and across domains

Students will know…

- Real and ideal gases are significantly different and behave significantly differently
- Boltzmann distributions describe particle movement within a gaseous sample

Students will be skilled at…

- Quantifiable analysis of given gases under various conditions
- Gas stoichiometry calculations

UNIT 10: KINETICS

TIMELINE: 1.5 WKS - 9WK3

Unit Summary: The study of the interchange of chemical and electrical energy using REDOX reactions

- **Transfer Goal:**
    - The student can use representations and models to communicate scientific phenomena and solve scientific problems
    - The student can use mathematics appropriately
    - The student can engage in scientific questions to extend thinking or to guide investigations
    - The student can plan and implement data collection strategies in relation to a particular scientific question
    - The student can perform data analysis and evaluation of evidence
    - The student can work with scientific explanations and theories
    - The student is able to connect and relate knowledge across various scales, concepts, and representations in and across domains

Students will know…

- The rate of a reaction is influenced by the concentration or pressure of reactants, the phase of reactants and products, and environmental factors like temperature and solvent.
- Not all collisions successfully result in new products.
- The identity and function of reaction intermediates

Students will be skilled at…

- Analyzing data sets to determine rate equations
- Interpreting potential energy graphs to determine elementary rate mechanisms
- Identifying and interpreting elementary reactions
- Graphing zero order, first order, and 2nd order rate laws
-

UNIT 11: GENERAL EQUILIBRIUM

TIMELINE: 2WKS - 9WK3

Unit Summary: The study of the interchange of chemical and electrical energy using REDOX reactions

- **Transfer Goal:**
    - The student can use representations and models to communicate scientific phenomena and solve scientific problems
    - The student can use mathematics appropriately
    - The student can engage in scientific questions to extend thinking or to guide investigations
    - The student can plan and implement data collection strategies in relation to a particular scientific question
    - The student can perform data analysis and evaluation of evidence
    - The student can work with scientific explanations and theories
    - The student is able to connect and relate knowledge across various scales, concepts, and representations in and across domains

Students will know…

- G=-RTlnK
- What happens when Q and K values are different or the same
- The effects on solubility of the presence of a common ion under various concentrations
- How to set up RICE tables

Students will be skilled at…

- Calculating Q and K
- Comparing Q and K
- Calculating Ksp
- Including the Common Ion effect in calculations
- Using LeChatelier's principle to predict the effects of changing environments on a reactions' progress

UNIT 12: ACIDS & BASES

TIMELINE: 2WKS - 9WK4

Unit Summary: The study of the interchange of chemical and electrical energy using REDOX reactions

- **Transfer Goal:**
    - The student can use representations and models to communicate scientific phenomena and solve scientific problems
    - The student can use mathematics appropriately
    - The student can engage in scientific questions to extend thinking or to guide investigations
    - The student can plan and implement data collection strategies in relation to a particular scientific question
    - The student can perform data analysis and evaluation of evidence
    - The student can work with scientific explanations and theories
    - The student is able to connect and relate knowledge across various scales, concepts, and representations in and across domains

Students will know…

- Protons, not electrons, are transferred during acid-base reactions
- Neutralization reaction progress can be graphed by a titration curve
- Certain groups of elements have an easily predictable reaction in a neutralization.

- Conjugate acids and bases can be determined by looking at the formula of an acid or base and their behavior can be predicted based on their Ka or Kb values.

Students will be skilled at…

- Solving RICE tables for various situations
- Predicting titration curves
- Performing acid-base titrations
- Predicting properties of neutralization salts
-

UNIT 13: AQUEOUS EQUILIBRIUM

TIMELINE: 3WKS - 9WK4

Unit Summary: The study of the interchange of chemical and electrical energy using REDOX reactions

- **Transfer Goal:**
  - The student can use representations and models to communicate scientific phenomena and solve scientific problems
  - The student can use mathematics appropriately
  - The student can engage in scientific questions to extend thinking or to guide investigations
  - The student can plan and implement data collection strategies in relation to a particular scientific question
  - The student can perform data analysis and evaluation of evidence
  - The student can work with scientific explanations and theories
  - The student is able to connect and relate knowledge across various scales, concepts, and representations in and across domains

Students will know…

- Buffers absorb pH changes of additional acid or base volumes
- There are ideal buffers for every case
- pH changes to a buffer solution can be calculated
- pH =7 is not the same as [OH-] = [H+]

Students will be skilled at…

- Designing a buffer solution with a target pH and buffer capacity
- Relating the predominant form of a chemical species involving a labile proton to the pH of a solution and the pKa associated with the labile proton
- Calculating pH changes to an existing buffer solution with various additions of various acids and/or bases
-

UNIT 14: EXAM REVIEW

TIMELINE: 2 WKS - 9WK4

- **Practice exam: learners will take a previously released multiple choice and FRQ exam under College Board time constraints. I will score it and learners will review topics they choose to work on, based on the results.**
- **Daily review: Using "5 steps to a 5" I will guide a review discussion each day on a certain topic that a majority of learners indicate they want my help. We will review misconceptions, key points I predict will be needed on the exam, and work through more multiple choice questions and FRQ problems.**

UNIT 15: AFTER THE AP EXAM: Projects

Timeline: 4 wks - 9wk4

These proposed projects are subject to change, depending on time and materials available, and the learners' interests.

- **Personal testimony videos: Learners record a 2-3 minute video of their experience in AP Chemistry and any suggestions or advice they have for incoming learners**
- **Storeroom project: Under direct supervision- learners help clean, organize, inventory, and maintain chemicals, equipment, and glassware in our storage facilities**
- **Ice cream lab: learners design a protocol for preparing small samples of vanilla ice cream, highlighting the colligative properties of solutions**
- **Medicinal Chemistry: learners analyze over the counter pain medications and synthesize a sample of aspirin**
- **Nuclear Chemistry: learners investigate general Nuclear Chemistry concepts and discuss current and historical events tied to nuclear energy**
- **"Now that I know"….: Learners perform and re-write a previous experiment to demonstrate their improved understanding of the topic and its relevance to multiple concepts.**
- **Career project: learners research a career of their choice that uses or requires significant chemistry knowledge, presenting their findings to their peers in a multimedia product.**
- **Green Chemistry lab- Flinn Scientific: learners will analyze and perform environmentally friendly experiments**