

Jesuit Academy Science Benchmarks

By the end of 8th grade, students will be able to:

- 1. Use the scientific process to conduct an experiment, identify controls and variables, and analyze the results. (Analysis)*
- 2. Use the engineering process develop a tool or prototype that is tested, modified, and re-tested to meet challenges and refine the tool/prototype. (Grit)*
- 3a. Present to a group on a topic you have researched.*
3b. Identify (in the research project) pros and cons of your research, while clearly communicating to the audience what you have learned. (Performance)
- 4. Develop a project or artifact that involves collaboration with peers and serves a greater social purpose. (Helping Society)*

8th Grade Physical Science Focus

The 8th grade science curriculum at Jesuit Academy focuses on Physical Science. Our curriculum introduces the engineering process and includes a number of building/assembly projects in various units. Students expand on their research and it becomes an essential component for the hypothesis on all lab reports. Additionally, students begin to analyze sources of errors within the labs we complete.

In addition to the engineering challenges, students are also exposed to a variety of micro-computers and programming languages. Throughout our units on electricity, renewable energy, and the STEM fair, students work with a variety of electronic components including MicroBits, Arduinos, and Raspberry Pis. The unit structure is somewhat different from a typical physical science course so that students gain some additional algebra skills (in math classes) before we take on Newton's Laws.

[Year Long Slide Set with Unit Reviews](#)

[Link to Tests on ThatQuiz](#)

Unit 1: Scientific Process, Engineering Process, and Measurement

Goals	1. SWBAT implement the steps of the scientific process to conduct and analyze experiments. 2. SWBAT explain the steps of the engineering process and compare and contrast it to the scientific process. 2. SWBAT measure and convert distances, masses, and volume using the metric system.
Topics Covered	- Problem, Research/Hypothesis, Experiment, Results, Conclusion (Sci. Process) - Problem, Research, Plan, Design, Test, Re-design, Re-test (Engineering process) - Research process (do's and don'ts) - Independent and Dependent Variables in an experiment - Demo vs. Experiment - Identifying Possible Errors in an experiment → Reliable vs. Valid - Metric and Si units for mass, volume, and distance ; - Metric and standard conversions ; Celsius to Fahrenheit conversions
Labs	- Mentos lab , Markers , Foam capsules , Internet Speed Test , ZeroG Lab , Mortal Kombat writing a good research part - Massing and Measuring (using balances and random objects) <i>* The purpose of labs in this unit are to get familiar with the 8th grade standard for lab reports, which includes doing background research and identifying possible errors in an experiment.</i>
Final Project	Research, design, and build an object for the classroom (stool, bench, bookcase, etc).
Additional Resources	• Quizlet Review Set • Sci Process and Measurement Test

Unit 2: Heat Energy Unit

Goals	1. SWBAT describe methods by which heat transfers from one place to another. 2. SWBAT explain how controlling heat transfers can save money and time.
Topics Covered	- Periodic Table Review; properties of elements - Molecular states of solids, liquids, and gases - Law of conservation of energy - Absolute zero - Conduction, Convection, Radiation - Applications to your home (insulation, window placement, sealing air-leaks)
Labs	- Specific Heat Lab - Sand shake lab - Cups in the microwave demo - Calorie lab (video setup) - Cooler Lab - Solar Ovens
Final Project	• Design a cooler that can keep an ice cube frozen for 2+ hours & Create a solar oven that can achieve temperatures above 48 degrees Celsius. • Research paper on weatherization
Other Resources	• Eureka Science Videos (17-24) • Review Template • Quizlet cards for Heat unit • Atoms and Heat Interactive • Heat Energy Test

Unit 3: Electricity and Electromagnetism

Goals	SWBAT explain the properties of electricity and magnetism and apply them to design and repair circuits.
Topics Covered	- Atoms and the properties of sub-atomic particles - Static electricity - Circuits and their properties (volts, amps, ohms, watts, series, parallel) - Ohm's Law, Watts Law - Properties of magnets and magnetic fields - Electromagnets - Electrical components (resistors, diodes, switches) - Electric motors and current (AC/DC)
Labs	- Static balloons - Wiring series circuits (real and virtual) - Wiring parallel circuits and switches (real and virtual) - Voltage Changes lab - Wiring with resistors lab - Battery and Electrolytes - Creating and enhancing electromagnets - Building a motor and observing turbine voltage - Arduino programming (virtual and real) * Students do a number of mini labs/demos in this unit in terms of building varieties of circuits. Most labs do not have a full report, but are documented in a running "electricity" journal.
Final Project	• Wire and program a micro-controller project with a sensor.
Other Resources	• Blobz Guide Interactive (Flash based) • Ohm's Law 1 • Ohm's Law 2 • Electricity EdPuzzle 1 • Electricity EdPuzzle 2 • Quizizz Review & Quizlet Review • Electricity Test

Unit 4: Renewable Energy

Goals	1. SWBAT identify and describe pros and cons of renewable and non-renewable energy sources. 2. SWBAT analyze how alternative energy could be installed and utilized at the school and in the community.
Topics Covered	- Fossil fuels pros and cons - Alternative energy sources pros and cons - Types of solar installations, how they work, and analysis of installation factors - Types of wind installations, how they work, and analysis of installation factors - How geothermal installations works • Renewable Energy Slides for Unit
Labs	- Carbon footprint calculator - Global Warming Lab - Solar placement diorama (based on shading, etc.) - Solar experiments: Best angle, Best direction, In vs. Out, Voltage potential - Wind experiments: Best fin configuration, Blade Size, Vertical vs. Horizontal - History of Wind Energy Essay

	- Grounds analysis for solar placement (tracking shadows)
Final Project	SWBAT build a solar car (from a kit) and modify it to achieve the greatest speed and accuracy (make it drive straight)
Other Resources	• Wind Interactive • Renewables Review & Fossil Fuels Review • Renewable Energy Test

Unit 5: Wave Energy - Sound

Goals	1. SWBAT describe the structure of waves and how sound is transmitted via waves. 2. SWBAT analyze wave patterns for frequency and amplitude and apply their findings to enhance audio productions.
Topics Covered	- Parts of a wave - How sound is transmitted via waves - Wavelengths, Frequency, Amplitude, and Decibels - Echolocation and the speed of sound through different mediums - The human hear and hearing across age spans and animal species
Labs	- Bell in vacuum - Tuning forks and frequency - Sound in various mediums (or no medium) - Mosquito Tone lab - Voice analysis with Audacity - Hearing tests on Audacity
Final Project	SWBAT filter a designated segment of audio from a video clip of an athletic event to make the announcers voices more recognizable. http://www.ergonomics4schools.com/lzone/noise.htm
Web Resources	https://www.nde-ed.org/EducationResources/HighSchool/Sound/introsound.htm https://twistedwave.com/online http://www.fearofphysics.com/Sound/dist_hear.html

Unit 6: Wave Energy - Light

Goals	1. SWBAT explain the properties of light across the electromagnetic spectrum. 2. SWBAT compare and contrast different uses in household products of the EM spectrum.
Topics Covered	- Structure and ranges of electromagnetic waves and photon paths - The electromagnetic spectrum - Daily applications of the electromagnetic spectrum - Positive and negative applications of electromagnetic radiation
Labs	- Prism lab - UV beads and sunglasses - Color wheels and color blending - 3d lab - RGB analysis - Speed of light lab

	- Wiring and detecting an infrared light (Arduino)
Final Project	Buying guide to televisions or wiimote whiteboard project

Unit 6: Astronomy

Goals	1. SWBAT identify and explain the structure of planets and other masses in our solar system. 2. SWBAT interpret indirect data to draw conclusions and/or generate hypotheses.
Topics Covered	- Planet analysis - Life cycle of stars - Light, radio, and other detection devices - Conditions for life on other planets
Labs	- Google Sky analysis - Bone density lab - Mathematics of red shift - We choose the moon - Detecting ExoPlanets (light dips, Arduino) - Gravity drop
Final Project	

Unit 7: Science Fair

Goals:	SWBAT use the scientific process to research, experiment, and analyze a topic in a specified field of science. SWBAT implement the engineering process to produce a tool or prototype that is tested, re-designed, and/or modified to meet specifications. Timeline: 3-5 weeks (usually stretches over spring break)
Topics Covered	- Research basics review - Citing Sources - Review and apply of the engineering process

Unit 8: Newtons Laws

Goals	1. SWBAT identify Newton's laws and express them in their own words. 2. SWBAT explain how Newton's laws can be applied to daily interactions in the world.
Topics Covered	- Basics of Newton's Laws - Velocity vs. Acceleration vs. Momentum - Kinetic and Potential Energy - Simple Machines and Work

	- Equation transformations and relationship with other equation $F=MA$ similar to $Watts=VI$
Labs	- Force needed to knock over the book - Acceleration vs. Velocity chasing Usain Bolt - Building an automatic timing device - Who's guilty in this car crash - Simple machines levers lab - Rocket launch
Final Project	Build and launch rockets

Unit 9: Chemistry Review (if time at end of year)

Goals	1. SWBAT identify and describe elements on the periodic table 2. SWBAT describe how different elements react to each other.
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