



## NGSS/Common Core State Standards

Students who demonstrate understanding can:

**MS-PS1-2** Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred

(Assessment Boundary: Assessment is limited to analysis of the following properties: density, melting point, boiling point, solubility, flammability, and odor.)

**MS-PS1-3.** Gather and make sense of information to describe that synthetic materials come from natural resources and impact society. [Clarification Statement: Emphasis is on natural resources that undergo a chemical process to form the synthetic material. Examples of new materials could include new medicine, foods, and alternative fuels.] (Assessment Boundary: Assessment is limited to qualitative information.)

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
<p><b>Analyzing and Interpreting Data</b> Analyzing data in 6-8 builds on K-5 and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis.</p> <ul style="list-style-type: none"> <li>Analyze and interpret data to determine similarities and differences in findings. (MS-PS1-2)</li> </ul> <p><b>Obtaining, Evaluating, and Communicating Information</b> Obtaining, evaluating, and communicating information in 6-8 builds on K-5 and progresses to evaluating the merit and validity of ideas and methods.</p> <ul style="list-style-type: none"> <li>Gather, read, and synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used, and describe how they are supported or not supported by evidence. (MS-PS1-3)</li> </ul> <p>-----</p> <p><b>Connections to Nature of Science</b></p> <p><b>Scientific Knowledge is Based on Empirical Evidence</b> Science knowledge is based upon logical and conceptual connections between evidence and explanations. (MS-PS1-2)</p>	<p><b>PS1.A: Structure and Properties of Matter</b></p> <ul style="list-style-type: none"> <li>Each pure substance has characteristic physical and chemical properties (for any bulk quantity under given conditions) that can be used to identify it. (MS-PS1-2),(MS-PS1-3)</li> </ul> <p><b>PS1.B: Chemical Reactions</b></p> <ul style="list-style-type: none"> <li>Substances react chemically in characteristic ways. In a chemical process, the atoms that make up the original substances are regrouped into different molecules, and these new substances have different properties from those of the reactants. (MS-PS1-2),(MS-PS1-3)</li> </ul>	<p><b>Patterns</b></p> <ul style="list-style-type: none"> <li>Macroscopic patterns are related to the nature of microscopic and atomic-level structure. (MS-PS1-2)</li> </ul> <p><b>Structure and Function</b></p> <ul style="list-style-type: none"> <li>Structures can be designed to serve particular functions by taking into account properties of different materials, and how materials can be shaped and used. (MS-PS1-3)</li> </ul> <p>-----</p> <p><b>Connections to Engineering, Technology, and Applications of Science</b></p> <p><b>Interdependence of Science, Engineering, and Technology</b></p> <ul style="list-style-type: none"> <li>Engineering advances have led to important discoveries in virtually every field of science, and scientific discoveries have led to the development of entire industries and engineered systems. (MS-PS1-3)</li> </ul> <p><b>Influence of Science, Engineering and Technology on Society and the Natural World</b></p> <ul style="list-style-type: none"> <li>The uses of technologies and any limitation on their use are driven by individual or societal needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions. Thus technology use varies from region to</li> </ul>

*Connections to other topics in this grade-level:*

**MS.PS3.D** (MS-PS1-2); **MS.LS1.C** (MS-PS1-2); **MS.LS2.A** (MS-PS1-3); **MS.LS4.D** (MS-PS1-3); **MS.ESS2.A** (MS-PS1-2); **MS.ESS3.A** (MS-PS1-3); **MS.ESS3.C** (MS-PS1-3)

*Articulation across grade-levels:*

**5.PS1.B** (MS-PS1-2); **HS.PS1.A** (MS-PS1-3); **HS.PS1.B** (MS-PS1-2); **HS.LS2.A** (MS-PS1-3); **HS.LS4.D** (MS-PS1-3); **HS.ESS3.A** (MS-PS1-3)

*Common Core State Standards Connections:*

**RST.6-8.1** Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions. (MS-PS1-2), (MS-PS1-3)

**RST.6-8.7** Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table). (MS-PS1-2)

**WHST.6-8.8** Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation. (MS-PS1-3)

Mathematics -

**MP.2** Reason abstractly and quantitatively. (MS-PS1-2)

**6.RP.A.3** Use ratio and rate reasoning to solve real-world and mathematical problems. (MS-PS1-2)

**6.SP.B.4** Display numerical data in plots on a number line, including dot plots, histograms, and box plots. (MS-PS1-2)

**6.SP.B.5** Summarize numerical data sets in relation to their context. (MS-PS1-2)

## Description & Medical Application

The Periodic Table Game is a fun way for students to familiarize themselves with how the periodic table is organized, and to explore all 118 known elements on the periodic table plus the physical and chemical properties that can be used to identify them. All living organisms on Earth, as well as everything that has mass and volume in the universe, are made up of atoms of these elements. Moreover, many of these elements have a number of medical applications as they may serve as essential components of organic macromolecules, necessary catalysts in important biochemical reactions, targets for pharmaceutical research, or even toxins that disrupt many biological functions.

The object of this game is for students to guess the correct element on the periodic table given a set of clues. The clue cards for each element contain a set of characteristics that pertain to that element. Although many elements have no known biological function, the majority of the elements will have clues that apply to the medical field.

## Learning Targets

By the end of this activity, students will be able to:

- Explain how the periodic table of elements is organized
- Differentiate between metals, non-metals, and semi-metals
- Use chemical and physical properties to identify different elements on the periodic table
- Identify similarities between different groupings of elements on the periodic table

## Time

Estimated Time	Actual Time (please make note below)
<b>Periodic Table Game: 30 – 60 minutes</b>	

Note: Share the actual time on the forum ([www.haspi.org](http://www.haspi.org)) or at HASPI curriculum conference

## Materials

Supply	Provided (P) or Needed (N)	Reusable ? Yes/No?	Quantity	Company/ Item #	Approximate Cost
Game Board	P	Y	10	See attached documents or download at HASPI.org	----
Element Clue Cards	P	Y	10 sets	See attached documents or download at HASPI.org	----
Game Pieces (1cm Cubes)	P	Y	40	<a href="http://www.amazon.com/Learning-Resources-Centimeter-Cubes-1000/dp/B000F8VB4G/ref=sr_1_1?s=t oys-and-games&amp;ie=UTF8&amp;qid=1399670629&amp;sr=1-1&amp;keywords=cubes">http://www.amazon.com/Learning-Resources-Centimeter-Cubes-1000/dp/B000F8VB4G/ref=sr_1_1?s=t oys-and-games&amp;ie=UTF8&amp;qid=1399670629&amp;sr=1-1&amp;keywords=cubes</a>	\$27.99/1000ct.
Dice	P	Y	10	<a href="http://www.amazon.com/Random-Polyhedral-Dice-Multiple-Wiz/dp/B009R6J8RY/ref=sr_1_3?ie=UTF8&amp;qid=1399670479&amp;sr=8-3&amp;keywords=dice">http://www.amazon.com/Random-Polyhedral-Dice-Multiple-Wiz/dp/B009R6J8RY/ref=sr_1_3?ie=UTF8&amp;qid=1399670479&amp;sr=8-3&amp;keywords=dice</a>	\$19.99/100ct.

## Additional Information

Information	Page #	Location
Students will need a general understanding of the organization of the periodic table before playing The Periodic Table Game. Be sure to cover or review the concepts of the periodic table before they play the game.		Setup
It is not expected that students are familiar with all 118 elements on the periodic table. Be sure to provide copies of an updated periodic table for them to refer to while they play the game.		Setup
You will need to cut out the element clue cards for the students before they play the game.		Setup

## Resources and References

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- <http://www.medicalgasresearch.com/content/3/1/18>
- <http://www.nature.com/news/2004/040122/full/news040119-8.htm> |
- <http://apps.catalysts.basf.com/apps/eibprices/mp/>
- <http://www.webmd.com/beauty/breast-implants/breast-implant-safety>
- [http://en.wikipedia.org/wiki/Cobalt\\_blue](http://en.wikipedia.org/wiki/Cobalt_blue)
- [http://en.wikipedia.org/wiki/GSI\\_Helmholtz\\_Centre\\_for\\_Heavy\\_Ion\\_Research](http://en.wikipedia.org/wiki/GSI_Helmholtz_Centre_for_Heavy_Ion_Research)
- [http://en.wikipedia.org/wiki/Island\\_of\\_stability](http://en.wikipedia.org/wiki/Island_of_stability)
- <http://en.wikipedia.org/wiki/JINR>
- <http://en.wikipedia.org/wiki/IUPAC>
- [http://en.wikipedia.org/wiki/Nickel\\_electroplating](http://en.wikipedia.org/wiki/Nickel_electroplating)
- [http://en.wikipedia.org/wiki/Nicolaus\\_Copernicus](http://en.wikipedia.org/wiki/Nicolaus_Copernicus)
- [http://en.wikipedia.org/wiki/Nuclear\\_fission](http://en.wikipedia.org/wiki/Nuclear_fission)
- [http://en.wikipedia.org/wiki/Periodic\\_table](http://en.wikipedia.org/wiki/Periodic_table)
- <http://en.wikipedia.org/wiki/Tantalus>
- <http://sehsc.americanchemistry.com/Silicone-Uses>
- <http://www.aip.org/history/curie/periodic.htm>
- [http://www.funnyjunk.com/funny\\_pictures/4797029/OC+human/](http://www.funnyjunk.com/funny_pictures/4797029/OC+human/)
- <http://www.lenntech.com/periodic/number/atomic-number.htm>
- <http://www.nlm.nih.gov/medlineplus/ency/article/001179.htm>
- <http://www.webelements.com/rhodium/>
- <https://www.webelements.com/iridium/>
- <http://www.webmd.com/vitamins-and-supplements/lifestyle-guide-11/supplement-guide-potassium>
- **Elements:**
- <http://en.wikipedia.org/wiki/Actinium>
- <http://en.wikipedia.org/wiki/Americium>
- <http://en.wikipedia.org/wiki/Antimony>
- <http://en.wikipedia.org/wiki/Argon>
- <http://en.wikipedia.org/wiki/Astatine>
- <http://en.wikipedia.org/wiki/Barium>
- <http://en.wikipedia.org/wiki/Berkelium>
- <http://en.wikipedia.org/wiki/Bismuth>
- <http://en.wikipedia.org/wiki/Bohrium>
- <http://en.wikipedia.org/wiki/Cadmium>
- <http://en.wikipedia.org/wiki/Californium>
- <http://en.wikipedia.org/wiki/Cerium>
- <http://en.wikipedia.org/wiki/Cesium>
- <http://en.wikipedia.org/wiki/Chromium>
- <http://en.wikipedia.org/wiki/Cisplatin>
- <http://en.wikipedia.org/wiki/Copernicium>
- <http://en.wikipedia.org/wiki/Curium>
- <http://en.wikipedia.org/wiki/Darmstadtium>
- <http://en.wikipedia.org/wiki/Dubnium>
- <http://en.wikipedia.org/wiki/Dysprosium>
- <http://en.wikipedia.org/wiki/Einsteinium>
- <http://en.wikipedia.org/wiki/Erbium>
- <http://en.wikipedia.org/wiki/Europium>
- <http://en.wikipedia.org/wiki/Fermium>
- <http://en.wikipedia.org/wiki/Flerovium>
- <http://en.wikipedia.org/wiki/Francium>
- <http://en.wikipedia.org/wiki/Gadolinium>
- <http://en.wikipedia.org/wiki/Gallium>
- <http://en.wikipedia.org/wiki/Gold>
- <http://en.wikipedia.org/wiki/Hafnium>
- <http://en.wikipedia.org/wiki/Hassium>
- <http://en.wikipedia.org/wiki/Holmium>
- <http://en.wikipedia.org/wiki/Indium>
- <http://en.wikipedia.org/wiki/Iridium>
- <http://en.wikipedia.org/wiki/Lanthanum>
- <http://en.wikipedia.org/wiki/Lawrencium>
- <http://en.wikipedia.org/wiki/Lead>
- <http://en.wikipedia.org/wiki/Livermorium>
- <http://en.wikipedia.org/wiki/Lutetium>
- <http://en.wikipedia.org/wiki/Meitnerium>
- <http://en.wikipedia.org/wiki/Mendelevium>
- <http://en.wikipedia.org/wiki/Mercury>
- <http://en.wikipedia.org/wiki/Neodymium>
- <http://en.wikipedia.org/wiki/Neon>
- <http://en.wikipedia.org/wiki/Neptunium>
- <http://en.wikipedia.org/wiki/Nickel>
- <http://en.wikipedia.org/wiki/Niobium>
- <http://en.wikipedia.org/wiki/Nobelium>
- <http://en.wikipedia.org/wiki/Osmium>
- <http://en.wikipedia.org/wiki/Palladium>
- <http://en.wikipedia.org/wiki/Platinum>
- <http://en.wikipedia.org/wiki/Plutonium>
- <http://en.wikipedia.org/wiki/Polonium>
- <http://en.wikipedia.org/wiki/Praseodymium>
- <http://en.wikipedia.org/wiki/Promethium>
- <http://en.wikipedia.org/wiki/Protactinium>

- <http://en.wikipedia.org/wiki/Radium>
- <http://en.wikipedia.org/wiki/Radon>
- <http://en.wikipedia.org/wiki/Rhenium>
- <http://en.wikipedia.org/wiki/Roentgenium>
- <http://en.wikipedia.org/wiki/Rubidium>
- <http://en.wikipedia.org/wiki/Ruthenium>
- <http://en.wikipedia.org/wiki/Rutherfordium>
- <http://en.wikipedia.org/wiki/Samarium>
- <http://en.wikipedia.org/wiki/Scandium>
- <http://en.wikipedia.org/wiki/Seaborgium>
- <http://en.wikipedia.org/wiki/Silicon>
- <http://en.wikipedia.org/wiki/Strontium>
- <http://en.wikipedia.org/wiki/Tantalum>
- <http://en.wikipedia.org/wiki/Technetium>
- <http://en.wikipedia.org/wiki/Tellurium>
- <http://en.wikipedia.org/wiki/Terbium>

- <http://en.wikipedia.org/wiki/Thallium>
- <http://en.wikipedia.org/wiki/Thorium>
- <http://en.wikipedia.org/wiki/Thulium>
- <http://en.wikipedia.org/wiki/Tin>
- <http://en.wikipedia.org/wiki/Titanium>
- <http://en.wikipedia.org/wiki/Tungsten>
- <http://en.wikipedia.org/wiki/Ununoctium>
- <http://en.wikipedia.org/wiki/Ununpentium>
- <http://en.wikipedia.org/wiki/Ununseptium>
- <http://en.wikipedia.org/wiki/Ununtrium>
- <http://en.wikipedia.org/wiki/Uranium>
- <http://en.wikipedia.org/wiki/Vanadium>
- <http://en.wikipedia.org/wiki/Wilhelm>
- <http://en.wikipedia.org/wiki/Xenon>
- <http://en.wikipedia.org/wiki/Ytterbium>