## Structure and Properties of Matter

### CP.1.1 Understand and explain that atoms have a positive nucleus (consisting of relatively massive positive protons and neutral neutrons) surrounded by negative electrons of much smaller mass, some of which may be lost, gained, or shared when interacting with other atoms.

| TE: | Teacher Demo: 104, 110 |
| TR: | Guided Reading and Study Workbook With Math Support: 4.1, 4.2, 6.1 |

### CP.1.2 Realize that and explain how a neutral atom’s atomic number and mass number can be used to determine the number of protons, neutrons, and electrons that make up an atom.

| SE/TE: | 110, 112 |
| TE: | Teacher Demo: 110; Build Science Skills: 112 |
| TR: | Guided Reading and Study Workbook With Math Support: 4.2; Laboratory Manual: 4A |
| TECH: | iText; PHSchool.com Web Code; NSTA SciLinks Web Code; Science News Web Code: |

### CP.1.3 Understand, and give examples to show, that isotopes of the same element have the same numbers of protons and electrons but differ in the numbers of neutrons.

<p>| SE/TE: | 112 |
| TR: | Guided Reading and Study Workbook With Math Support: 4.3; Laboratory Manual: 4A |
| TECH: | iText: 4.3 |</p>
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<td>CP.1.4 Know and explain that physical properties can be used to differentiate among pure substances, solutions, and heterogeneous mixtures.</td>
<td>SE/TE: 38-44, 45-48, 50, 164, 231-232; Quick Lab: 167, 232; Data Analysis: 42</td>
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<td>TE:  Teacher Demo: 43, 48, 231; Build Science Skills: 50</td>
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<td>TR:  Guided Reading and Study Workbook With Math Support: 2.1; 2.2, 8.1; Laboratory Manual: 2B, 3A</td>
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**Changes in Matter**

| CP.1.5 Distinguish among chemical and physical changes in matter by identifying characteristics of these changes. | SE/TE: 51, 56-58, 84-91, 192-194, 199-205, 206-209; Inquiry Activity: 191; Quick Lab: 56, 90, 203 |
| | TE:  Teacher Demo: 55, 86, 200; Build Science Skills: 208 |
| | TR:  Guided Reading and Study Workbook With Math Support: 2.2, 2.3, 3.3, 7.1, 7.2, 7.3; Laboratory Manual: 7A |

| CP.1.6 Understand and explain how an atom can acquire an unbalanced electrical charge by gaining or losing electrons. | SE/TE: 159-160 |
| | TE:  Build Science Skills: 159 |
| | TR:  Guided Reading and Study Workbook With Math Support: 6.1 |

| CP.1.7 Identify the substances gaining and losing electrons in simple oxidation-reduction reactions. | SE/TE: 204-205 |
| | TE:  Build Science Skills: 204 |
| | TR:  Guided Reading and Study Workbook With Math Support: 7.2 |
| | TECH:  iText: 7.2; NSTA SciLinks Web Code: ccn-1072 |

<p>| CP.1.8 Know and explain that the nucleus of a radioactive isotope is unstable and may spontaneously decay, emitting particles and/or electromagnetic radiation. | SE/TE: 292-296; Inquiry Activity: 291 |
| | TE:  Teacher Demo: 294 |
| | TR:  Guided Reading and Study Workbook With Math Support: 10.1; Laboratory Manual: 10B |
| | TECH:  iText: 10.1; Planet diary Web Code: ccc-1101 |</p>
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| **CP.1.9** Show how the predictability of the nuclei decay rate allows radioactivity to be used for estimating the age of materials that contain radioactive substances. | SE/TE: 298-301; Quick Lab: 300  
TE: Teacher Demo: 299  
TR: Guided Reading and Study Workbook With Math Support: 10.2; Laboratory Manual: 10A  
TECH: iText: 10.2; NSTA SciLinks Web Code: ccn-1102 |
| **CP.1.10** Understand that the Periodic Table is a listing of elements arranged by increasing atomic number, and use it to predict whether a selected atom would gain, lose, or share electrons as it interacts with other selected atoms. | SE/TE: 126-129, 130-133, 139-145, 159, 165-166; Quick Lab: 128  
TE: Teacher Demo: 141  
TR: Guided Reading and Study Workbook With Math Support: 5.1, 5.2, 5.3; Laboratory Manual: 5B  
| **CP.1.11** Understand and give examples to show that an enormous variety of biological, chemical, and physical phenomena can be explained by changes in the arrangement and motion of atoms and molecules. | SE/TE: 51, 56-58, 72-74, 84-91, 200, 709-711, 717; Exploration Lab: 92-93; Concepts in Action: 52-53, 210-211; How it Works: 201  
TE: Teacher Demo: 86; Build Science Skills: 50  
TR: Guided Reading and Study Workbook With Math Support: 2.2, 2.3, 3.3, 23.2, 23.3; Laboratory Manual:  
| **CP.1.12** Realize and explain that because mass is conserved in chemical reactions, balanced chemical equations must be used to show that atoms are conserved. | SE/TE: 193-198; Inquiry Activity: 191; Quick Lab: 196  
TE: Teacher Demo: 195; Build Science Skills: 197  
TR: Guided Reading and Study Workbook With Math Support: 7.1  
| **CP.1.13** Explain that the rate of reactions among atoms and molecules depends on how often they encounter one another, which is in turn affected by the concentrations, pressures, and temperatures of the reacting materials. | SE/TE: 212-215, 218-219; Quick Lab: 214; Design Your Own Lab: 220-221  
TE: Teacher Demo: 213; Build Science Skills: 213  
TR: Guided Reading and Study Workbook With Math Support: 7.4, 7.5  

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| CP.1.14 Understand and explain that catalysts are highly effective in encouraging the interaction of other atoms and molecules. | SE/TE: 215, 284; Quick Lab: 214  
TE: Teacher Demo: 284  
TR: Guided Reading and Study Workbook With Math Support: 7.4, 9.4  
TECH: iText: 7.4, 9.4 |
| **Energy Transformations**                                   |                                                                                  |
| CP.1.15 Understand and explain that whenever the amount of energy in one place or form diminishes, the amount in other places or forms increases by the same amount. | SE/TE: 453-459; Inquiry Activity: 445; Quick Lab: 454  
TE: Teacher Demo: 456  
TR: Guided Reading and Study Workbook With Math Support: 15.2; Laboratory Manual: 15B  
| CP.1.16 Explain that heat energy in a material consists of the disordered motions of its atoms or molecules. | SE/TE: 474-476; Quick Lab: 476  
TR: Guided Reading and Study Workbook With Math Support: 16.1  
TECH: iText: 16.1; PHSchool.com Web Code: cca-2160 |
| CP.1.17 Know and explain that transformations of energy usually transform some energy into the form of heat, which dissipates by radiation or conduction into cooler surroundings. | SE/TE: 479-483, 828-831; Quick Lab: 476, 481  
TE: Teacher Demo: 480; Build Science Skills: 482  
TR: Guided Reading and Study Workbook With Math Support: 16.2, 26.1; Laboratory Manual: 16A, 16B  
| CP.1.18 Recognize and describe the heat transfer associated with a chemical reaction or a phase change as either exothermic or endothermic, and understand the significance of the distinction. | SE/TE: 86, 88-91, 208-209; Quick Lab: 90; Exploration Lab: 92-93  
TE: Teacher Demo: 86; Build Science Skills: 208  
TR: Guided Reading and Study Workbook With Math Support: 3.3, 7.3; Probeware Lab Manual: Lab 1  
TECH: iText: 3.3, 7.3 |
| CP.1.19 Understand and explain that the energy released whenever heavy nuclei split or light nuclei combine is roughly a million times greater than the energy absorbed or released in a chemical reaction. \((E=mc^2)\) | SE/TE: 309-315, 459, 828-829; Science and History: 312-313; How it Works: 314  
TE: Teacher Demo: 311; Build Science Skills: 315  
TR: Guided Reading and Study Workbook With Math Support: 10.4  
TECH: iText: 10.4; NSTA SciLinks Web Code: ccn-1104 |
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<td>CP.1.20 Realize and explain that the energy in a system is the sum of both potential energy and kinetic energy.</td>
<td>SE/TE: 456-458&lt;br&gt;TE: Teacher Demo: 456&lt;br&gt;TR: Guided Reading and Study Workbook With Math Support: 15.2&lt;br&gt;TECH: iText: 15.2</td>
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<td><strong>Motion</strong></td>
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<td>CP.1.21 Understand and explain that the change in motion of an object (acceleration) is proportional to the net force applied to the object and inversely proportional to the object’s mass. ( a = \frac{F}{m} )</td>
<td>SE/TE: 364-369; Inquiry Activity: 355; Concepts in Action: 370-371&lt;br&gt;TE: Teacher Demo: 365, 367&lt;br&gt;TR: Guided Reading and Study Workbook With Math Support: 12.2; Laboratory Manual: 12A, 12B&lt;br&gt;TECH: iText: 12.2; PHSchool.com Web Code: cca2120; NSTA SciLinks Web Code: ccn2122; Discovery Channel Videotapes: Air Forces</td>
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<td>CP.1.22 Recognize and explain that whenever one object exerts a force on another, an equal and opposite force is exerted back on it by the other object.</td>
<td>SE/TE: 372-373&lt;br&gt;TE: Build Science Skills: 373&lt;br&gt;TR: Guided Reading and Study Workbook With Math Support: 12.3&lt;br&gt;TECH: iText: 12.3; NSTA SciLinks Web Code: ccn2123</td>
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| CP.1.25 | Understand and explain that waves can superpose on one another, bend around corners, reflect off surfaces, be absorbed by materials they enter, and change direction when entering a new material. | SE/TE: 508-512, 516; Exploration Lab: 524-525  
TE: Teacher Demo: 508-512  
TR: Guided Reading and Study Workbook With Math Support: 17.3  
|---|---|---|
| CP.1.26 | Realize and explain that all motion is relative to whatever frame of reference is chosen, for there is no absolute motionless frame from which to judge all motion. | SE/TE: 328-329  
TE: Teacher Demo: 329  
TR: Guided Reading and Study Workbook With Math Support: 11.1; Laboratory Manual: 11A  
TECH: iText: 11.1; NSTA SciLinks Web Code: ccn-2111 |
| **Forces of Nature** | | |
| CP.1.27 | Recognize and describe that gravitational force is an attraction between masses and that the strength of the force is proportional to the masses and decreases rapidly as the square of the distance between the masses increases. \( F = G \frac{m_1 m_2}{r^2} \) | SE/TE: 380-382, 792; Quick Lab: 380  
TE: Build Science Skills: 381  
TR: Guided Reading and Study Workbook With Math Support: 12.4  
TECH: iText: 12.4; NSTA SciLinks Web Code: ccn-2124 |
| CP.1.28 | Realize and explain that electromagnetic forces acting within and between atoms are vastly stronger than the gravitational forces acting between atoms. | SE/TE: 378-380, 601  
TE: Teacher Demo: 379  
TR: Guided Reading and Study Workbook With Math Support: 12.4  
TECH: iText: 12.4 |
| CP.1.29 | Understand and explain that at the atomic level, electric forces between oppositely charged electrons and protons hold atoms and molecules together and thus, are involved in all chemical reactions. | SE/TE: 206-207, 379-380  
TR: Guided Reading and Study Workbook With Math Support: 7.3, 12.4  
TECH: iText: 7.3, 12.4 |
| CP.1.30 | Understand and explain that in materials, there are usually equal proportions of positive and negative charges, making the materials as a whole electrically neutral. However, also know that a very small excess or deficit of negative charges will produce noticeable electric forces. | SE/TE: 168-169, 600-603  
TE: Teacher Demo: 168, 169, 601; Build Science Skills: 168  
TR: Guided Reading and Study Workbook With Math Support: 6.2, 20.1; Laboratory Manual: 20B  
TECH: iText: 6.2, 20.1 |
| CP.1.31 | Realize and explain that moving electric charges produce magnetic forces, and moving magnets produce electric forces. | SE/TE: 635-639; Quick Lab: 637; Application Lab: 648-649; Concepts in Action: 640-641  
TE: Teacher Demo: 636, 638  
TR: Guided Reading and Study Workbook With Math Support: 21.2  

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**Historical Perspectives of Integrated Chemistry – Physics**

**Science: Integrated Chemistry-Physics: Standard 2**

Students gain understanding of how the scientific enterprise operates through examples of historical events. Through the study of these events, they understand that new ideas are limited by the context in which they are conceived, are often rejected by the scientific establishment, sometimes spring from unexpected findings, and grow or transform slowly through the contributions of many different investigators.

<p>| CP.2.1 | Explain that Antoine Lavoisier invented a whole new field of science based on a theory of materials, physical laws, and quantitative methods, with the conservation of matter at its core. Recognize that he persuaded a generation of scientists that his approach accounted for the experimental results better than other chemical systems. | SE/TE: 126, 193 |
| CP.2.2 | Describe how Lavoisier’s system for naming substances and describing their reactions contributed to the rapid growth of chemistry by enabling scientists everywhere to share their findings about chemical reactions with one another without ambiguity. | SE/TE: 126 |
| CP.2.3 | Explain that John Dalton’s modernization of the ancient Greek ideas of element, atom, compound, and molecule strengthened the new chemistry by providing physical explanations for reactions that could be expressed in quantitative terms. | SE/TE: 101 |
| CP.2.4 | Explain that Isaac Newton created a unified view of force and motion in which motion everywhere in the universe can be explained by the same few rules. Note that his mathematical analysis of gravitational force and motion showed that planetary orbits had to be the very ellipses that Johannes Kepler had demonstrated two generations earlier. | SE/TE: 380-381 |
| CP.2.5 | Describe that Newton’s system was based on the concepts of mass, force, and acceleration, his three laws of motion relating them, and a physical law stating that the force of gravity between any two objects in the universe depends only upon their masses and the distance between them. | SE/TE: 364-367, 373, 380-381 |</p>
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<td>CP.2.6 Explain that the Newtonian model made it possible to account for such diverse phenomena as tides, the orbits of the planets and moons, the motion of falling objects, and Earth’s equatorial bulge</td>
<td>SE/TE: 361-362, 381, 790-792, 801</td>
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<td>TR: Guided Reading &amp; Study Workbook With Math Support: 25.1, 25.2</td>
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<td>iText: 25.1, 25.2</td>
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<td>CP.2.7 Describe that among the surprising ideas of Albert Einstein’s special relativity is that nothing can travel faster than the speed of light, which is the same for all observers no matter how they or the light source happen to be moving.</td>
<td>SE/TE: 459, 534; How it Works: 845</td>
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<td>CP.2.8 Explain that the special theory of relativity is best known for stating that any form of energy has mass, and that matter itself is a form of energy. (E=mc²)</td>
<td>SE/TE: 459</td>
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<tr>
<td>CP.2.9 Describe that general relativity theory pictures Newton’s gravitational force as a distortion of space and time.</td>
<td>SE/TE: 459; How it Works: 845</td>
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<td>CP.2.10 Explain that Marie and Pierre Curie made radium available to researchers all over the world, increasing the study of radioactivity and leading to the realization that one kind of atom may change into another kind, and so must be made up of smaller parts. Note that these parts were demonstrated by Ernest Rutherford, Niels Bohr, and other scientists to be a small, dense nucleus that contains protons and neutrons and is surrounded by a cloud of electrons.</td>
<td>SE/TE: 104-105, 113-116, 292-293; Science and History: 312-313</td>
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<td>CP.2.11 Explain that Rutherford and his colleagues discovered that the heavy radioactive element uranium spontaneously splits itself into a slightly lighter nucleus and a very light helium nucleus.</td>
<td>SE/TE: 104-105</td>
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<td>CP.2.12 Describe that later, Austrian and German scientists showed that when uranium is struck by neutrons, it splits into two nearly equal parts plus one or two extra neutrons. Note that Lise Meitner, an Austrian physicist, was the first to point out that if these fragments added up to less mass than the original uranium nucleus, then Einstein’s special relativity theory predicted that a large amount of energy would be released. Also note that Enrico Fermi, an Italian working with colleagues in the United States, showed that the extra neutrons trigger more fissions and so create a sustained chain reaction in which a prodigious amount of energy is given off.</td>
<td>SE/TE: 309, 313, 459</td>
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