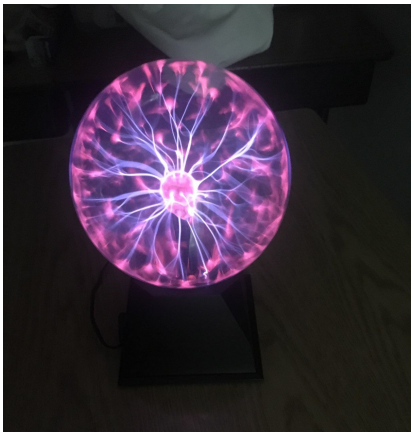
STEM Newsletter | December 2017

Hands-On Science: Plasma & Energy

In December, the theme of the month was *Plasma & Energy*. Students were introduced into various applications of *chemiluminescence*, the emission of light from chemicals. In the first experiment, our trained science instructors demonstrated the emission spectrum of sodium by electrocuting a pickle soaked in saltwater with 120 volts of DC current! Students also studied the cool effects of running electrical current through noble gases by using a plasma ball. Neat!



Students also were introduced to pyrotechnics and the chemistry of fireworks. Trained Olive Children & Berkeley Academy science teachers demonstrated the emitted colors when various metal ion salts were burned under a strong flame; this technique is commonly called a “flame test.” Finally, students experienced chemiluminescence firsthand by creating a chemical reaction in a "glowstick" that emits energy in the form of visible light. In the image in the upper right hand corner, students conduct a test to analyze the thermodynamics of the chemiluminescent reaction occurring in glowsticks by placing them in hot water (*left*), room-temperature water *(middle*), and cold water *(right)*.

Snacks with a Scientist

Olive Children Foundation and Berkeley Academy thank **Mr. Andy Sass** for being our guest speaker this month, sharing his experiences in mineral extraction and chemical engineering with our students. Mr. Sass received his B.S. in Chemical Engineering from U.C. Davis and has worked on and designed dozens of chemical plants. Mr. Sass brought several samples of minerals including crystalline gypsum, sodium carbonate, gold ore, and a 20 kilogram ingot of lead!

During the event, students were also introduced to the various industrial and commercial applications of chemical engineering, and how we use goods made possible by chemical engineering in everyday life. We are thankful for having the privilege of hosting Mr. Sass as he shared his experiences as a chemical engineer with the kids.

S.T.E.M. Initiative

Enrollment is **OPEN** for Olive Children's STEM Initiative program, a 10-week hands-on immersion program to get students involved in a research project that aligns with their interest. Paired with a high school volunteer mentor, students will design, execute, and disseminate a research project of their choice. For more information, or to enroll, please visit http://www.olivechildren.com/stem-initiative. Partial and full financial aid scholarships are available for students and families with demonstrable financial need. The deadline to submit financial aid applications and enrollment forms is January 9, 2018.

Science Education Research Program (SERP)

Olive Children Foundation is committed to providing cutting-edge and top-notch STEM (science, technology, engineering, math) education to the students in our care and to the greater community. As part of the new Science Education Research Program (S.E.R.P.), Olive science staff have been busy designing innovative and novel ways to teach science in a novel, engaging ways. Read more about our participation in the STEM Education Coalition at http://www.stemedcoalition.org/.

Coming Up Next Month: **Fun with Physics and the Olympics!**

Respectfully yours,

Edward Njoo
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NGSS Standards Covered This Month

PS4.A: Wave Properties

- A simple wave has a repeating pattern with a specific wavelength, frequency, and amplitude. (MS-PS4-1)
- A sound wave needs a medium through which it is transmitted. (MS-PS4-2)

PS4.B: Electromagnetic Radiation

- When light shines on an object, it is reflected, absorbed, or transmitted through the object, depending on the object's material and the frequency (color) of the light. (MS-PS4-2)
- The path that light travels can be traced as straight lines, except at surfaces between different transparent materials (e.g., air and water, air and glass) where the light path bends. (MS-PS4-2)
- A wave model of light is useful for explaining brightness, color, and the frequency-dependent bending of light at a surface between media. (MS-PS4-2)
- However, because light can travel through space, it cannot be a matter wave, like sound or water waves. (MS-PS4-2)

PS4.A: Wave Properties

- Waves, which are regular patterns of motion, can be made in water by disturbing the surface. When waves move across the surface of deep water, the water goes up and down in place; there is no net motion in the direction of the wave except when the water meets a beach. *(Note: This grade band endpoint was moved from K–2.)*(4-PS4-1)
- Waves of the same type can differ in amplitude (height of the wave) and wavelength (spacing between wave peaks). (4-PS4-1)

PS4.B: Electromagnetic Radiation

- An object can be seen when light reflected from its surface enters the eyes. (4-PS4-2)

PS1.A: Structure and Properties of Matter

- Substances are made from different types of atoms, which combine with one another in various ways. Atoms form molecules that range in size from two to thousands of atoms. (MS-PS1-1)
- 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)
- Gases and liquids are made of molecules or inert atoms that are moving about relative to each other. (MS-PS1-4)
- In a liquid, the molecules are constantly in contact with others; in a gas, they are widely spaced except when they happen to collide. In a solid, atoms are closely spaced and may vibrate in position but do not change relative locations. (MS-PS1-4)
- Solids may be formed from molecules, or they may be extended structures with repeating subunits (e.g., crystals). (MS-PS1-1)
- The changes of state that occur with variations in temperature or pressure can be described and predicted using these models of matter. (MS-PS1-4)

PS1.B: Chemical Reactions

- 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),(MS-PS1-5)
- The total number of each type of atom is conserved, and thus the mass does not change. (MS-PS1-5)
- Some chemical reactions release energy, others store energy. (MS-PS1-6)

PS3.A: Definitions of Energy

- The term "heat" as used in everyday language refers both to thermal energy (the motion of atoms or molecules within a substance) and the transfer of that thermal energy from one object to another. In science, heat is used only for this second meaning; it refers to the energy transferred due to the temperature difference between two objects. *(secondary to MS-PS1-4)*
- The temperature of a system is proportional to the average internal kinetic energy and potential energy per atom or molecule (whichever is the appropriate building block for the system's material). The details of that relationship depend on the type of atom or molecule and the interactions among the atoms in the material. Temperature is not a direct measure of a system's total thermal energy. The total thermal energy (sometimes called the total internal energy) of a system depends jointly on the temperature, the total number of atoms in the system, and the state of the material. *(secondary to MS-PS1-4)*