## Chemistry K-12 Vertical Alignment

<table>
<thead>
<tr>
<th>Topic</th>
<th>Grade</th>
<th>Grade 1</th>
<th>Grade 2</th>
<th>Grade 3</th>
<th>Grade 4</th>
<th>Grade 5</th>
<th>Grade 6</th>
<th>Grade 7</th>
<th>Grade 8</th>
<th>Middle School</th>
<th>High School</th>
<th>Advanced Placement</th>
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</thead>
<tbody>
<tr>
<td>Physical &amp; Chemical Properties</td>
<td>6.6.C</td>
<td>Explain and predict changes in reaction to sound and lighting and their effects on the environment.</td>
<td>Explain and predict changes in temperature and light and their effects on the environment.</td>
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<tr>
<td>Materials Science</td>
<td>5.6.B</td>
<td>Demonstrate and explain the properties of a system made of large-scale particles such as a toy that can be taken apart and put back together.</td>
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<tr>
<td>Types of Mixtures</td>
<td>2.6.A</td>
<td>Matter is composed of atoms and molecules that are arranged in a fixed pattern.</td>
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</table>
### Atomic Theory & the Periodic Table

1. Explain how molecules and atoms are made up of subatomic particles such as protons, neutrons, and electrons.
2. Classify and record elements and compounds in terms of their atomic and molecular structures, including periodic trends.
3. Write the chemical formulas for simple molecules and ions, and predict their properties based on electronegativity differences.
4. Analyze and interpret elemental data, including atomic radius, electronegativity, and ionization energy, to identify periodic trends.

### Element Bonding

1. Construct models using atomic structure, bonds, and molecular geometry to understand the forces between atoms in molecules and compounds.
2. Name and write the chemical formulas for covalent, ionic, and molecular compounds using the International Union of Pure and Applied Chemistry (IUPAC) nomenclature rules.
3. Apply the concept of molecular structure to explain intermolecular and intramolecular forces.
4. Differentiate between empirical and molecular formulas, and calculate molar mass and molar concentration.
<table>
<thead>
<tr>
<th>Stoichiometry</th>
<th>Conservation of Mass</th>
<th>Gas Laws</th>
<th>Nuclear</th>
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</thead>
<tbody>
<tr>
<td><strong>Chem.8.B</strong></td>
<td><strong>Chem.9.C</strong></td>
<td><strong>Chem.10.B</strong></td>
<td><strong>Chem.8.C</strong></td>
</tr>
<tr>
<td>calculate the number of atoms or</td>
<td>perform stoichiometric calculations,</td>
<td>describe and calculate the relationships among volume, pressure, number of moles, and temperature for an ideal gas; describe and apply the concept of the balanced nuclear equation;</td>
<td>calculate percent composition of compounds;</td>
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<tr>
<td>molecules in a sample of material</td>
<td>including determination of mass, gas volume, and percent yield; using the law of conservation of mass;</td>
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<td>describe the concept of limiting reactants in a balanced chemical equation.</td>
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<td>using Avogadro's number;</td>
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<tr>
<td><strong>Chem.9.C</strong></td>
<td></td>
<td><strong>Chem.10.C</strong></td>
<td><strong>Chem.14.C</strong></td>
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<tr>
<td>perform stoichiometric calculations, including determination of mass, gas volume, and percent yield; using the law of conservation of mass;</td>
<td>define and apply Dalton's law of partial pressure.</td>
<td>define and apply Dalton's law of partial pressure.</td>
<td>give examples of applications of nuclear phenomena such as nuclear medicine, radiation therapy, nuclear power generation, and nuclear power generation.</td>
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<td><strong>Chem.14.B</strong></td>
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<td>calculate percent composition of</td>
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<td>compare fission and fusion reactions;</td>
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<td>compounds;</td>
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<td>describe the concept of limiting</td>
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<td>describe the characteristics of alpha, beta, and gamma radioactive decay processes;</td>
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<td>reactants in a balanced chemical</td>
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<td>equation.</td>
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<td><strong>IPC.8.B</strong></td>
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<td>develop and use models to balance</td>
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<td>chemical equations and support the</td>
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<td>claim that atoms, and therefore mass, are conserved during a chemical reaction;</td>
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<td>research and communicate the uses, advantages, and applications of current nuclear technologies; and</td>
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**Key**
- Black text indicates the topic of the row.
- Blue text signifies the cross-curricular material.

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