

## Physical Science Standards

| Cluster                                      | NSES 5-8   | AAAS 6-8  | PA 7 <sup>th</sup>   |
|--|--|---|--|
| I  | <ul style="list-style-type: none"> <li>• A substance has <b>characteristic properties</b>, such as density, a boiling point, and solubility, all of which are independent of the amount of the sample. A <b>mixture of substances</b> often can be separated into the original substances using one or more of the characteristic properties. p154</li> </ul> <p>**[NSES K-4 p127: Materials can exist in different <b>states — solid, liquid, and gas</b>. Some common materials, such as water, can be changed from one state to another by heating or cooling.]</p> | <ul style="list-style-type: none"> <li>• Equal volumes of different substances usually have different weights. 4D p78</li> <li>• Atoms and molecules are perpetually in motion. Increased temperature means greater average energy, so most substances expand when heated. In <b>solids</b>, the atoms are closely locked in position and can only vibrate. In <b>liquids</b>, the atoms or molecules have higher energy, are more loosely connected, and can slide past one another; some molecules may get enough energy to escape into a <b>gas</b>. In <b>gases</b>, the atoms or molecules have still more energy and are free of one another except during occasional collisions. 4D p78</li> <li>• Many <b>substances dissolve in water</b>... 4D p78</li> </ul> | <ul style="list-style-type: none"> <li>• Distinguish ...<b>mixtures</b>. 3.4.7A p15</li> <li>• Describe and conduct experiments that identify ...<b>physical properties</b>. 3.4.7A p15</li> <li>• Distinguish salt from fresh water (e.g., density, electrical conduction). 3.5.7D p21</li> </ul> |
| Physical Properties and Phases of Substances |  |   |  |

\*\* Note: AAAS states “Going into details of the structure of the atom is unnecessary at this level, and holding back makes sense.” (p 77)



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| III                  | <ul style="list-style-type: none"> <li>Chemical elements do not break down during normal laboratory reactions involving such treatments as heating, exposure to electric current, or reaction with acids. <b>There are more than 100 known elements</b> that combine in a multitude of ways to produce <b>compounds</b>, which account for the living and nonliving substances that we encounter. p154</li> </ul> | <ul style="list-style-type: none"> <li>Scientific ideas about elements were borrowed from some Greek philosophers of 2,000 years earlier, who believed that everything was made from four basic substances: air, earth, fire, and water. It was the combinations of these “<b>elements</b>” in <b>different proportions</b> that gave other substances their observable properties. The Greeks were wrong about those four, but now <b>over 100 different elements have been identified</b>, some rare and some plentiful, out of which everything is made. 4D p78</li> <li>All matter is made up of atoms which are far too small to see directly through a microscope. The atoms of any <b>element</b> are alike but are different from atoms of other elements. Atoms may stick together in well-defined molecules or may be packed together in large arrays. Different arrangements of atoms into groups compose all substances. A 4D p78</li> <li>Because most <b>elements tend to combine with others</b>, few elements are found in their pure form. 4D p78</li> </ul> | <ul style="list-style-type: none"> <li>Describe concepts about the...properties of matter. 3.4.7A p15</li> <li>Identify <b>elements as basic building blocks of matter</b> that cannot be broken down chemically. 3.4.7A p15</li> <li>Distinguish <b>compounds</b> from mixtures. 3.4.7 p15</li> </ul> |
| Elements & Compounds |   |   |  |

\*\*Note: NSES states that few students at this level can comprehend the idea of atomic and molecular particles. Elements and compounds should be defined operationally from their chemical characteristics (p 149).

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| IV                 | <ul style="list-style-type: none"> <li>The <b>motion of an object</b> can be described by its <b>position, direction of motion, and speed</b>. That motion can be measured and represented on a graph. p154</li> <li>An object that is not being subjected to a force will continue to move at a constant speed and in a straight line. p154</li> <li>If more than one force acts on an object along a straight line, then the forces will reinforce or cancel one another, depending on their direction and magnitude. <b>Unbalanced forces will cause changes in the speed or direction of an object's motion.</b> p154</li> </ul> | <ul style="list-style-type: none"> <li><b>An unbalanced force acting on an object changes its speed or direction of motion, or both.</b> If the force acts toward a single center, the object's path may curve into an orbit around the center. 4F p90</li> </ul> <p>** [AAAS 9-12 p91: The change in motion of an object is proportional to the applied force...]</p> | <ul style="list-style-type: none"> <li><b>Describe the motion of an object based on its position, direction and speed.</b> 3.4.7C</li> <li>Explain various motions using models. 3.4.7C</li> </ul> <p>** [PA 10<sup>th</sup> 3.4.10C p16: Identify elements of simple machines in complex machines]</p> |
| Motions and Forces |  |  |   |

\*\*Note: NSES states students will be able to associate force with motion but will have difficulty understanding balanced forces in equilibrium. (p154)  
AAAS states that inertia should be given attention at this level. (p 90)

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|----------------------------|---|---|--|
| V                          | <ul style="list-style-type: none"> <li>• <b>Energy is a property of many substances</b> and is associated with heat, light, electricity, mechanical motion, sound, nuclei, and the nature of a chemical. <b>Energy is transferred in many ways.</b> p155</li> <li>• In most chemical and nuclear reactions, <b>energy is transferred into or out of a system.</b> Heat, light, mechanical motion, or electricity might all be involved in such transfers. p155</li> <li>• <b>Heat</b> moves in predictable ways, flowing from warmer objects to cooler ones, until both reach the same temperature. p155</li> </ul> | <ul style="list-style-type: none"> <li>• <b>Energy appears in different forms.</b> Heat energy is in the disorderly motion of molecules; chemical energy is in the arrangement of atoms; mechanical energy is in moving bodies or in elastically distorted shapes; gravitational energy is in the separation of mutually attracting masses. 4E p85</li> <li>• <b>Energy cannot be created or destroyed</b>, but only changed from one form into another. 4E p85</li> <li>• Most of what goes on in the universe—from exploding stars and biological growth to the operation of machines and the motion of people—involves <b>some form of energy being transformed into another.</b> Energy in the form of <b>heat</b> is almost always the product of an energy transformation. 4E p85</li> <li>• <b>Heat</b> can be transferred through materials by the collisions of atoms or across space by radiation. If the material is fluid, currents will be set up in it that aid the transfer of heat. 4E p85</li> </ul> | <ul style="list-style-type: none"> <li>• Explain the <b>conversion of one form of energy to another</b> by applying <b>knowledge of each form of energy.</b> 3.4.7B p16</li> </ul> |
| Forms & Transfer of Energy |   |   |  |

\*\* Note: NSES states students should understand that energy is an important property of structures. Teachers should aim to improve their understanding of energy by experiencing many kinds of energy transfer (p 154).  
AAAS states that the students should move from a qualitative to a quantitative view of energy (p 85).

| Cluster                | NSES 5-8   | AAAS 6-8  | PA 7 <sup>th</sup>  |
|------------------------|--|---|---|
| VI<br><br>Sound Energy | <ul style="list-style-type: none"> <li>• Energy is a property of many substances and is associated with...sound... p155</li> </ul> | <ul style="list-style-type: none"> <li>• Vibrations in materials set up wavelike disturbances that spread away from the source. Sound and earthquake waves are examples. These and other waves move at different speeds in different materials. 4F8<br/>Heat can be transferred through materials by the collisions of atoms or across space by radiation. If the material is fluid, currents will be set up in it that aid the transfer of heat. 4F p90</li> <li>• ...just as something can be "heard" when sound waves from it enter the ear. 4F p90</li> </ul> | <ul style="list-style-type: none"> <li>• Identify and describe sound changes in moving objects. 3.4.7B p16</li> <li>• Explain how sound...travel in waves of differing speeds, sizes and frequencies. 3.4.7C p16</li> </ul> |

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|----------------------|---|---|---|
| VII                  | <ul style="list-style-type: none"> <li>Light interacts with matter by transmission (including refraction), absorption, or scattering (including reflection). To see an object, <b>light from that object--emitted by or scattered from it--must enter the eye.</b> p155</li> <li>The <b>sun is a major source of energy</b> for changes on the earth's surface. The sun loses energy by emitting light. A tiny fraction of that light reaches the earth, transferring energy from the sun to the earth. The <b>sun's energy arrives as light with a range of wavelengths, consisting of visible light, infrared, and ultraviolet radiation.</b> p155</li> </ul> | <ul style="list-style-type: none"> <li>Something can be "seen" <b>when light waves emitted or reflected by it enter the eye...</b> 4F p90</li> <li>Human eyes respond to only a narrow range of <b>wavelengths of electromagnetic radiation— visible light.</b> Differences <b>wavelength</b> of within that range are perceived as differences in color. 4F p90</li> <li>Light from <b>the sun is made up of a mixture of many different colors of light,</b> even though to the eye the light looks almost white. Other things that give off or reflect light have a different mix of colors. 4F p90</li> </ul> | <ul style="list-style-type: none"> <li>Explain how...<b>light travel</b> in waves of differing speeds, sizes and frequencies 3.4.7C</li> <li>Explain how convex and concave mirrors and lens change light images. 3.4.7C</li> <li>Know that the <b>sun is a major source of energy that emits wavelengths of visible light, infrared and ultraviolet radiation.</b> 3.4.7B</li> </ul> |
| Light & Solar Energy |   |   |   |

\*\*Note: AAAS states that students should “learn about the electromagnetic spectrum, including the assertion that it consists of wavelike radiations. Wavelength should be the property receiving the most attention but only minimal calculation” (p 90).

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|-------------------------|---|--|---|
| VIII                    | <ul style="list-style-type: none"> <li><b>Electrical circuits</b> provide a means of transferring electrical energy when heat, light, sound, and chemical changes are produced. p155</li> </ul> | <ul style="list-style-type: none"> <li><b>Electric currents</b> and <b>magnets</b> can exert a force on each other. 4G p95</li> </ul>      | <ul style="list-style-type: none"> <li>Explain the parts and functions in an <b>electrical circuit</b>. 3.4.7B p16</li> </ul> |
| Electricity & Magnetism | <p>**[NSES K-4 p127: <b>Magnets</b> attract and repel each other and certain kinds of other materials.]</p>   | <p>**[AAAS 3-5 p94: Without touching them, a <b>magnet</b> pulls on all things made of iron and either pushes or pulls other magnets.]</p> | <p>** [PA 4<sup>th</sup> 3.3.4C p16: Recognize <b>forces that attract or repel</b> other objects and demonstrate them.]</p>   |

\*\*Note: AAAS states “Students should make devices to observe the magnetic effects of current and the electric effects of moving magnets. At first, the devices can be simple electromagnets; later, more complex devices, such as motor kits, can be introduced” (p 95).

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| Remainder of standards (not mapped to NSES) | 1. Classify fluid power systems according to fluid used or mode of power transmission (e.g., air, oil). PA 3.4.7C |
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