

COMMUNITY UNIT SCHOOL DISTRICT 200

Chemistry High School Advanced Level

- 1. Subject Expectation (State Goal 11)** **The student will understand the processes of scientific inquiry and technological design, investigate questions, conduct experiments and solve problems.**

Essential Learning 1 (Learning Standard B)	Know and apply the concept, principles and processes of scientific inquiry
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| Critical Content | 11.A.5a | Formulate hypotheses referencing prior research and knowledge |
| | 11.A.4b | Conduct controlled experiments or simulations to test hypotheses |
| | 11.A.4c | Collect, organize and analyze data accurately and precisely |
| | 11.A.4d | Apply statistical methods to the data to reach and support conclusions |
| | 11.A.4e | Formulate alternative hypotheses to explain unexpected results |
| | 11.A.4f | Use available technology, report, display and defend conclusions drawn from investigations |
| | | <ul style="list-style-type: none">- calculators- lab equipment- presentation tools- research resources- computers- research- data collection and analysis- use of interfaces |
| | | <ul style="list-style-type: none">• know and apply the rules of significant figures in measurements• demonstrate and apply dimensional analysis• demonstrate and apply the metric system |

Essential Learning 2 (Learning Standard B)	Know and apply the concepts, principles and processes of technological design
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| Critical Content | 11.B.5a | Identify a design problem that has practical applications and propose possible solutions, considering such constraints as available tools, materials, time and costs |
| | 11.B.4b | Propose and compare different solution designs to the design problem based upon given constraints including available tools, materials and time |
| | | <ul style="list-style-type: none">• use interactive software to investigate different simulations• present lab data in groups |

- 11.B.4c Develop working visualizations of the proposed solution designs
- concept mapping
 - white board presentations
 - presentation software
- 11.B.4e Develop and test a prototype or simulation of the solution design using available materials, instruments and technology
- use interactive software to investigate different simulations
 - present lab data in groups
- 11.B.4f Evaluate the test results based on established criteria, note sources of error and recommend improvements
- use interactive software to investigate different simulations
 - present lab data in groups
- 11.B.4g Use available technology, report to an audience the relative success of the design based on the test results and criteria

2. Subject Expectation (State Goal 12) The student will understand the fundamental concepts, principles and interconnections of the life, physical and earth/space sciences.

Essential Learning 1 (Learning Standard C)	Know and apply kinetic theory and collision theory to explain energy transformation Know and apply concepts that describe properties of matter and energy and the interactions between them
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- Critical Content 12.C.4a Use kinetic theory and the laws of thermodynamics to explain energy transformations
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 - explain and calculate anticipated behavior of gases by using:
 - Boyle's Law
 - Charles' Law
 - Combined Gas Law
 - Ideal Gas Law
 - Avogadro's Law
- 12.C.5b Analyze properties of materials in relation to their physical and/or chemical structures
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 - explain and calculate how certain energy changes affect phase changes, especially as related to:
 - phase diagrams
 - boiling point
 - melting point
 - colligative properties
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 - differentiate the behavior of gases from that of liquids and solids in terms of the kinetic molecular theory

Essential Learning 2 (Learning Standard C)	Know and apply concepts that describe properties of matter and the principles that explain them
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Critical Content	12.C.5b	Analyze the properties of materials in relation to their chemical structures <ul style="list-style-type: none"> • use solubility concepts and data to qualitatively and quantitatively characterize solutions, including: <ul style="list-style-type: none"> - solubility curves - solubility products
	*	<ul style="list-style-type: none"> • compare and contrast heterogeneous and homogeneous mixtures
	*	<ul style="list-style-type: none"> • calculate solution concentrations according to: <ul style="list-style-type: none"> - molarity - molality - dilution - mass percent - electrolytes and non-electrolytes - chromatography

Essential Learning 3 (Learning Standard C)	Investigate and predict concepts relating to the nature of chemical change
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Critical Content	12.C.4b	Analyze and explain the atomic structure of matter <ul style="list-style-type: none"> • write and name chemical formulas including organic compounds
	12.C.5a	Analyze reactions in natural and man-made energy systems <ul style="list-style-type: none"> • apply the “mole concept” to: <ul style="list-style-type: none"> - balance chemical reactions - categorize types of chemical reactions, including product prediction - understand stoichiometric calculations - determine limiting reactants - calculate percent yield - construct net ionic equations - relate energy diagrams to endothermic and exothermic reactions
	*	<ul style="list-style-type: none"> • investigate electrochemical concepts: <ul style="list-style-type: none"> - define oxidation and reduction - relate electron transfer and reduction potentials - balance Redox equations by the half reaction method - explore the structure of electrochemical cells and batteries - conduct electrolysis and electroplating experiments
	*	<ul style="list-style-type: none"> • analyze qualitatively and quantitatively chemical reactions with respect to kinetics in terms of: <ul style="list-style-type: none"> - rate expressions - factors affecting rate
	*	<ul style="list-style-type: none"> • analyze chemical reactions with respect to chemical equilibrium in terms of: <ul style="list-style-type: none"> - equilibrium expressions and constants - LeChatelier’s Principle
	12.C.5b	Analyze the properties of materials in relation to their chemical structures <ul style="list-style-type: none"> • analyze the nature of acids and bases as they relate to:
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 - Arrhenius, Bronsted-Lowry, and Lewis acids and bases
 - pH calculations
 - hydrolysis
 - acid base indicators and titrations
 - buffers
 - name and identification of acids and bases
 - strong versus weak acids and bases

Essential Learning 4 **Investigate and apply the concepts of structure of matter.**
(Learning Standards C & D)

Critical Content	12.C.4b	Analyze and explain the atomic structure of matter <ul style="list-style-type: none"> • demonstrate an understanding of atomic structure as it relates to: <ul style="list-style-type: none"> - electron configurations - electron transition and bright line spectra - s, p, d and f orbitals - Bohr model - quantum mechanical model
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	12.D.4b	Describe the effects of electromagnetic and nuclear forces <ul style="list-style-type: none"> • explain the bonding and geometry of molecules in terms of: <ul style="list-style-type: none"> - types of bonding (ionic, covalent and metallic) - polarity - intermolecular forces - VSEPR Model • describe organic molecules as they relate to: <ul style="list-style-type: none"> - isomers - functional groups - nomenclature system - basic organic reactions • predict properties of certain species based on an understanding of the periodic table and periodicity in terms of: <ul style="list-style-type: none"> - electro negativity - electron affinity - ionization energy
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Essential Learning 5 **Know and apply wave theory and thermodynamic principles to**
(Learning Standard C) **explain energy changes in matter.**

Critical Content	12.C.4a	Use wave theory and the laws of thermodynamics to explain energy transformations
	12.C.5b	Analyze the properties of materials in relation to their chemical structures <ul style="list-style-type: none"> • Analyze the effects that electromagnetic radiation have on matter, as they relate to: <ul style="list-style-type: none"> - regions in the electromagnetic spectrum - energy associated with electron transitions • Differentiate between heat and temperature, especially as related to: <ul style="list-style-type: none"> - calorimetry - phase diagrams - heat of reaction
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**3. Subject Expectation
(State Goal 13)**

The student will understand the relationships among science, technology and society in historical and contemporary contexts.

Essential Learning 1 (Learning Standard A)

Know and apply the accepted practices of science

Critical Content	13.A.4a	Estimate and suggest ways to reduce the degree of risk involved in science activities <ul style="list-style-type: none">• safety contract• safety instruction• safety assessment
	13.A.4b	Assess the validity of lab results including sample size and potential sources of error as related to technology <ul style="list-style-type: none">• sample size• class sets of data• number of trials• awareness of limitations of measurement tools
	13.A.4c	Describe how scientific knowledge, explanations, and technological designs may change with new information over time <ul style="list-style-type: none">• investigate the development of any scientific model
	13.A.4d	Explain how peer review helps to assure the accurate use of data and improves the scientific process <ul style="list-style-type: none">• homework groups• discuss, present or debate a problem or question

Essential Learning 2 (Learning Standard B)

Know and apply concepts that describe the interaction between science, technology and society
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Critical Content	13.B.4a	Compare and contrast scientific inquiry and technological design as pure and applied sciences <ul style="list-style-type: none">• analyze the impact of science and technology on society
	13.B.5e	Assess how scientific and technological progress has affected other fields of study, careers and job markets and aspects of everyday life