

St. Theresa Science Program

St. Theresa School begins its formal Science Program in fourth grade. Interactive science textbooks allow students to practice their science skills at home and at school. Through a combination of lessons, interactive activities, lab experiments in a fully appointed science lab, and research, students build science vocabulary, practice, and deep knowledge of scientific concepts across all domains in five years. Mathematics, graphing, and data analysis are incorporated beginning in fourth grade and become more complex through graduation. St. Theresa students experience science using the Next Generation Science Standards; we rely on the more rigorous National Science Foundation standards of engagement and research. All middle school students are required to develop a science fair project each year. Six projects a year participate in the Oakland Diocesan Science Fair, and each year, at least one project is qualified to move on to the County Science Fair.

Fourth-grade Science: Students begin to learn how to use scientific equipment in a lab setting. They use the knowledge to conduct experiments on changing forms of energy – mechanical, electrical, light, thermal, and sound – and move to motion and speed. Students end the first trimester experimenting with electricity, drawing electric circuit schematics, and changing electricity into other forms of energy. The second trimester begins with plants and animals, the reproduction of seed-bearing plants, and photosynthesis. From individual organisms, students learn the complexity of ecosystems. In the third trimester, we use what we have learned to explore Earth's natural resources, fossils, and the geologic time scale. Students learn about the properties of minerals and rocks, as well as fast and slow changes to Earth, such as earthquakes, volcanoes, weathering, erosion, and deposition. We conclude with the water cycle. Significant projects include mapmaking, the plant and pollinator ecosystem, the water cycle, and real-life problems, as well as engineering projects presented by the Boston Museum of Science.

Fifth-grade Science: Major projects teach students to manage their time and resources, and incorporate what they are learning to be prepared for the rigorous middle school curriculum. We begin by building a life-sized periodic table with flaps, where students see how elements are used in the world. States of matter, solids, liquids, gases, and non-Newtonian fluids, mixtures and solutions, and chemical vs. physical changes. Forces and motion that delve deeply into Newton's laws of motion. Using what they have learned, students create their own Rube Goldberg Machine. The second trimester begins with space science, the solar system, stars, asteroids, meteors, and comets. Students demonstrate their learning through the Planetary Olympics Project. Students enhance their understanding of the water cycle by completing a research project on the effects of El Niño and La Niña on California and globally, which contribute to climate change. In the third trimester, students study adaptations focusing on the animals of the Galapagos Islands. The final project will be the Keystone Species project. By examining global keystone species, students learn about the environmental impact of intentional and unintentional actions.

Sixth-grade Science: Earth and Space Science is the focus in the first year of middle school. Using high school science textbooks, students incorporate their background knowledge of the solar system. The book, *Astrophysics for Young People in a Hurry*, by Neil deGrasse Tyson, quickly brings new students up to speed and helps current students gain insight into the ways the universe affects Earth's movements: rotation, revolution, seasons, lunar phases, and the tides. In the second trimester, we learn about the formation of Earth, the geologic time scale, mass extinctions, which give us the fossil record, and how we use relative and absolute dating to confirm our research. Earth's tectonic plates, compared to the original theory of Continental Drift, give us a deep understanding of earthquakes and volcanoes, culminating in the Earthquake Project, in which we use government data to track and map worldwide earthquakes. Through this activity, students experience the Ring of Fire. Earth's activity gives us the cycle of weathering, erosion, and deposition, where we test and classify rocks and minerals. Once students build their knowledge of Earth's cycles: the carbon, nitrogen, rock, and hydrologic cycles, they take shape. In our final trimester, we study climate and weather using our knowledge of Earth's systems. The novel *Two Degrees*, by Alan Gratz, puts the effects of climate change in a young person's perspective. Students study ocean currents and wind. Students examine the Great Pacific Garbage Patch and work to create possible solutions for mitigating damage to Earth by the removal of plastic waste in the ocean and reducing plastic in their school and homes. Our final project of the year is the Africa project in which students hone in on one aspect of the continent of Africa, and how, using the resources in Africa, minerals and rare Earth materials, we create cell phones, electronics, and the powerful magnets that enhance them, helping the entire world enhance our technology.

Seventh-grade Science: This is the year of life science. We begin the year with ecology as we examine ecological relationships and the importance of biodiversity. We move into evolutionary theory with natural and artificial selection and gene variation, and the previously learned fossil record as evidence for evolution. Comparative anatomy and the examination of embryonic life have helped us understand how the anatomy begins quite similarly, and through genetic changes and modifications, creates organisms adapted to best survive the environment. In our second trimester, we study cell theory, the structure and functions of a cell, types of cells, and homeostasis. Students create a cell model using the medium of their choice: three-D printed, from food, or found items from home to create and label each organelle. *The Immortal Life of Henrietta Lacks*, by Rebecca Skloot, helps us examine the legality, ethics, and our own personal morality of using the cells that were taken unknowingly from a woman with cancer and using them to create many of the vaccines we use today, including the first COVID-19 vaccine. We study the cycle of glucose and ATP, cellular and anaerobic respiration, and the relationships between photosynthesis and cellular respiration. We move on to genetics, and the Austrian monk, Gregor Mendel, whose experiments on pea plants helped us develop the laws of inheritance. Students learn about chromosomes, alleles, and genes, using Punnett squares and pedigree charts, with the second trimester culminating in a personally meaningful genetic disorder research project. The third trimester begins our deep understanding of our own human bodies as we study the following systems: skeletal, muscular, integumentary, respiratory, cardiovascular, digestive, excretory, reproductive, nervous, and endocrine. As the year closes, we study the effects of our behaviors and choices on our own bodies.

Eighth-grade Science: Physical science is the combination of chemistry and physics. As we begin the year, we focus on atoms, molecules, and kinetic theory as they apply to atoms and molecules. We move to isotopes and electron configuration as it applies to the periodic table of elements. Atomic combinations including covalent, ionic, and metallic bonding, molecular solids, writing chemical formulas, and investigating molecular shape. *The Disappearing Spoon*, by Sam Kean, helps students understand the race to understand the elements, and the power of those elements that make up Earth. Students end the trimester with a project that explains the difference between bioluminescence and fluorescence to our fourth-grade students. Our second trimester begins with physical and chemical changes, and the laws of the conservation of energy, conservation of mass, and constant composition, ending with the balancing of chemical equations. As our second trimester begins and students study the Mole and molar mass, they create the Mole Project, in which they make a hand-sewn mole model with a theme. We continue with the mole concept for molecules and compounds, molar and empirical formulas, and stoichiometry. We use our knowledge of bonds to study bond energy and types of reactions: heat, spontaneous, and non-spontaneous, reaction rates, and the factors that affect them, and collision theory. We measure the reaction rates based on the catalysts and calculate the chemical equilibrium. Finally, we study acids and bases, and our eighth-grade students demonstrate and help young visitors to the lab measure acids and bases using pH strips at our annual open house. We end our units of chemistry on nuclear reactions, fission, fusion, and nucleosynthesis. Students write and defend a position supporting or refuting the use of nuclear power. Then we begin our physics unit with forces: speed, acceleration, balanced and unbalanced forces, gravity and weight, action and reaction, friction, pressure, work, energy, power, and simple machines. As we move into our electrical unit, we explore electric charge, current, circuits, resistance, and power, and end the unit with electricity and magnetism. We wrap around where we started with the electromagnetic spectrum, where we first used it to find the elements in stars, and now use it to understand the nature of light, reflection, refraction, color, and the eye. Using waves, we study the nature of sound, and we end our year by using waves for communication.