**High School - SIAs Choice Quarter 1**

**https://padlet.com/coxl21/vyzd4smio00x**

**Biology**

**BIO1.LS1.7** Utilize a model of a cell plasma membrane to compare the various types of cellular transport and test predictions about the movement of molecules into or out of a cell based on the homeostasis of energy and matter in cells.

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Curricular Unit: [Keepers of the Gate](https://www.teachengineering.org/curricularunits/view/van_membrane_unit)

[The Keepers of the Gate Challenge](https://www.teachengineering.org/lessons/view/van_membrane_lesson1)

Students are presented with a real-life problem as a challenge to investigate, research and solve. Specifically, they are asked to investigate why salt water helps a sore throat, and how engineers apply this understanding to solve other problems. Students read medical journal articles and watch a TEDx Talk to learn more about nanotechnology applications. After students reflect and respond to the challenge question, they conduct the associated activity to perform journaling and brainstorming.

[Cell Membrane Structure & Function](https://www.teachengineering.org/lessons/view/van_membrane_lesson2)

Students learn about the different structures that comprise cell membranes, fulfilling part of the Research and Revise stages of the legacy cycle. They view online animations of cell membrane dynamics (links provided). Then they observe three teacher demonstrations that illustrate diffusion and osmosis concepts, as well as the effect of movement through a semi-permeable membrane using Lugol's solution. Lastly, students use the associated activity to test their understanding of the cell structure and membrane.

**Chemistry**

**CHEM1.PS4.1** Using a model, explain why elements emit characteristic frequencies of light and how this information is used.

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Electromagnetic Radiation

[Flame Test: Red, Green, Blue, Violet?](https://www.teachengineering.org/activities/view/van_nanoparticles_lesson01_activity1)

To become familiar with the transfer of energy in the form of quantum, students perform flame tests, which is one-way chemical engineers identify elements—by observing the color emitted when placed in a flame. After calculating and then preparing specific molarity solutions of strontium chloride, copper II chloride and potassium chloride (good practice!), students observe the distinct colors each solution produces when placed in a flame, determine the visible light wavelength, and apply that data to identify the metal in a mystery solution. They also calculate the frequency of energy for the solutions.

**Physical Science**

**PSCI.PS1.12** Classify a substance as acidic, basic, or neutral by using pH tools and appropriate indicators.

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[Basically Acids](https://www.teachengineering.org/lessons/view/uoh_hp_lesson_acids)

Students use the associated activity to learn the basics of acid/base chemistry in a fun, interactive way by studying instances of acid/base chemistry found in popular films such as Harry Potter and the Prisoner of Azkaban and National Treasure. Students learn what acids, bases and indicators are and how they can be used, including invisible ink. They also learn how engineers use acids and bases every day to better our quality of life. Students' interest is piqued by the use of popular culture in the classroom.

[Basically Acidic Ink](https://www.teachengineering.org/activities/view/uoh_hp_activity_acidic_ink)

Students hypothesize whether vinegar and ammonia-based glass cleaner are acids or bases. They create designs on index cards using these substances as invisible inks. After the index cards have dried, they apply red cabbage juice as an indicator to reveal the designs.

**Physics/Physical World Concepts**

**PHYS.PS2.13** Develop a model to predict the range of a two-dimensional projectile based upon its starting height, initial velocity, and angle at which it was launched.

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[Projectile Motion](https://www.teachengineering.org/activities/view/nyu_projectile_activity1)

Students are introduced to the concept of projectile motion, of which they are often familiar from life experiences, such as playing sports like basketball and baseball, even though they may not understand the physics involved. Students use tabletop-sized robots to build projectile throwers and measure motion using sensors. They compute distances and velocities using simple kinematic equations and confirm their results through measurements by hand. To apply the concept, students calculate the necessary speed of an object to reach a certain distance in a hypothetical scenario: A group of hikers stranded at the bottom of a cliff need food, but rescuers cannot deliver it themselves, so they must devise a way to get the food to the hikers. A student worksheet is provided.

**Human Anatomy & Physiology**

**HAP.LS1.8** Identify major bones within the axial and appendicular divisions, describing their physiological roles in creating a body scaffold, internal organ protection, and anchor points for skeletal muscles participating in movement.

**HAP.LS1.9** Diagram microscopic bone structures, identifying regions that participate in hematopoiesis and storage of minerals and fat.

**HAP.LS1.10** Explain the process of bone formation, growth, and repair.

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[Bone Fractures and Engineering](https://www.teachengineering.org/lessons/view/cub_biomed_lesson10)

Students learn about the role engineers and engineering play in repairing severe bone fractures. They acquire knowledge about the design and development of implant rods, pins, plates, screws and bone grafts. Students then can use the associated activity to practice their own bone repairing procedure. They learn about materials science, biocompatibility and minimally-invasive surgery.

**Environmental Science/Ecology**

**EVSC.LS2.1** Using a variety of data sources, construct an explanation for the impact of climate, latitude, altitude, geology, and hydrology patterns on plant and animal life in various terrestrial biomes.

[Anthropogenic Biomes](http://ecotope.org/anthromes/education/anthromes_hs_lesson_plan_2010_10_01.pdf) (referenced from <http://www.nea.org/tools/lessons/60644.htm>)

Students are introduced to a new way of looking at the biomes of the earth by studying land areas of the biosphere which include human use. The unit introduces and incorporates anthropogenic biomes into the ecology unit.

Fairbank, Janet. 2010. Anthropogenic Biomes: A High School Biology Unit Plan. Prepared in consultation with Erle Ellis and Sari Bennett. Published online October 1, 2010. Downloaded from: <<http://ecotope.org/anthromes/education/anthromes_hs_lesson_plan_2010_10_01.pdf>>