



UTAH
Science – Chemistry
***Chemistry: Matter and Change* © 2005**

OBJECTIVES	PAGE REFERENCES
Standard I: Students will understand that all matter in the universe has a common origin and is made of atoms, which have structure and can be systematically arranged on the periodic table.	
Objective 1: Recognize the origin and distribution of elements in the universe.	
a. Identify evidence supporting the assumption that matter in the universe has a common origin.	SE: 70, 179 <i>Astronomy Connection</i> 152
b. Recognize that all matter in the universe and on earth is composed of the same elements.	SE: 179 <i>Astronomy Connection</i> 152 TWE: DI 124
c. Identify the distribution of elements in the universe.	SE: 70, 179 <i>Astronomy Connection</i> 152 <i>Section Assessment</i> 849 #4
d. Compare the occurrence of heavier elements on earth and in the universe.	SE: <i>Astronomy Connection</i> 152
Objective 2: Relate the structure, behavior, and scale of an atom to the particles that compose it.	
a. Summarize the major experimental evidence that led to the development of various atomic models, both historical and current.	SE: 87-91, 92-97, 117-118, 127-134 TWE: P 133 EX 89, 97 DI 94 DE 92-93 CJ 94
b. Evaluate the limitations of using models to describe atoms.	TWE: QD 129
c. Discriminate between the relative size, charge, and position of protons, neutrons, and electrons in the atom.	SE: 92-97 <i>Chapter Assessment</i> 112 #36 & #38 TWE: CJ 94 A 97 DI 98
d. Generalize the relationship of proton number to the element's identity.	SE: 98-99 <i>Chapter Assessment</i> 112 #44
e. Relate the mass and number of atoms to the gram-sized quantities of matter in a mole.	SE: 310-312, 313-319 <i>Chapter Assessment</i> 346-347 #89-106 TWE: CU 312, 318 QD 310 CJ 316 MC 315 A 317

OBJECTIVES	PAGE REFERENCES
Objective 3: Correlate atomic structure and the physical and chemical properties of an element to the position of the element on the periodic table.	
a. Use the periodic table to correlate the number of protons, neutrons, and electrons in an atom.	SE: 154, 156-157
b. Compare the number of protons and neutrons in isotopes of the same element.	SE: 100-104, 180 <i>MiniLab</i> 102 <i>Chapter Assessment</i> 112 #48 TWE: A 101, 807 IM 100
c. Identify similarities in chemical behavior of elements within a group.	SE: 163-169 <i>MiniLab</i> 164 <i>ChemLab</i> 170-171 <i>Chapter Assessment</i> 176 #82 TWE: CJ 161 DE 166-167 A 164
d. Generalize trends in reactivity of elements within a group to trends in other groups.	SE: 163-169 <i>ChemLab</i> 170-171 TWE: MC 167 RT 169
e. Compare the properties of elements (e.g., metal, nonmetallic, metalloid) based on their position in the periodic table.	SE: 155-158 <i>ChemLab</i> 170-171 <i>Discovery Lab</i> 151 <i>Chapter Assessment</i> 174 #32 & #37 TWE: A 158 QD 161
Standard II: Students will understand the relationship between energy changes in the atom specific to the movement of electrons between energy levels in an atom resulting in the emission or absorption of quantum energy. They will also understand that the emission of high-energy particles results from nuclear changes and that matter can be converted to energy during nuclear reactions.	
Objective 1: Evaluate quantum energy changes in the atom in terms of the energy contained in light emissions.	
a. Identify the relationship between wavelength and light energy.	SE: 118-123 <i>Chapter Assessment</i> 147 #76 TWE: QD 120 A 126
b. Examine evidence from the lab indicating that energy is absorbed or released in discrete units when electrons move from one energy level to another.	SE: 122-128 <i>MiniLab</i> 125 <i>Problem-Solving Lab</i> 130 <i>ChemLab</i> 142-143 <i>Chapter Assessment</i> 147 #71 TWE: A 128
c. Correlate the energy in a photon to the color of light emitted.	SE: 123-128 <i>Chapter Assessment</i> 147 #70-72 TWE: RT 126 A 128
d. After observing spectral emissions in the lab (e.g., flame test, spectrum tubes), identify unknown elements by comparison to known emission spectra.	SE: <i>MiniLab</i> 125 <i>ChemLab</i> 142-143 TWE: A 125

OBJECTIVES	PAGE REFERENCES
Objective 2: Evaluate how changes in the nucleus of an atom result in emission of radioactivity.	
a. Recognize that radioactive particles and wavelike radiations are products of the decay of an unstable nucleus.	SE: 105-106, 807, 810-812 <i>Section Assessment 814 #10 & #13</i> TWE: A 812 CU 813
b. Interpret graphical data relating half-life and age of a radioactive substance.	SE: 817 <i>MiniLab 819</i> <i>Section Assessment 820 #24</i> <i>Chapter Assessment 837 #83, #84 & #89</i> TWE: CU 819 A 818
c. Compare the mass, energy, and penetrating power of alpha, beta, and gamma radiation.	SE: 106-107, 811-812 <i>Chapter Assessment 112 #56</i> TWE: A 813
d. Compare the strong nuclear force to the amount of energy released in a nuclear reaction and contrast it to the amount of energy released in a chemical reaction.	SE: 810, 821-822 <i>Section Assessment 814 #14</i>
e. After researching, evaluate and report the effects of nuclear radiation on humans or other organisms.	SE: 829-831 <i>Chapter Assessment 838 #99</i> <i>Chemistry and Society 834</i> TWE: RT 831 EX 831
Standard III: Students will understand chemical bonding and the relationship of the type of bonding to the chemical and physical properties of substances.	
Objective 1: Analyze the relationship between the valence (outermost) electrons of an atom and the type of bond formed between atoms.	
a. Determine the number of valence electrons in atoms using the periodic table.	SE: 159-162, 179-185, 186-196 <i>Chapter Assessment 174 #49 & #50</i> TWE: RT 162
b. Predict the charge an atom will acquire when it forms an ion by gaining or losing electrons.	SE: 212-214, 221-224 <i>Section Assessment 214 #5</i> TWE: CJ 213 CD 212 CU 214 EX 214
c. Predict bond types based on the behavior of valence (outermost) electrons.	SE: 263-264 <i>Section Assessment 267 #65</i> TWE: CJ 263 IM 264 A 265
d. Compare covalent, ionic, and metallic bonds with respect to electron behavior and relative bond strengths.	SE: 215-220, 228-229, 241-247 <i>ChemLab 232-233</i> TWE: CJ 217, 243 A 218, 231 VL 228 DE 248-249

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Objective 2: Explain that the properties of a compound may be different from those of the elements or compounds from which it is formed.	
a. Use a chemical formula to represent the names of elements and numbers of atoms in a compound and recognize that the formula is unique to the specific compound.	SE: 70-73, 76-77, 221-225, 331-337 TWE: CJ 76, 225 A 227, 337 CU 227 EX 337
b. Compare the physical properties of a compound to the elements that form it.	SE: 74 <i>Chapter Assessment 83 #57</i>
c. Compare the chemical properties of a compound to the elements that form it.	SE: 74 <i>Chapter Assessment 83 #57</i>
d. Explain that combining elements in different proportions results in the formation of different compounds with different properties.	SE: 75-77 <i>Chapter Assessment 84 #73</i> TWE: CJ 76 DI 250 QD 75
Objective 3: Relate the properties of simple compounds to the type of bonding, shape of molecules, and intermolecular forces.	
a. Generalize, from investigations, the physical properties (e.g., malleability, conductivity, solubility) of substances with different bond types.	SE: 217-220, 228-229, 266 <i>Problem-Solving Lab 219</i> <i>MiniLab 230</i> <i>ChemLab 232-233</i> TWE: RT 231 A 233, 266 VL 228
b. Given a model, describe the shape and resulting polarity of water, ammonia, and methane molecules.	SE: 259-262, 264-266 <i>MiniLab 261</i> TWE: MC 260 RT 262
c. Identify how intermolecular forces of hydrogen bonds in water affect a variety of physical, chemical, and biological phenomena (e.g., surface tension, capillary action, boiling point).	SE: 395, 397-399, 404-405 <i>ChemLab 410-411</i> <i>Section Assessment 403 #17</i> TWE: A 395 QD 398 RT 403 IM 405
Standard IV: Students will understand that in chemical reactions matter and energy change forms, but the amounts of matter and energy do not change.	
Objective 1: Identify evidence of chemical reactions and demonstrate how chemical equations are used to describe them.	
a. Generalize evidences of chemical reactions.	SE: 62-63, 277-278 <i>Discovery Lab 277, 353</i> <i>ChemLab 78-79</i> <i>Section Assessment 65 #11; 283 #7</i> TWE: CJ 278 RS 303
b. Compare the properties of reactants to the properties of products in a chemical reaction.	SE: 62-63 TWE: QD 64

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c. Use a chemical equation to describe a simple chemical reaction.	SE: 278-283 <i>Chapter Assessment</i> 304-305 #71-79 TWE: IM 281 RS 303 QD 354 CU 355 RT 355
d. Recognize that the number of atoms in a chemical reaction does not change.	SE: 63-65, 280-283, 354-356 TWE: CJ 355 IM 281 A 282
e. Determine the molar proportions of the reactants and products in a balanced chemical reaction.	SE: 354-357, 358-359 <i>ChemLab</i> 374-375 <i>Chapter Assessment</i> 378-379 #54-63 TWE: CU 355 A 355 RT 355
f. Investigate everyday chemical reactions that occur in a student's home (e.g., baking, rusting, bleaching, cleaning).	SE: 62-63, 673-676 <i>Chemistry Online</i> 599 <i>MiniLab</i> 638 <i>How It Works</i> 376, 628 TWE: CJ 278, 530, 538 AC 847
Objective 2: Analyze evidence for the laws of conservation of mass and conservation of energy in chemical reactions.	
a. Using data from quantitative analysis, identify evidence that supports the conservation of mass in a chemical reaction.	SE: 63-65, 354-356 TWE: QD 64 CJ 355
b. Use molar relationships in a balanced chemical reaction to predict the mass of product produced in a simple chemical reaction that goes to completion.	SE: 360-363 <i>MiniLab</i> 362 <i>ChemLab</i> 374-375 <i>Chapter Assessment</i> 379-380 #64-75 TWE: RT 363 A 360, 363 QD 360 CU 363
c. Report evidence of energy transformations in a chemical reaction.	SE: 496-500 <i>Discovery Lab</i> 277, 489 <i>ChemLab</i> 520-521 TWE: QD 501 P 499
d. After observing or measuring, classify evidence of temperature change in a chemical reaction as endothermic or exothermic.	SE: 219, 247 <i>ChemLab</i> 520-521 <i>Section Assessment</i> 505 #27 TWE: QD 490 DE 492-493 CU 494

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e. Using either a constructed or a diagrammed electrochemical cell, describe how electrical energy can be produced in a chemical reaction (e.g., half reaction, electron transfer).	SE: 663-672 <i>ChemLab</i> 688-689 <i>Chapter Assessment</i> 693 #49 TWE: A 669, 671 DE 670-671
f. Using collected data, report the loss or gain of heat energy in a chemical reaction.	SE: 504 <i>Discovery Lab</i> 277, 489 <i>ChemLab</i> 520-521 <i>Chapter Assessment</i> 525 #87
Standard V: Students will understand that many factors influence chemical reactions and some reactions can achieve a state of dynamic equilibrium.	
Objective 1: Evaluate factors specific to collisions (e.g., temperature, particle size, concentration, and catalysts) that affect the rate of chemical reaction.	
a. Design and conduct an investigation of the factors affecting reaction rate and use the findings to generalize the results to other reactions.	SE: <i>Problem-Solving Lab</i> 533 <i>Discovery Lab</i> 529 <i>MiniLab</i> 539 <i>ChemLab</i> 550-551 <i>Section Assessment</i> 545 #23 TWE: A 542 DE 536-537
b. Use information from graphs to draw warranted conclusions about reaction rates.	SE: 533-534, 538-540, 546, 548-549 <i>ChemLab</i> 550-551 <i>MiniLab</i> 539 <i>Chapter Assessment</i> 555-556 #71 & #72 TWE: A 534 P 538 CU 541
c. Correlate frequency and energy of collisions to reaction rate.	SE: 532-534, 537-538 <i>ChemLab</i> 550-551 <i>Section Assessment</i> 535 #6 & #7 <i>Chapter Assessment</i> 556 #79 & #80 TWE: CU 535 RT 541 RS 553
d. Identify that catalysts are effective in increasing reaction rates.	SE: 539-541 <i>Discovery Lab</i> 529 <i>How It Works</i> 552 <i>Section Assessment</i> 541 #15 TWE: P 538 AC 540 CU 541 A 541
Objective 2: Recognize that certain reactions do not convert all reactants to products, but achieve a state of dynamic equilibrium that can be changed.	
a. Explain the concept of dynamic equilibrium.	SE: 561-563 TWE: VL 562
b. Given an equation, identify the effect of adding either product or reactant to a shift in equilibrium.	SE: 569-571 <i>MiniLab</i> 573 <i>Section Assessment</i> 574 #11 <i>Chapter Assessment</i> 591 #59 TWE: RT 574

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c. Indicate the effect of a temperature change on the equilibrium, using an equation showing a heat term.	SE: 572-573 <i>Chemistry and Technology</i> 588 <i>MiniLab</i> 573 <i>Section Assessment</i> 574 #13 <i>Chapter Assessment</i> 591 #62 & #63 TWE: A 571, 574 QD 570
Standard VI: Students will understand the properties that describe solutions in terms of concentration, solutes, solvents, and the behavior of acids and bases.	
Objective 1: Describe factors affecting the process of dissolving and evaluate the effects that changes in concentration have on solutions.	
a. Use the terms solute and solvent in describing a solution.	SE: 292, 453-460, 469-470, 471-475 <i>Chapter Assessment</i> 484 #48 TWE: IM 455 CD 458, 463 CU 461
b. Sketch a solution at the particle level.	SE: 455, 458, 467, 471 <i>Chapter Assessment</i> 484 #56 TWE: DI 455
c. Describe the relative amount of solute particles in concentrated and dilute solutions and express concentration in terms of molarity and molality.	SE: 462-470, 620-621 <i>ChemLab</i> 626-627 <i>Chapter Assessment</i> 484 #55, #76-79, #83 TWE: CD 463 MC 465 A 467 RE 469
d. Design and conduct an experiment to determine the factors (e.g., agitation, particle size, temperature) affecting the relative rate of dissolution.	Factors affecting rate of solvation (dissolution) are discussed on: SE: 456 <i>Chapter Assessment</i> 484 #52
e. Relate the concept of parts per million (PPM) to relevant environmental issues found through research.	TWE: EX 468 P 467
Objective 2: Summarize the quantitative and qualitative effects of colligative properties on a solution when a solute is added.	
a. Identify the colligative properties of a solution.	SE: 471-475 <i>MiniLab</i> 473 <i>Section Assessment</i> 475 #38 TWE: IM 472 A 474, 475 QD 474
b. Measure change in boiling and/or freezing point of a solvent when a solute is added.	SE: <i>MiniLab</i> 473 <i>Problems</i> 474-475 <i>Chapter Assessment</i> 485 #86, #87 & #89 <i>Appendix A</i> 881 #19-21 TWE: A 473
c. Describe how colligative properties affect the behavior of solutions in everyday applications (e.g., road salt, cold packs, antifreeze).	SE: 475 TWE: QD 474 A 474 CJ 474 DI 472

OBJECTIVES	PAGE REFERENCES
Objective 3: Differentiate between acids and bases in terms of hydrogen ion concentration.	
a. Relate hydrogen ion concentration to pH values and to the terms acidic, basic or neutral.	SE: 596-599, 610-614 <i>Problem-Solving Lab</i> 624 <i>Section Assessment</i> 601 #2; 616 #24 <i>Chapter Assessment</i> 631 #88 TWE: CU 615 RE 623
b. Using an indicator, measure the pH of common household solutions and standard laboratory solutions, and identify them as acids or bases.	SE: 616 <i>Discovery Lab</i> 595 TWE: EX 611 P 614 CJ 620 QD 622
c. Determine the concentration of an acid or a base using a simple acid-base titration.	SE: 618-621 <i>ChemLab</i> 626-627 <i>Section Assessment</i> 625 #38 TWE: A 619
d. Research and report on the uses of acids and bases in industry, agriculture, medicine, mining, manufacturing, or construction.	SE: 605, 615 <i>How It Works</i> 628 <i>Chapter Assessment</i> 632 #107 TWE: CJ 596, 609, 611, 617 CDIV 619
e. Evaluate mechanisms by which pollutants modify the pH of various environments (e.g., aquatic, atmospheric, soil).	SE: 847-849 <i>MiniLab</i> 848 <i>Earth Science Connection</i> 847 TWE: QD 847 CJ 620

Codes Used for TWE Pages

A	Assessment
AC	Applying Chemistry
CD	Concept Development
CDIV	Cultural Diversity
CJ	Chemistry Journal
CU	Check for Understanding
DE	Demonstration
DI	Differentiated Instruction
EX	Extension
IM	Identifying Misconceptions
MC	Math in Chemistry
P	Portfolio
QD	Quick Demo
RE	Reinforcement
RS	Review Strategies
RT	Reteach
VL	Visual Learning