



Workshop Objectives and Standards

The following workshops are designed for grades 5th – 8th. Applicable **topics and standards for the full range of subject matter available** accompany each workshop description. Adjustments are made to suit the specific grade involved.

The **overarching objectives for all workshops** are listed below

- Communication, Teamwork, and Interactive skills
CCSD: S7CS6, S5CS5
- Tools, Materials, Measurement, Safety, and Hands-On skills
CCSD: PS2, S.8.1.3, S7CS2, S7CS4, S6CS2, S6CS4, S5CS3, T.S7CS.1, T.S6CS4, T.S6CS9.32
- Research, Analysis, Estimation, and Critical-Thinking skills
CCSD: S7CS3,5, S6CS5, S5CS4, T.S7CS7.27, T.S7CS7.28
- Inspiration through observation and inquiry. Understanding through scientific methods and collaboration.
CCSD: S7CS9, S7CS8c, S7CS1-5, S6CS9b

About Us

Kevin Howard: Workshop Creator and Presenter

- 5+ years in educational presentation and Hands-On program development
- 10 years as an aerospace engineer, analyst, and software designer
- Broad scientific content knowledge and extensive experience in its real-world application
- Global Perspective from unique national and international experience
- Fluency in Spanish

Elena Garcia, Ph.D: Research and Project Development Partner

- 10 years Aerospace research and instruction (Georgia Tech Faculty)
- Extensive international experience
- Fluency in Spanish

References available upon request

Contact

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Biology and Ecology

Living Machines

The tremendous variety of life around you arises from unique combinations of the same simple ingredients. Examine the living machines that put them together, the power of colonies, the strength of scale, and the relations among living things.

Topics Include: Cell, DNA, Genome, Bacteria, Biofilm, Metabolism, Strength and Scale, Individual vs Colony Behavior, Symbiotic and Parasitic Relationships

CCSD Standards: S7L2, S7L3, S7L4, S7L5, S5L2, S5L3, S5L4

Take a Breath

Bacteria might be gross, but you have a lot more in common with them than you might realize. Take a deep breath and get ready to get your hands on the cornerstones of life: cellular respiration and the amazing ATP molecule.

Topics Include: Cellular Respiration and the ATP Molecule, Combustion, Krebs Cycle, Glycogen Cycle, Anaerobic/Aerobic Respiration, Redox Reactions, Catalysts

CCSD Standards: S.8.3.1, S7L2, S7L4a, S5L3, S5P2

The Birds, The Bees, Plants and You

Examine the fragile balance of biological systems from microorganisms to humans. And get your hands and mind on the important issues we face today.

Topics Include: Carbon Cycle, Energy Cycle, Photosynthesis, Bio Diversity, Ecological Balance, Population Strain, Potable Water, Flood Control, Oil Spills, Heat Island Effect, Climate Change

CCSD Standards: PS10, S.8.6.5, S7CS5a, S7L4, S6E5, S5L4

Eat or Be Eaten

Be a part of the food chain, literally, in a game of ecological competition and balance. Learn first hand about biological relationships and environmental influences while trying to avoid extinction!

Topics Include: Food Chain, Carbon Cycle, Energy Cycle, Autotroph, Heterotroph, Producer, Primary Consumer, Secondary Consumer, Predator / Prey

CCSD Standards: S7CS5a, S7L2, S7L4, S6CS5a, S5CS4a, S5L4



The workshops above may also be presented as a
Biology and Ecology Course



Can You Sense It?

Learn and experiment with the ins and outs of the senses that help us experience our world.

Topics Include: Nervous System, Olfactory System, Auditory System, Vision, Touch, Taste, Additive / Subtractive Color, Light Frequencies, Sound Frequencies, Diffusion, Volatile Fluids

CCSD Standards: S7L2, S7L4

Freeze Frame

Strobe lights and optical illusions are more than just neat effects, they can be amazing tools, a window into your mind's function, and a hidden part of your everyday life.

Topics Include: Strobe Effect, Timing Devices, Circuits, Frame Rate, Retinal Impression, Physiology, Optical Illusions

CCSD Standards: S7L2, S7L4



The 2 workshops above may also be presented as a Physiology Course





Chemistry and State Change

Free Work, Just Change States!

You have learned the states of matter, but have you made them work for you? From light bulbs to catapults, experiment with ways humans have harnessed the power of state change, and see if you can come up with some new ideas of your own.

Topics Include: State Change, Matter, Latent Heat, Energy, Water Cycle, Evaporation, Condensation, Sublimation, Plasma, Phase Diagrams, Desalination/Filtration, Stirling Cycle, Nucleation Sites
CCSD Standards: PS6, S6E4c, S5P2b

Food for Thought

It takes a lot of energy to think. Where would you guess it comes from? Take another look at your food and open your eyes to the vast potential of chemical energy.

Topics Include: Atoms, Molecules, Mixtures, Compounds, Exothermic/Endothermic, Acid/Base Reactions, pH Scale, Energy Cycle, Cellular Metabolism, Fermentation, Piezoelectric Effect
CCSD Standards: PS3, S.8.3.3, S7L2a, S7L4a, S5P2a, S5P2c

Of Insects and Fuel Cells

All around us plants, insects, even cars are doing the same thing we are. Explore how oxidation reactions work for animals and can be used for the technologies of tomorrow.

Topics Include: Redox Reactions, Cellular Respiration, ATP Molecule, Voltaic Pile, Batteries, Catalysts, Fuel Cells
CCSD Standards: PS3, S.8.3.1-4, S.8.3.3, S7L2a, S7L4b, S5P2c, S5P3b

Close Encounters of the Chemical Kind

When we search for alien life are we looking for the wrong thing? Find out why carbon is our focus and what other options there are. Taste, feel, and play with the amazing potential of carbon and silicon structures.

Topics Include: Organic Chemistry, Cross linking, Protein, Hydrocarbon, Energy Cycle, Viscosity (Newtonian and Non-Newtonian Fluids)
CCSD Standards: PS3, S7L4a, S5P2a, S5P2c

What's that Smell?

From a plant's vascular system to that smell you just can't find, there are forces at work that can seem to defy physics. See them in action and learn to harness the unexpected for yourself.

Topics Include: Diffusion, Brownian Motion, Osmosis, Filtration, Statistics, Entropy, Capillary Attraction, Surface Tension
CCSD Standards: S7CS3b, S7L2b, S6E5.i, S5L3



These workshops may also be presented as a
Chemistry Course





Earth and Space

Earth Works

Earth's geological processes may be slow, but that doesn't mean they are boring. Learn to feel, watch, and use the power beneath your feet.

Topics Include: Planetary Composition, Magnetic Poles, Plate Tectonics, Earthquakes, Volcanoes, Deposition, Rocks, Fossils, Oil Formation, Erosion, Tides, Currents, Energy Sources, Sonar Imaging

CCSD Standards: PS6, S.8.5.4, S.8.5.1, S.8.5.3, PS4, S.8.4.1, S6E5a, S6E5, S6E3, S5E1

Weather or Not

Could Mars have once been like the Earth? Find out what makes our atmosphere special, see how it works, and feel what it can do.

Topics Include: Weather, Water Cycle, State Change, Atmosphere, Density, Air Pressure, Coriolis Effect, Jet Stream, Ionosphere, Aurora Borealis, Plasma, Solar Wind, Planetary Comparisons

CCSD Standards: PS6, S.8.7.3, S.8.9.1, PS9, S6E2, S6E3, S6E4, S6E5e

From Soil it was Made

At the root of all habitats is soil. Play with earth's forces to learn how soil is created, why life is dependent upon it, and how natural and human actions affect it. Then experiment with solutions of your own.

Topics Include: Soil Development, Ecosystems and Habitats, Nitrogen Fixing, Water Cycle, Evapotranspiration, Biofilms, Deforestation, Desertification, Erosion and Prevention, Hydroseeding

CCSD Standards: PS4, PS5, PS10, S.8.4.1, S.8.5.3, S.8.6.5, S7L4, S6E3, S6E5, S5E1



The workshops above may also be presented as an Earth Sciences Course



Escape Velocity

Is there gravity in space? Why do Astronauts float? Tackle these and many other science misconceptions while experimenting with gravity wells, learning about orbits, and putting your rocket building skills to the test.

Topics Include: Gravity, Orbital Mechanics, Escape Velocity, Space Travel (Risks, Limitations, and Concepts), Artificial Gravity, Solar System, Time, Relativity, Rocket Design

CCSD Standards: PS8, S.8.8.6, S.8.8.7, S6E1e

Space Out

Explore the challenges ahead for interplanetary travel and space tourism. Learn about the machines that are getting us there before experimenting with your own version.

Topics Include: Rocket Propulsion, Design Concepts, Staging, Reentry, Shock Waves, Hypersonics, Cryogenics, Radiation, Parabolic and Orbital Trajectories, Aerobraking

CCSD Standards: PS8, S.8.8.6, S.8.8.7, S6E1, S6E2

It's Astronomical!

Seeing the future might be impossible, but watching events unfold billions of years ago is a snap, just look up! And time travel is just the beginning; the facts and theories about the universe we live in may just boggle your mind.

Topics Include: Celestial Bodies and Events, Astronomic Distances, Light Speed, Red Shift, Relativistic Effects, Gravity, Dark Matter, Black Holes, Worm Holes, Mobius Strip

CCSD Standards: PS2, PS8, S.8.8.6, S.8.8.7, S6E1, S6E2



The 3 workshops above may also be presented as an Astro Course





Electricity to Robotics

Shocking Science

Holy flying electrons zap man! Static electricity is neat stuff. Don't just learn about it, generate it, feel it, and discover ways to detect it.

Topics Include: Subatomic Particles, Electric Field, Energy, Contact Electrification, Conductors, Insulators, Plasma, Triboelectric Series, Lightning, Versorium, Franklin Bells, Electroscope

CCSD Standards: PS3, S.8.3.3, S6E6, S5P3a, S5P3c

Light it Up

How can 400,000 volts be safe and 12 volts kill you, and what does that have to do with vegetables? Explore the power of chemicals, the material of myths, and get current on your electrical knowledge.

Topics Include: Voltage, Amperage, Current, DC, Resistance, Power, Multimeters, Ionic Conductivity, Van de Graaff Generator, Superconductivity, Voltaic Piles, Batteries, Parallel and Series Circuits

CCSD Standards: PS2, PS3 S.8.3.3, S6CS4, S6E6, S5P2a, S5P3b, T.S6CS6.3

Opposites Attract

Throughout the last century physicists wrestled with the relationship between electricity and magnetism. Find out what they learned and how we have applied their findings to everything from your tooth brush to particle accelerators.

Topics Include: Permanent and Electromagnet, Solenoid, Speaker, Motor, Generator, AC / DC, Magnetic Induction, Transformer, Cathode Ray Tube, Rail Gun, Particle Collider

CCSD Standards: PS3, S.8.8.6, S6E6, S5P3



The workshops above may also be presented as an
Electricity and Magnetism Course



Get Discrete

Even the simplest circuits can do amazing things. Build your own and learn the basics of discrete electronic components in the process.

Topics Include: Resistor, Potentiometer, Capacitor, Transistor, Voltmeter, Ohmmeter, Ammeter, Soldering, Breadboard, Circuit Board, Voltage, Current, Resistance, Power Relationships

CCSD Standards: PS2, S6CS4, T.S7CS.1, T.S6CS6, T.S6CS4, T.S6CS9, S5P3b, S5CS3c

Picture Perfect Memory

How do you think cameras, DVDs, and computers are able to remember and show us all the things we put into them? Learn for yourself and create your own memory ... by hand.

Topics Include: Semiconductor, Diode, LED, Transistor, Analog/Digital, Memory Storage (Light, Magnetism, Solid State), Amplifier

CCSD Standards: PS2, S6CS4, T.S7CS.1, T.S6CS6, T.S6CS4, T.S6CS9, S5P3b, S5CS3c

Mind and Machine

Now that you understand the basics of electronics, memory and displays, enter the mind of the machine, and see if you can make it think for you.

Topics Include: Microchip, Software, Hardware, Firmware, Logic Circuits (AND, NAND, OR, NOR), Robotics, Artificial Intelligence, Neural Network, Agent Based Modeling, Internet

CCSD Standards: PS2, S6CS4, T.S7CS.1, T.S6CS6, T.S6CS4, T.S6CS9, S5P3b, S5CS3c



The 3 workshops above may also be presented as a
Robotics and Programming Fundamentals Course





Flight and Physics

Anti Gravity Machines

Uncover the secrets of buoyant force, ways to achieve it, and hazards to avoid on the way to building your own anti gravity machine.

Topics Include: Atmospheric Composition, Brownian Motion, Density, Buoyancy, Archimedes Principle, Ballonet (and biologic equivalent), Periodic Table, Reactive and Inert Elements

CCSD Standards: PS6, S.8.6.2, PS3, S.8.3.1-4, S6E4a-c,

Make It Fly

Learn the secrets that stumped humanity for centuries and lie behind the designs of every aircraft today and yet to come.

Topics Include: Air Resistance, Drag, Center of Gravity, Moment, Surface Area, Planform (Conventional, Canard, Flying Wing) Weight and Balance, Stability and Control

CCSD Standards: PS1, PS2, S.8.6.2, S7CS7, S5P1, S5CS7

Wings and Things

Have you ever ridden a flying vacuum before? Chances are you have. See how the principles jet liners use to fly can be applied to everything from boomerangs to paint sprayers. Then build and test your own airfoils.

Topics Include: Venturi Effect, Gyroscopic Effect, Vortex, Lift, Drag, Density, Static and Dynamic Pressure, Bernoulli's Principle, Hot Wire, Airfoil, Wind Tunnel, Computational Fluid Dynamics

CCSD Standards: S.8.6.2, S6E4a-c, S5P1

The Need for Speed

Whether breaking land speed records or avoiding being stranded in space, knowing a few basic rules will help you. Learn to master them. Then take a rocket flight of your own!

Topics Include: Newton's Laws, Force, Mass, Acceleration, Atmosphere, Density, Outer Space, Wings, Propellers, Jet Engines, Rocket Motors (solid, liquid, electric), Rocket Design

CCSD Standards: PS2, PS6, S6E1e, S5P1

Spin It

From nuclear power to your laundry room you may be surprised how many uses there are for the special characteristics of spinning objects. Take a spin and learn the hows and whys behind everything from breakdancing to navigational systems.

Topics Include: Centrifugal/Centripetal Force, Gyroscopic Effect, Precession, Artificial Gravity, Acceleration, Momentum, Conservation of Momentum, Density, Centrifuge, Flywheel, Coriolis Effect

CCSD Standards: PS6, S6E1e, S6E4, S5P1a

Floating on Air

You've probably seen helicopters and hovercraft, but what about ducted fans and ground effect vehicles? Find out how they are all related and levitate for yourself!

Topics Include: Propellers, Torque, Counter Rotation, Auto Gyration, Ground Effect, Hover Craft, Helicopters, Ducted Fans, Newton's Laws

CCSD Standards: PS2, PS6, S8.8.7, S6E1e, S5P1



These workshops may also be presented as an Aero Course





Light, Sound, and Energy

Feel the Force

Force fields are not just the material of science fiction movies, they are very real and very useful. Experiment with them for yourself, if you can figure out how to find them.

Topics Include: Magnetic, Electric, and Gravitational Fields, Field Visualization, Plotting and Exponential Relationships, Potential and Kinetic Energy, Momentum, Induction

CCSD Standards: PS2, PS3, S6E1e, S5P3

Catch the Wave

Reexamine the principles of sound and rediscover the world you thought you knew. From shock waves to ultrasonics, explore the production, visualization, and amplification of sound in ways you may not have considered before.

Topics Include: Matter, Waves, Shocks, Interference, Resonant Frequency, Doppler Effect, Oscilloscopes, Wave Pools, Amplification, Musical Instruments

CCSD Standards: PS3, PS6, S.8.9.1, S6E6, S5P3

End of the Rainbow

What do a light bulb, your microwave, and a TV remote have in common? Find out and dig into the treasure trove of potential at the end of this electromagnetic spectrum.

Topics Include: Heat, Energy, Spectral Lines, Ultraviolet, Visible, Infrared, Radio, Microwaves, Lasers, Analog, Digital, Frequency Modulation, Electromagnetic Spectrum, Wireless Communications, Induction, Electroluminescence, Chemoluminescence, Bioluminescence

CCSD Standards: PS3, S.8.6.2, S8.8.6, S6E6, S5P3, S5P2

Bionic Eyes and Ears

Whether magnifying the microscopic or searching for the astronomic, knowing how to amplify waves is the key. Discover how and build your own tools.

Topics Include: Speed of Light, Time, Refraction, Reflection, Amplification (Lenses and Parabolic Dish) Telescopes, Microscopes, Ultrasound, MRI, Radar, GPS (Triangulation), Laser

CCSD Standards: PS3, S.8.8.6, S6CS4c, S5P3



These workshops may also be presented as an Energy Course





Mechanics: Build it, Drop it, Shoot it!

Move It

Do you want to move mountains or at least pick up your family car? No sweat, we'll teach you how, along with all kinds of other useful tricks you can accomplish with mechanical advantage.

Topics Include: Force, Work, Friction, Conservation of Energy, Mechanical Advantage, Simple Machines, Archimedes Screw, History of Machines.

CCSD Standards: PS2, S7CS3, S7CS5, S6CS3, S6CS5, S5P1a, S5CS5b

Put It In Gears

Explore how simple mechanisms are combined to form the complex machines that are all around us today. Here is your chance to take things apart without having to put them back together. But don't leave before you finish building your own machine!

Topics Include: Work, Power, Entropy, Compound Machines, Gears, Cams, Pulley Systems, Hydraulics, Pneumatics

CCSD Standards: PS2, S7CS3, S7CS5, S6CS3, S6CS5, S5P1a, S5CS5b

Shoot It

From the middle to the space ages, explore the numerous ways human kind has discovered to propel things. And take your own imagination to new heights - literally!

Topics Include: Mechanical Advantage, Lever, Fulcrum, Momentum, Sling, Trebuchet, Material Selection, Elasticity, Sling Shot, Gun Powder, Air Pressure, Rocket Propulsion

CCSD Standards: S.8.8.7, S5CS5b, S5P1



The workshops above may also be presented as a Machines Course



Building on the Basics

Ever wondered how sky scrapers and space stations are designed, or been fascinated by automobile crash tests? Learn the secrets of ordinary and extraordinary structures, before building to the sky or creating the ultimate egg protection capsule.

Topics Include: Structural Geometry (Triangle, Circle, Sphere), Plates, Cables, Welds, Space Frames, Trusses, Monocoque Design, and Geodesic Domes

CCSD Standards: PS2, S7CS5, S7CS6, S5P1, S5CS5b

Don't Stress Out

Do you know all the I's, O's and U's about structures? Well, no need to stress out about it. Uncover how shapes of structural cross sections are part of your everyday life. Then put them to work to achieve the impossible or at least the unbeatable.

Topics Include: Stress, Strain, Tension, Compression, Shear, Strength, Fatigue, Structural Members (tube, I beam, channel), Frames, Material Selection Charts

CCSD Standards: PS2, S7CS5, S7CS6, S5P1a, S5CS5b



The 2 workshops above may also be presented as a Structures Course





Science Matters!

Why Scientists Matter

Do the roles of engineers, researchers, and scientists blur in your mind? Get a feel for the science disciplines yourself by playing a part in the discovery, investigation, and exploitation of the world's newest material: Toffle.

Topics Include: Scientific, Engineering, and Research Roles, Observation, Deduction, Implementation, Communication, Classification, Terminology

CCSD Standards: PS1, S7CS9, S7CS8, S7CS3, S7CS1, S5CS8, S5CS6

Outdoor Survival

If you were lost, could you purify water, find your way, tell the time, stay warm or find food? Explore simple ways to use science and every day materials to help you not only survive, but enjoy the outdoors.

Topics Include: Micro Organisms, Filtration, Orienteering, Weather Prediction, Simple Tools, Materials, Sources of Food, Health Risks, Shelter, Warmth, Physical Dangers, Physiological Control, Teamwork, Planning, Environmental Awareness, Conservation

CCSD Standards: PS7, S.8.5.6, S7L4d, S7L4e, S6E1d, S6E2, S6E3d, S6E6, S5L4

What's Burning?

Dinosaurs, rocket fuel, fire works, and fluorescent lights have more in common than you might think. Explore exothermic reactions, electromagnetic radiation, and aerodynamics before competing against your peers to build the best fire!

Topics Include: Combustion, Oxidation, Exothermic Reactions, Hydrocarbons, Energy Cycle, Electromagnetic Radiation, Spectral Lines, Fireworks, Capillary Attraction, Fire Safety

CCSD Standards: PS3, S.8.3.2, S7CS2, S7L4b, S6CS2, S5P2c

Lights, Camera, Science!

Behind the glitz and awe of special effects, magic and theatrical productions is also a good bit of science. Learn the whys behind some of the tricks of the trade, and amaze someone else for a change.

Topics Include: Props, Lighting, Makeup, Smoke and Mirrors, Density, State Change, Reflection, Opacity, Circuits, Material Properties, Sound, Physiological Effects

CCSD Standards: PS3, PS6, S7L2, S5P3, S5P2

*Further presentations will be added to this list as time permits.
Some modification of this series may also be required*