

Chemicals of Innovation

Grade Levels: 5-8

Duration: 90 min

Design a robust learning experience by selecting resources from this guide that fit the needs of your students. Reinforce learning before, after, and even during your visit by diving deeper into some of the science and engineering concepts.

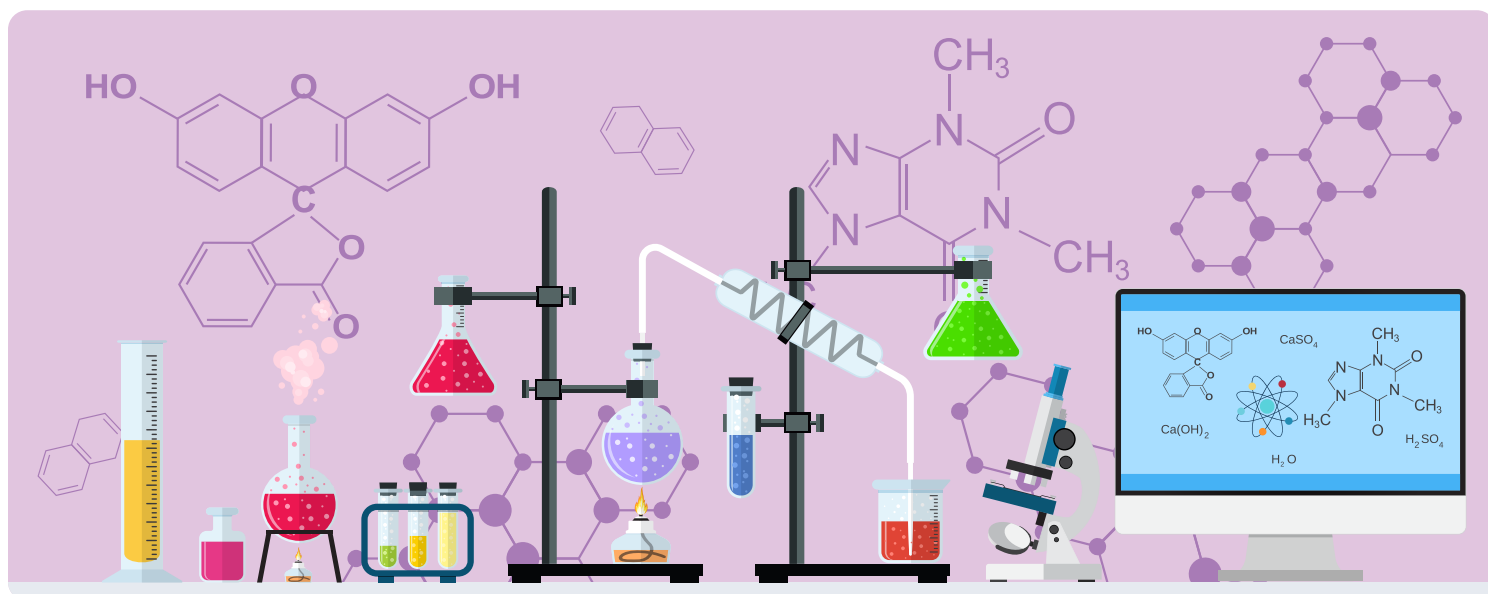


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When to implement

The following icons indicate when resources should be implemented for greatest benefit to your students' experience in the lab.



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Duration: 90 min

Concepts/Skills

Chemical reactions, periodic table of elements, energy and matter, cause and effect.

Objectives

Students will:

- Identify the name, atomic number, and atomic symbol of elements of the periodic table.
- Describe the difference between physical and chemical reactions
- Utilize the scientific method to carry out experiments with chemical reactions.

Vocabulary

These are words and concepts that we will discuss in the lab. Your students' experience will be enhanced if they are familiar with these terms prior to your visit. If you need inspiration for vocabulary activities, please see our Vocabulary Choice Board activity.

Term	Definition
Atom	The smallest unit of a chemical element. Composed of neutrons, protons and electrons.
Atomic number	The number of protons in the nucleus of an atom for a particular element.
Chemical reaction	A process that leads to the irreversible transformation of one set of chemical substances (reactants) to another (product).
Compound	Two or more elements bonded together.
Control	A standard of comparison in scientific experimentation.
Electron	An elementary particle having a negative charge, found orbiting the nucleus of an atom.
Element	A substance composed of identical atoms that cannot be separated into simpler substances.
Hypothesis	An educated guess or prediction of what will happen in an experiment.
Neutron	An elementary particle having no charge, found in the nucleus of all atoms except Hydrogen.
Nucleus	The positively charged central region of an atom, composed of protons and neutrons.
Products	Chemical compounds that are a result of a chemical reaction.
Proton	An elementary particle having a positive charge, found in the nucleus of all atoms.
Reactants	Chemical compounds that are mixed to create a chemical reaction.
Solution	A mixture that is composed of only one phase of matter (e.g. a powder that has been completely dissolved into a liquid).

Related Texts

The following titles may provide students with a greater contextual understanding of the field of chemistry and give greater opportunity to incorporate science and engineering into Language Arts lessons. We are not endorsing the following authors, but feel that the information presented in these texts may be of benefit to your students and enhance their learning experience.

Age Range	Title and author	Text Type	Description
Grades 3-8	"Why Chemistry Matters" (<i>series</i>) by Lynnette Brent	Reference	A series of books that covers many different aspects of chemistry including chemical changes, elements and compounds, mixtures and solutions, and the states of matter.
Grades 4-8	"Adventures of the Elements (Volume I)" by Richard E James III	Narrative, fiction	Five siblings embark on a quest through a chemical world alongside "element guardians" to save the world from diabolical molecules like Ozzie Ozone and Dert Phosphate.
Grades 4-8	"The Mystery of the Periodic Table" by Benjamin D. Wiker	Narrative, non-fiction	A delightful and absorbing journey through the creation of the periodic table and the discovery of the elements.
Grades 5-8	"How to Make a Universe with 92 Ingredients: An Electrifying Guide to the Elements" by Adrian Dingle	Reference	An imaginative way for young readers to connect chemistry with the science of their daily lives.
Grades 7-9	"The Cartoon Guide to Chemistry" by Larry Gonick and Craig Criddle	Reference	A humorous exploration of the basics of the history of chemistry, atomic structure and the periodic table, bonds, reactions, energy, matter, and more.
Grades 7-12	"Napoleon's Buttons: How 17 Molecules Changed History" by Penny Le Couteur and Jay Burreson	Narrative, non-fiction	Seventeen groups of molecules are traced as the most influential molecules in history.

Exhibit Connections

Make connections between learning from the lab and the exhibits and programs found in The Tech Interactive's galleries.



Body Worlds Decoded





Students use augmented reality and other emerging technologies to examine organs and body systems through immersive 3D models.



This exhibit contains sensitive content featuring the human body.

Periodic Table of the Human Body

Elements make up everything in the universe, including humans! These are the 10 most abundant elements in the human body:

<p>oxygen 8 O 15.999</p>	<p>Making up over 60% of our body mass, oxygen is required for cellular respiration (energy conversion in cells).</p>	<p>carbon 6 C 12.009</p>	<p>Carbon is an essential building block of proteins, fats, and carbohydrates, and is found in virtually every cell in our bodies.</p>	<p> These four elements make up nearly 96% of a human's body mass!</p> <ul style="list-style-type: none">  Alkali metals  Alkaline earth metals  Other nonmetals
<p>hydrogen 1 H 1.0078</p>	<p>More than 60% of our body is composed of water, which is where most of the hydrogen in our bodies is found.</p>	<p>nitrogen 7 N 14.006</p>	<p>A critical component of proteins, nitrogen is also essential to the amino acids that make up DNA.</p>	

Calcium
20
Ca
40.078

Calcium is an essential element for the development and maintenance of teeth and bones.

**Check out the skeletal system section of Body Worlds Decoded to see the 206 bones of the human body and how they develop.*

phosphorus
15
P
30.974

Also found in our teeth and bones, **phosphorus** is an essential element in the chemical energy our cells produce and use.

potassium
19
K
39.098

An essential element for muscular function, **potassium** also plays a key role in sending and receiving electrical pulses to and from the brain.

sulfur
16
S
32.059

Sulfur, the element responsible for rotten egg smell, is most abundantly found in our hair, skin, and nails.

sodium
11
Na
22.990

Not just for your popcorn, **sodium** plays a key role in the transmission of nerve impulses and the regulation of fluid volume, temperature, and blood pressure.

**Be sure to explore the nervous system section of Body Worlds Decoded to see how nerves send information between the brain and our body.*

magnesium
12
Mg
24.305

An important element in the cardiovascular system, **magnesium** helps regulate heartbeat, blood pressure and blood sugar.

**See how the heart works in the cardiovascular system section of Body Worlds Decoded.*

Plastination: Where chemistry meets anatomy

The plastinate specimens in the exhibition are all real preserved human remains. Many long and complicated chemical reactions and processes were used to preserve these remains and keep the muscles and organs intact. Each plastinate takes approximately one year to be fully preserved and ready for display.



Be sure to ask a staff member or volunteer about the plastination process used to create these amazing specimens!



Lab-Related Activities



The following activities can be implemented either before or after the lab and are meant to bridge the learning from the lab back to the classroom.

Activity	Description	Time
Green Pennies 	Students experiment with different oxidizing compounds to turn pennies green and then back to copper.	45 minutes
Periodic Table Battleship 	Students develop a greater familiarity with the periodic table of elements. <i>You sank my potassium!</i>	30-40 minutes



Looking for other hands-on activities and resources to use in your classroom?
Check out our [education resources](#) page!

Writing Prompts



The following writing prompts and questions are just a few examples of journal topics to incorporate writing into your students' lab experience. These prompts can be used in conjunction with any classroom writing journal.

Pre-visit prompts



- We will be attending the Chemicals of Innovation at The Tech Interactive; what are you most looking forward to in this lab? Why?
- There is more to chemistry than just mixing solutions together. What does chemistry mean to you? Why?
- Safety is very important in a chemistry lab. What would be your top three chemistry lab safety rules and why?

Post-visit prompts



- The principal is very excited to hear about your lab experience! Explain what you did and learned about in the lab since they were unable to attend the lab.
- Describe the difference between a chemical reaction and a physical reaction. Provide an example of each type of reaction.
- Imagine you are a chemical engineer creating a new product that features either an endothermic reaction or an exothermic reaction. What is your product and what type of reaction does it feature? Create an advertisement for your product, including a sketch, that explains the purpose and use of your product.

Next Generation Science Standards

Chemicals of Innovation supports the following NGSS

Grades	Physical Sciences	Disciplinary Core Ideas	Crosscutting Concepts	Science and Engineering Practices
Grade 5	5-PS1.-2 5-PS1-3 5-PS1-4	PS1.A PS1.B	Cause and Effect Scale, Proportion and Quantity Energy and Matter Systems and System Models	1, 2, 3, 6, 7, 8
Grades 6-8	MS-PS1-2	PS1.A PS1.B	Energy and Matter Structure and Function	1, 2, 3, 6, 7, 8



Visit thetech.org/fieldtrips for more information on field trip offerings, booking information, and more!

