Alabama Science

# Chemistry

**Matter and Its Interactions**

**Structure and Properties**

**Patterns**

1 Use the periodic table as a model to predict the structure and properties of atoms and elements. CHE.1

**Structure and Properties**

**Structure and Function**

**Structure and Properties**

**Cause and Effect**

**Structure and Properties**

**Patterns**

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**Assess the merits and limitations of historic and modern atomic models pertaining to the presence, position, mass, and charge of subatomic particles.** CHE.1.A

**a Assess the merits and limitations of historic and modern atomic models pertaining to the presence, position, mass, and charge of subatomic particles.** CHE.1.A

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**Develop and use models of an element's subatomic particles to compare and contrast its atoms, ions, and isotopes.** CHE.1.B

**b Develop and use models of an element's subatomic particles to compare and contrast its atoms, ions, and isotopes.** CHE.1.B

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**Analyze and interpret data to identify or describe an element based on its number of pr ab its organization and**

**c Analyze and interpret data to identify or describe an element based on its number of protons, its relative abundance of isotopes, its organization and placement of electrons, and its light emission spectrum.** CHE.1.C

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| **placement of electrons, and its light emission spectrum.** CHE.1.C | |
| **Ask questions to determine the relationship between an element's physical and chemical properties and its position on the periodic table.** CHE.1.D | **d** **Ask questions to determine the relationship between an element's physical and chemical properties and its position on the periodic table.** CHE.1.D |
| **Construct explanations of how periodic trends can be used to predict the properties of elements.** CHE.1.E | **e** **Construct explanations of how periodic trends can be used to predict the properties of elements.** CHE.1.E |
| **Motion and Stability: Forces and Interactions** | **Atomic and Molecular Interactions**<br>**Structure and Function**<br>2 Construct explanations of the formation of intramolecular and intermolecular forces and their effects on atomic and molecular interactions. CHE.2<br>**Atomic and Molecular Interactions**<br>**Systems and System Models**<br>**Atomic and Molecular Interactions**<br>**Cause and Effect**<br>**Atomic and Molecular Interactions**<br>**Scale, Proportion, and Quantity**<br>**Atomic and Molecular Interactions**<br>**Systems and System Models**<br>**Atomic and Molecular Interactions**<br>**Patterns**<br>**Atomic and Molecular Interactions**<br>**Structure and Function** |

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| **Develop and use Lewis dot diagrams to model the formation of covalent and ionic bonds.** CHE.2.A | **a** **Develop and use Lewis dot diagrams to model the formation of covalent and ionic bonds.** CHE.2.A |
| **Construct an explanation of the change in potential energy that occurs when chemical bonds are formed.** CHE.2.B | **b** **Construct an explanation of the change in potential energy that occurs when chemical bonds are formed.** CHE.2.B |
| **Plan and carry out an investigation to identify specific physical and chemical properties of compounds formed from ionic, covalent, and metallic bonding.** CHE.2.C | **c** **Plan and carry out an investigation to identify specific physical and chemical properties of compounds formed from ionic, covalent, and metallic bonding.** CHE.2.C |
| **Develop and use models based on valence shell electron pair repulsion (VSEPR) theory to predict the shape of a molecule up to four electron domains around the central atom.** CHE.2.D | **d** **Develop and use models based on valence shell electron pair repulsion (VSEPR) theory to predict the shape of a molecule up to four electron domains around the central atom.** CHE.2.D |
| **Construct an explanation of the polarity of a molecule based on electronegativity data and molecular geometry.** CHE.2.E | **e** **Construct an explanation of the polarity of a molecule based on electronegativity data and molecular geometry.** CHE.2.E |
| **Analyze and interpret data from the periodic table to derive chemical formulas and names for ionic and covalent compounds.** CHE.2.F | **f** **Analyze and interpret data from the periodic table to derive chemical formulas and names for ionic and covalent compounds.** CHE.2.F |

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| **Analyze and interpret data to compare the strengths of intermolecular forces and to explain how these forces affect physical properties.** CHE.2.G | **g** **Analyze and interpret data to compare the strengths of intermolecular forces and to explain how these forces affect physical properties.** CHE.2.G |
| **Matter and Its Interactions: Energy** | **Chemical Reactions**<br>**Systems and System Models**<br>3 Develop and use multiple types of models to represent chemical reactions. CHE.3<br>**Chemical Reactions**<br>**Scale, Proportion, and Quantity**<br>**Chemical Reactions**<br>**Patterns**<br>**Chemical Reactions**<br>**Energy and Matter**<br>**Chemical Reactions**<br>**Stability and Change** |
| **Use qualitative and quantitative reasoning to describe and balance chemical equations to satisfy the law of conservation of matter.** CHE.3.A | **a** **Use qualitative and quantitative reasoning to describe and balance chemical equations to satisfy the law of conservation of matter.** CHE.3.A |
| **Use qualitative and quantitative reasoning to classify chemical reactions, predict the products of single replacement and double replacement reactions, and represent chemical reactions using ionic eq** | **b** **Use qualitative and quantitative reasoning to classify chemical reactions, predict the products of single replacement and double replacement reactions, and represent chemical reactions using ionic equations.** CHE.3.B |

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**Analyze and interpret temperature and bond energy data to classify a reaction as endothermic or exothermic.** CHE.3.C

c **Analyze and interpret temperature and bond energy data to classify a reaction as endothermic or exothermic.** CHE.3.C

**Construct an explanation, using particle diagrams and collision theory, for how particle size, concentration, and temperature affect the rate of a chemical reaction.** CHE.3.D

d **Construct an explanation, using particle diagrams and collision theory, for how particle size, concentration, and temperature affect the rate of a chemical reaction.** CHE.3.D

**Matter and Its Interactions**

**Stoichiometry**

**Scale, Proportion, and Quantity**

4 Use stoichiometric ratios to support the claim that atoms, and therefore mass, are conserved during chemical reactions. CHE.4

a Quantitatively apply the concepts of the mole and Avogadro's number to conceptualize and calculate percent composition and empirical or molecular formulas of common compounds. CHE.4.A

b Use mathematical representations of the mole concept to solve reaction stoichiometry problems, involving mole-to-mole conversions, mass-to-mole conversions, and mass-to-mass conversions. CHE.4.B

c Use mathematical models to reveal the relationships among the theoretical, actual, and percent yields of chemical reactions. CHE.4.C

d Qualitatively and quantitatively determine the limiting reactant when given the masses of all reactants. CHE.4.D

e Use mathematics and computational thinking to perform gas stoichiometry calculations involving mass, volume, and number of moles at standard temperature and pressure (STP). CHE.4.E

**Solutions**

**Structure and Function**

5 Obtain, evaluate, and communicate information concerning factors that affect solubility and the properties of solutions. CHE.5

a Use mathematics and computational thinking to express the concentrations of given solutions in terms of molarity and molality. CHE.5.A

b Develop and use models to illustrate solute-solvent interactions. CHE.5.B

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**olutions**

**Scale, Proportion, and Quantity**

**Solutions**

**Cause and Effect**

**Acids and Bases**

6 Make qualitative and quantitative claims, based on ion concentration, about the acidic, basic, or neutral characteristics of a solution. CHE.6

a Obtain, evaluate, and communicate information concerning the properties of acids and bases. CHE.6.A

b Use the periodic table and computational thinking to derive chemical formulas and names of acids and bases. CHE.6.B

**Acids and Bases**

**Structure and Function**

**Acids and Bases**

**Scale, Proportion, and Quantity**

**Use mathematics and computational thinking to prepare solutions from both solids and concentrated solutions when given a desired molarity and volume.** CHE.5.C

c **Use mathematics and computational thinking to prepare solutions from both solids and concentrated solutions when given a desired molarity and volume.** CHE.5.C

**Analyze and interpret data to explain the effects of temperature on the solubility of solid, liquid, and gaseous solutes in a solvent and the effects of pressure on the solubility of gaseous solutes.** CHE.5.D

d **Analyze and interpret data to explain the effects of temperature on the solubility of solid, liquid, and gaseous solutes in a solvent and the effects of pressure on the solubility of gaseous solutes.** CHE.5.D

**Design and conduct experiments to evaluate the effect of solute concentration on the colligative properties of a solution.**

e **Design and conduct experiments to evaluate the effect of solute concentration on the colligative properties of a solution.** CHE.5.E

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| **Use multiple models to predict the relative properties of strong, weak, concentrated, and dilute acids and bases.** CHE.6.C | **c Use multiple models to predict the relative properties of strong, weak, concentrated, and dilute acids and bases.** CHE.6.C |
| **Use mathematics to calculate the pH, pOH, [OH- ], and [H3O+ ] of common solutions.** CHE.6.D | **d Use mathematics to calculate the pH, pOH, [OH- ], and [H3O+ ] of common solutions.** CHE.6.D |
| **Plan and carry out a strong acid-strong base titration to determine the concentration of an unknown acidic or basic solution.** CHE.6.E | **e Plan and carry out a strong acid-strong base titration to determine the concentration of an unknown acidic or basic solution.** CHE.6.E |

**Energy**

**Gases**

**Cause and Effect**

7 Plan and carry out investigations to determine how the atomic and molecular motion in chemical and physical processes is related to the kinetic molecular theory. CHE.7

- a Qualitatively and quantitatively relate changes in the temperature and pressure of a gas to particle motion and number of collisions. CHE.7.A
- b Express the relationship among pressure, volume, temperature, and the number of moles of a gas quantitatively, conceptually, and graphically. CHE.7.B