CARY ACADEMY

MIDDLE SCHOOL

SCIENCE CURRICULUM

Address

Cary Academy
1500 N. Harrison Ave.
Cary, NC 27511

Phone

Administration: (919) 677-3873
Middle School: (919) 228-4600
Upper School: (919) 228-4544

Online

Email: info@caryacademy.org
Website: www.caryacademy.org

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Middle School Curriculum

Science: Grade 6

The overarching goal of our framework for 6-12 science education is to ensure that by the end of 12th grade, all students should:

a) appreciate the beauty and wonder of science

b) possess sufficient knowledge of science and engineering to engage in public discussions on related issues

c) carefully consume and apply scientific and technological information in their everyday lives

d) actively be life-long learners of science

e) demonstrate the scientific and technological skills/practices to enter careers of their choice.

Science 6 focuses on teaching students how to become capable, independent researchers through the utilization of the scientific method (QUEST). Throughout the year, students will develop intimate knowledge of the nature of science, application of experimental design, and environmental stewardship

TRIMESTER 1: THE NATURE OF SCIENCE

Lab safety procedures and safety equipment usage

Introduction to the scientific method and controlled experimentation utilizing the QUEST model of inquiry

Question and Observe
Uncover comparative questions
Explore predictions
Start an action plan
Think about findings and share discoveries

Through the QUEST model of inquiry, students will practice the following skills:

- Make good observations, both qualitative and quantitative, utilizing their senses
- Convert observations into comparative, testable questions
- Form a testable prediction (hypothesis) based on comparative question asked
- Create a controlled experiment (action plan) that considers what variables and controls to incorporate and measure
- Organize data into tables and graphs both by hand and through Excel
- Evaluate data to find patterns/relationships, and draw conclusions
- Share discoveries with scientific community including other students, teachers, parents, and community members
- Go farther by thinking about other testable questions generated from findings

Nature Journaling

Ecosystems & Importance of Biodiversity

- Understand flow of energy in an ecosystem
- Analyze interactions between abiotic and biotic factors
- Examine N.C. threatened and endangered species, and their importance to ecosystems
- Assess human impacts on ecosystems

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TRIMESTER 2: APPLICATION OF EXPERIMENTAL DESIGN

Solid Waste Management
Conduct a personal waste audit and come up with ways to reduce your own waste footprint
Inquire into "Where does our waste go?" by utilizing hands-on lessons and activities
Figure out how to reduce our waste footprint through environmental engineering solutions (landfill liner; build a mock landfill)

Introduction and proper usage of several common pieces of lab equipment:
Students will learn how to correctly measure temperature (thermometer), mass (triple-beam balance), distance (ruler/meter stick), volume (graduated cylinder/beaker), and probes interfaced to science data sensing software. Focus will be on International System of Units. Refining and Advancing Lab Skills: students will review and extend upon the different skills learned during the first unit covering the nature of science

Physical Science Engineering Challenges
Students will be able to define a problem and then design a solution. By testing their designs, collecting and analyzing data, and then revising their designs based on evidence, students will continue to practice **QUEST**

TRIMESTER 3: ENVIRONMENTAL STEWARDSHIP

Continue Nature Journaling

Practice Environmental Field Methods including a Day Field Trip to Umstead Park (Biltmore stick use; water quality testing; soil quality testing; animal tracking and biodiversity survey)

Green innovations Identify innovations that have solved real-world problems or made a positive difference in the world.

Citizen Science
From Caren Cooper, Assoc. Prof., NCSU:
"Citizen science is a range of activities and projects through which people from all walks of life help advance scientific discovery. Citizen scientists bring science into the mainstream and make science relevant to their lives."

Students will have several opportunities throughout the year to be introduced to citizen science and how they as middle school students can contribute to scientific research.

Introduction to 7th Grade unit (Introduction to matter and atoms; microscopes and cells; and speed)

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Science: Grade 7

The theme for Science 7 is "Spaceship Earth." The interconnectedness of Earth's systems and human's role in those systems will be examined through "hands-on" learning experiences, research, simulations, modeling, and engineering design. Students will examine how Earth is like a spaceship, how Earth came to be, how Earth is able to provide the necessary life support systems for humans, how humans are impacting these systems, and what we can do to be good stewards and enhance the sustainability of Earth. The year will culminate with our simulated Human Mission to Mars in which students will use their knowledge of how Earth supports human life and of Mars' conditions to establish a Martian habitat.

Throughout the year, principles of astronomy, biology, chemistry, geology, physics, robotics, and rocketry will be addressed as their importance arises along our journey. Particular attention also will be given to communicating the interdisciplinary nature of learning (where students see the need to employ many science disciplines to solve problems) as well as the many ways that students can engage in real science which affects the communities in which they live (citizen science or engineering solutions). Finally, students will explore potential careers in the various areas of science we cover.:

Our Spaceship

Activities designed to introduce students to their role as a member of our Cary Academy Science 7 (CAS7) spaceship

- Student designed crew ID badge
- Crew safety guidelines
- Crew expectations

Introduction to Spaceship Earth

- Similarities between a spaceship and Earth
- Human requirements for life on a spaceship and on Earth
- The question of whether Earth will always be able to provide the human requirements for life will be revisited throughout the year.

How did Earth come to be? (building of our spaceship)

- Universe development/timeline:
    - Big Bang Experiment including review of lab safety, scientific method, and experimental design.
    - Matter, atoms, atomic theory, fundamental forces, elements and the Periodic Table, physical and chemical properties of matter
    - Galaxy formation, the Milky Way Galaxy, star production/lifecycle/nuclear fusion and fission
    - Our sun: forms of energy, solar energy engineering project, electromagnetic spectrum, wave properties
    - Our solar system: thinking in systems, scale, parts of our solar system
    - Earth: formation, layers, motions, seasons, atmosphere (composition, compounds, bonding), magnetosphere, development of life on Earth (cells: plant, animal, bacteria)
- Earth/Mars Comparison: in preparation for our Human Mission to Mars, students will explore the similarities/differences in the motions, layers, atmosphere, magnetosphere, and life on Earth and Mars.

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How does Earth provide the requirements for human life? (development of our life support system)

- Habitable zone: star type (a yellow star), orbital distance, surface temperature of Earth, planetary mass, gravity, Earth/Mars comparison.
- Liquid water: states of matter, molecules, measuring temperature, changes of state, atmosphere and temperature, atmospheric mass, Earth/Mars water comparison.
- Atmospheric conditions: greenhouse gases and their role in surface temperature, climate change, nitrogen, oxygen (oxidation and combustion), ozone, flow of matter (chemical change, conservation of matter, endothermic/exothermic), Earth/Mars comparison.
- Soil and Food Production: convection in the Earth, geochemistry (minerals and nutrients), plant growth (nitrogen cycle, fertilizers, carbon cycle), Earth/Mars soil comparison.

Human Impact on Earth's Systems (what are we doing to our life support system)

- Water cycle, carbon cycle, rock cycle, nitrogen cycle
- Student carbon footprint assessment

Stewardship and Sustainability (we are all crew on Spaceship Earth)

- Possible solutions to reduce human impact: nutrient recycling/composting, reducing carbon footprint, water use reduction/repurposing/capturing

Human Mission to Mars (what would it take if we had to find a new home)

- Overview of Mars Exploration to date
- Rocketry: parts and functions, Newton's Laws, Free Body Diagrams, friction, gravity, flight stage simulation (Scratch programming), trajectory, rocket building and launch.
- Entry, Descent and Landing
    - Lander (egg) drop competition
- Robotics: Lego Mindstorm robot building and programming
- Construction of a model sustainable community on Mars

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Science: Grade 8

Science 8 contains interrelated elements from three main science disciplines: earth science, physics, and biology. The theme in the 8th grade is "The Water Planet". Energy and water are recurring underlying themes which pervade the concepts and phenomena students explore in each of the three science disciplines. In earth science students learn how to be good stewards of freshwater and ocean resources. In physics, students learn to quantify work and energy while gaining an appreciation for the advantages of water transportation. The study of biology encompasses a diversity of invertebrate phyla and a focused look at 3 systems in the human body. Rather than covering topics by discipline, each topic is covered in the context of the unit of study. For example, mollusk structure and function is explored within the context of the marine biology unit when students learn about clams and whelks in the intertidal zone. Throughout the year, in each unit, the role of energy and the importance of water are explored on various levels: from the molecular level up to the global scale.

SCOPE AND SEQUENCE

I. Water:

A. describe the properties of water

B. describe the various processes in the water cycle and the places where water is stored on planet earth.

C. gain an appreciation for potable water as a precious resource.

D. measure important water quality parameters in the field

E. understand the significance of water quality results.

F. use GIS to analyze environmental data.

G. use the design process to collaboratively create a workable aquaponics food growing apparatus.

II. Oceans

H. relate density to ocean and air currents

I. define density, mass and volume

J. describe the topography of the ocean floor in the various ocean regions

K. describe typical food chains in various marine environments.

L. understand the basis for productivity in different marine ecosystems.

M. classify invertebrates into the main groups

   a) Mollusks

   b) Arthropods

   c) Roundworms

   d) Flatworms

   e) Cnidarians

   f) Sponges

N. G. describe unifying characteristics for each group

O. H. relate structure to function in the various groups of animals.

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III. Water transportation

A. understand buoyancy and density as it applies to marine organisms and ocean transportation

B. apply knowledge of simple machines and energy conversions to build an efficient electric powered model boat

C. list and describe the main forms of energy

D. give examples of energy transformations in living and non-living systems

Human Body Systems

A) describe the main structure and function for various human body systems
   a) digestive
   b) respiratory
   c) circulatory

B) explain how the three systems provide the substances needed for cellular respiration

C) explain the importance of good nutrition D. describe diffusion and osmosis and explain why these are essential for life processes

D) list the causes of cardiovascular disease.

NOTE:
The Science 8 course also includes a two-week Healthy Sexuality unit taught in conjunction with the Charger Trails program. For more information about the Healthy Sexuality unit, please view the following document:
http://www.caryacademy.org/uploaded/Curriculum/Healthy_Sexuality.PDF?1390344523280

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Science: AMPT

Advances In Medical Technology Program

The Cary Academy Advances in Medical Technology Program (AMTP) is a trimester-long health sciences elective designed to create an exciting, interactive learning experience for seventh-grade students with a focus on cardiovascular health. AMTP integrates medical technology with computer/internet technology and the health sciences. The program unites Cary Academy students with outstanding health care provider resources in the area, which in the past have included the following: Brody School of Medicine's da Vinci robot (used for cardiovascular surgery), UNC Hospitals Patient Simulation Lab, and local cardiovascular experts.

Students apply for AMTP at the end of 6th grade. The AMTP module is taught primarily during the student's regular 7th grade physical education and health period as an elective supplement to the two health modules that all 7th grade students complete. AMTP is meant to be a fun, interactive experience, with the workload being the same as any other health module. A $50 materials fee is charged as the program involves dissections of preserved specimens, the use of technology equipment, and at least one field trip.

EXAMPLE LABS AND EXPERIENCES IN AMTP

- Preserved Pig Heart Dissection to examine the anatomy of the heart. A student may choose to only watch the dissection as opposed to conducting the dissection if they are more comfortable doing so. Students are educated regarding the use of animal specimens for scientific investigation. Note that all animal specimens have been salvaged from animals that were sacrificed for meat production and that the specimens used in the program would have been discarded. Cary Academy's use of animal specimens for scientific investigation is consistent with the National Science Teacher Association and National Science Education Standards.
- Prevention of Heart Disease (interactive presentation by a collaborating cardiologist).
- Robotics in Medicine: The building of a robotic arm using Lego Mindstorms to simulate the da Vinci robot as used in cardiovascular surgery.
- Diseases of the Heart (hands-on lab).
- Emerging Technologies in Cardiovascular Surgery: the da Vinci Robot and other technology (interactive presentation by a collaborating cardiologist).
- How to measure heart rate and how it is affected by various stimuli/exercise (hands-on experiment with Vernier Heart Rate sensors).
- How to use a stethoscope and how to interpret heart sounds using multimedia technology.
- How to recognize when a person is having a heart attack and basic CPR (interactive presentation by a collaborating health professional).
- What is blood pressure and how to measure blood pressure (hands-on experiment with manual and automatic blood pressure cuffs and Vernier Blood Pressure sensors).
- Creation of patient education materials (poster, trifold, brochure, PSA) on coronary artery disease diagnosis and treatment.
- Grandparents Day and Health Fair Blood Pressure Clinics: students conduct blood pressure measurements and provide health information for visitors and the CA community.