Active Chemistry Correlation to the Massachusetts Science Curriculum Framework, Grades 9-10

Strand 3 : Physical Sciences (Chemistry and Physics)

Chemistry

Standards and Expected Performances	Location/Page where Standard is found
2. Properties of Matter	
2.1 Identify and explain some of the physical properties that are used to classify matter, e.g., density, melting point, and boiling point.	7-12, 96, 112, 126-128, 141, 146-147, 159-161, 204, 287-297, 292, 339, 476, 595-596, 599, 602-604, 606, 654, 672
2.2 Explain the difference between mixtures and pure substances.	19, 30, 71, 104-107, 164, 196, 215, 260, 262, 312, 337, 361-366, 451-452, 596, 763, 774, 784
2.3 Describe the four states of matter (solid, liquid, gas, plasma) in terms of energy, particle motion, and phase transitions.	114-119, 260, 364, 404-406, 410-413, 546-550, 555-558, 714-719
2.4 Distinguish between chemical and physical changes.	12,166, 282, 434-437, 439, 472, 524-526, 547, 556, 677, 678
3. Atomic Structure	
3.1 Trace the development of atomic theory and the structure of the atom from the ancient Greeks to the present (Dalton, Thompson, Rutherford, Bohr, and modern theory).	11-12, 19-22, 29-31, 39-41, 51-54
3.2 Interpret Dalton's atomic theory in terms of the Laws of Conservation of Mass, Constant Composition, and Multiple Proportions.	15, 20, 24, 34, 166, 270, 525, 623

3.3 Identify the major components of the nuclear atom (protons, neutrons, and electrons) and explain how they interact.	15-25, 29-31, 33-34, 39, 41, 47-49, 54, 59-63, 64-65, 71, 73 78, 79-85, 96, 159, 196, 200, 292, 304, 419, 448,499, 611, 646, 763, 838
3.4 Understand that matter has properties of both particles and waves.	35-42, 81-88, 302-305,
3.5 Using Bohr's model of the atom interpret changes (emission/absorption) in electron energies in the hydrogen atom corresponding to emission transitions between quantum levels.	36-39, 40, 43, 157- 161, 302,
3.6 Describe the electromagnetic spectrum in terms of wavelength and energy; identify regions of the electromagnetic spectrum.	36-39, 40, 43, 46-56, 157- 161, 300-306,
3.7 Write the electron configurations for elements in the first three rows of the periodic table.	68-76
3.8 Describe alpha, beta, and gamma particles; discuss the properties of alpha, beta, and gamma radiation; and write balanced nuclear reactions.	79-90
3.9 Compare nuclear fission and nuclear fusion and mass defect.	79-90
3.10 Describe the process of radioactive decay as the spontaneous breakdown of certain unstable elements (radioactive) into new elements (radioactive or not) through the spontaneous emission by the nucleus of alpha or beta particles. Explain the difference between stable and unstable isotopes.	79-90
3.11 Explain the concept of half-life of a radioactive element, e.g., explain why the half-life of C14 has made carbon dating a powerful tool in determining the age of very old objects.	79-90
4. Periodicity	
4.1 Explain the relationship of an element's position on the periodic table to its atomic number and mass.	15-22, 2634, 46-56, 58-67, 68-76, 77-91, 212, 276, 419
4.2 Use the periodic table to identify metals, nonmetals, metalloids, families (groups), periods, valence electrons, and reactivity with other elements in the table.	46-56, 58-67, 71-73, 196-197, 200, 287-297, 646, 838
4.3 Relate the position of an element on the periodic table to its electron configuration.	58-67, 68-76

4.4 Identify trends on the periodic table (ionization energy, electronegativity, electron affinity, and relative size of atoms and ions).	29-33, 39, 47, 49, 50-51, 54, 58, 67, 77, 78, 79-85, 89-91, 96, 159, 196, 304, 366, 448, 499, 611, 763, 772-774, 851,
5. Chemical Bonding	
5.1 Explain how atoms combine to form compounds through both ionic and covalent bonding.	163, 166, 186-190, 213-218, 222, 228-232, 256-258, 266-273, 276, 325, 356-360, 364-368, 392-397, 445, 456-463, 496-497, 525-526, 608, 613, 616, 619, 622-629,626-629, 636, 642-647, 672, 680-682, 725, 738, 757-765, 761,769-777, 838, 850-853
5.2 Draw Lewis dot structures for simple molecules.	71-76, 364-368, 451-455, 622-629, 757-765, 769-777, 838, 850-853,
5.3 Relate electronegativity and ionization energy to the type of bonding an element is likely to undergo.	47-48, 50-51, 58, 365-366, 772-774, 851, 862
5.4 Predict the geometry of simple molecules and their polarity (valence shell electron pair repulsion).	71-76, 364-368, 451-455, 622-629, 757-765, 769-777, 838, 850-853,
5.5 Identify the types of intermolecular forces present based on molecular geometry and polarity.	365,-366, 404, 410, 751, 753, 761, 769-770, 772-772, 794,
5.6 Predict chemical formulas based on the number of valence electrons.	13, 83, 65, 69, 104-106, 109, 164, 215, 595, 760
5.7 Name and write the chemical formulas for simple ionic and molecular compounds, including those that contain common polyatomic ions.	13, 83, 65, 69, 104-106, 109, 164, 215, 595, 760
6. Chemical Reactions and Stoichiometry	
6.1 Balance chemical equations by applying the law of conservation of mass.	21, 96, 102, 154, 163, 166, 186-190, 213-218, 222, 228-232, 256-258, 266-273, 276, 325, 356-360, 392-397, 445, 456-463, 525-526, 608, 613, 616, 619, 626-629, 636, 642-647, 672, 680-682, 725, 738, 761, 838

6.2 Recognize synthesis, decomposition, single displacement, double displacement, and neutralization reactions.	21, 96, 102, 154, 163, 166, 186-190, 213-218, 222, 228-232, 256-258, 266-273, 276, 325, 356-360, 392-397, 445, 456-463, 525-526, 608, 613, 616, 619, 626-629, 636, 642-647, 672, 680-682, 725, 738, 761, 838
6.3 Understand the mole concept in terms of number of particles, mass, and gaseous volume.	19-21, 78, 82, 96, 212, 215-216, 279, 394, 411, 412, 437, 570, 885
6.4 Determine molar mass, percent compositions, empirical formulas, and molecular formulas.	212, 217, 279, 411, 412, 570,
6.5 Calculate mass-mass, mass-volume, volume-volume, and limiting reactant problems for chemical reactions.	19-21, 78, 82, 96, 212, 215-216, 278, 280-283, 286, 394, 411, 412, 437, 570, 885
6.6 Calculate percent yield in a chemical reaction.	274-285, 408-415,
7. Gases and Kinetic Molecular Theory	
7.1 Using the kinetic molecular theory, explain the relationship between pressure and volume (Boyle's law), volume and temperature (Charles' law), and the number of particles in a gas sample (Avogadro's hypothesis).	575-583,
7.2 Explain the relationship between temperature and average kinetic energy.	114,-115, 373, 384, 411, 470, 472, 515, 712, 715, 738,
7.3 Perform calculations using the ideal gas law.	111-116, 403-405, 428, 715-721,
7.4 Describe the conditions under which a real gas deviates from ideal behavior.	404-405, 715
7.5 Interpret Dalton's empirical Law of Partial Pressures and use it to calculate partial pressures and total pressures.	15, 20, 24, 54,
7.6 Use the combined gas law to determine changes in pressure, volume, or temperature.	373, 383-387, 403-405, 410-415, 428, 577, 578, 580, 698-700, 714-721
8. Solutions	
8.1 Describe the process by which solutes dissolve in solvents.	122, 436, 440, 463, 624-627, 672, 697-698, 858-865, 884-887, 935

8.2 Identify and explain the factors that affect the rate of dissolving, i.e., temperature, concentration, and mixing.*	122, 405, 436, 437, 476, 480, 490, 617, 624-626, 633, 672, 867, 821-823, 848, 852, 857-859, 869, 870, 884, 888, 914
8.3 Describe the dynamic equilibrium that occurs in saturated solutions.	122, 405, 436, 437, 476, 480, 490, 617, 624-626, 633, 672, 867, 821-823, 848, 852, 857-859, 869, 870, 884, 888, 914
8.4 Calculate concentration in terms of molarity, molality, and percent by mass.	405, 436-437, 480, 490, 633, 822, 823, 848, 870, 884, 914
8.5 Use a solubility curve to determine saturation values at different temperatures.	863
8.6 Calculate the freezing point depression and boiling point elevation of a solution.	476
8.7 Write net ionic equations for precipitation reactions in aqueous solutions.	902-909
9. Acids and Bases	
9.1 Define Arrhenius' theory of acids and bases in terms of the presence of hydronium and hydroxide ions, and Bronsted's theory of acids and bases in terms of proton donor and acceptor, and relate their concentrations to the pH scale.	10, 13, 182, 184-190, 210, 213, 215, 233-234, 250, 257, 424, 445, 488-490, 491, 539, 570, 588, 625, 687-689, 703, 706, 754, 817, 820-824, 828-829, 868, 870-871,
9.2 Compare and contrast the nature, behavior, concentration and strength of acids and bases. a. Acid-base neutralization b. Degree of dissociation or ionization c. Electrical conductivity	10, 13, 182, 184-190, 210, 213, 215, 233-234, 250, 257, 424, 445, 488-490, 491, 539, 570, 588, 625, 687-689, 703, 706, 754, 817, 820-824, 828-829, 868, 870-871,
9.3 Identify a buffer and explain how it works.	490-491, 685-692
9.4 Explain how indicators are used in titrations and how they are selected.	182-185, 234, 319, 443-445, 486-488, 490-491, 495,625, 685-687, 868, 870, 871
9.5 Describe an acid-base titration. Identify when the equivalence point is reached and its significance.	485-495, 868, 870, 871
9.6 Calculate the pH or pOH of aqueous solutions using the hydronium or hydroxide ion concentration.	485-501

10. Equilibrium and Kinetics	
10.1 Write the equilibrium expression and calculate the equilibrium constant for a reaction.	877, 880-884, 886-888, 932
10.2 Predict the shift in equilibrium when the system is subjected to a stress (LeChatelier's principle).	877, 880-884, 886-888, 932
10.3 Identify the factors that affect the rate of a chemical reaction (temperature, concentration) and the factors that can cause a shift in equilibrium (concentration, pressure, volume, temperature).	170, 324-325, 341, 470, 480-481, 528, 538-539, 613-614, 706
10.4 Explain rates of reaction in terms of collision frequency, energy of collisions,and orientation of colliding molecules.	478-480
10.5 Define the role of activation energy in a chemical reaction.	170, 324-325, 341, 470, 480-481, 528, 538-539, 613-614, 706
11. Thermochemistry (Enthalpy)	
11.1 Interpret the law of conservation of energy.	166, 270, 333, 472, 525, 623
11.2 Explain the relationship between energy transfer and disorder in the universe.	86, 262, 333-335, 337-338, 859, 861
11.3 Analyze the energy changes involved in physical and chemical processes using calorimetry.	328, 516, 535-536, 560-566
11.4 Apply Hess's law to determine the heat of reaction.	318-327, 470-473, 514-518,
11.5 Oxidation-Reduction and Electrochemistry	
11.6 Describe the chemical processes known as oxidation and reduction.	147-148, 292-293, 357, 358, 498, 501, 506, 637, 645-646, 672
11.7 Assign oxidation numbers.	450, 452-453, 645
11.8 Balance oxidation-reduction equations by using half-reactions.	293,313, 314, 357
11.9 Identify the components, and describe the processes that occur in an electrochemical cell.	193, 195, 198, 200, 287-297, 318-327, 348, 353-358, 428
11.10 Explain how a typical battery, such as a lead storage battery or a dry cell, works.	26, 27, 33, 309, 311, 315-317, 348, 353-359, 428, 615, 873,

11.11 Compare and contrast voltaic and electrolytic cells and their uses.	193, 195, 198, 200, 348, 353-358, 428
11.12 Calculate the net voltage of a cell given a table of standard reduction potentials.	286-294, 353-355