



Active Chemistry Correlation to the New York State Learning Standards for Science

Correlation Key:	<u><i>Movie Special Effects</i></u>	<u><i>Periodic Table</i></u>	<u><i>Cool Chemistry</i></u>
"X" Coverage = Secondary concept of the activity or problem. Students gain a basic understanding or introduction of the concept.			
"XX" In-depth Coverage = Primary concept that is the focus of the activity or problem. Students gain thorough understanding of the concept.	Chapter 1	Chapter 2	Chapter 3
"X" or "XX" in italics indicate concepts that can be covered when incorporating technology into the curriculum.			
Standard 1—Analysis, Inquiry, and Design			
Scientific Inquiry			
1. The central purpose of scientific inquiry is to develop explanations of natural phenomena in a continuing, creative process.	XX	XX	XX
Students:			
• elaborate on basic scientific and personal explanations of natural phenomena, and develop extended visual models and mathematical	XX	XX	XX
• hone ideas through reasoning, library research, and discussion with others, including experts.	XX	XX	XX
• work toward reconciling competing explanations; clarifying points of agreement and disagreement.	XX	XX	XX
• coordinate explanations at different levels of scale, points of focus, and degrees of complexity and specificity and recognize the need for such alternative representations of the natural world.	XX	XX	XX
2. Beyond the use of reasoning and consensus, scientific inquiry involves the testing of proposed explanations involving the use of conventional techniques and procedures and usually requiring considerable ingenuity.	XX	XX	XX
Students:			
• devise ways of making observations to test proposed explanations.	XX	XX	XX
• refine their research ideas through library investigations, including electronic information retrieval and reviews of the literature, and through peer feedback obtained from review and discussion.	XX	XX	XX



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<ul style="list-style-type: none"> develop and present proposals including formal hypotheses to test their explanations, i.e., they predict what should be observed under specified conditions if the explanation is true. 	XX	XX	XX
<ul style="list-style-type: none"> carry out their research plan for testing explanations, including selecting and developing techniques, acquiring and building apparatus, and recording observations as necessary. 	XX	XX	XX
<p>Students will use mathematical analysis, scientific inquiry, and engineering design, as appropriate, to pose questions, seek answers, and develop solutions.</p> <p>Engineering Design</p>			
<p>1. Engineering design is an iterative process involving modeling and optimization finding the best solution within given constraints which is used to develop technological solutions to problems within given constraints.</p>	XX	XX	XX
<p>Students engage in the following steps in a design process:</p>			
<ul style="list-style-type: none"> initiate and carry out a thorough investigation of an unfamiliar situation and identify needs and opportunities for technological invention or innovation. 	XX	XX	XX
<ul style="list-style-type: none"> identify, locate, and use a wide range of information resources, and document through notes and sketches how findings relate to the problem. 	XX	XX	XX



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<ul style="list-style-type: none"> generate creative solutions, break ideas into significant functional elements, and explore possible refinements; predict possible outcomes using mathematical and functional modeling techniques; choose the optimal solution to the problem, clearly documenting ideas against design criteria and constraints; and explain how human understands, economics, ergonomics, and environmental considerations have influenced the solution. 	XX	XX	XX
<ul style="list-style-type: none"> develop work schedules and working plans which include optimal use and cost of materials, processes, time, and expertise; construct a model of the solution, incorporating developmental modifications while working to a high degree of quality (craftsmanship). 			
<ul style="list-style-type: none"> devise a test of the solution according to the design criteria and perform the test; record, portray, and logically evaluate performance test results through quantitative, graphic, and verbal means. Use a variety of creative verbal and graphic techniques effectively and persuasively to present conclusions, predict impacts and new problems, and suggest and pursue modifications. 	X	X	X
Standard 2—Information Systems			
1. Information technology is used to retrieve, process, and communicate information and as a tool to enhance learning.	X	X	X
Students:			
<ul style="list-style-type: none"> understand and use the more advanced features of word processing, spreadsheets, and data-base software. 	X	X	X
<ul style="list-style-type: none"> prepare multimedia presentations demonstrating a clear sense of audience and purpose. 	X	X	X



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• access, select, collate, and analyze information obtained from a wide range of sources such as research data bases, foundations, organizations, national libraries, and electronic communication networks, including the Internet.	X	X	X
• students receive news reports from abroad and work in groups to produce newspapers reflecting the perspectives of different countries.	X	X	X
• utilize electronic networks to share information.	X	X	X
• model solutions to a range of problems in mathematics, science, and technology using computer simulation software.	X	X	X
2. Knowledge of the impacts and limitations of information systems is essential to its effective and ethical use.			
Students:			
• explain the impact of the use and abuse of electronically generated information on individuals and families.	X	X	X
• evaluate software packages relative to their suitability to a particular application and their ease of use.	X	X	X
• discuss the ethical and social issues raised by the use and abuse of information systems.	X	X	X
Students will access, generate, process, and transfer information using appropriate technologies.	X	X	X
3. Information technology can have positive and negative impacts on society, depending upon how it is used.			
Students:			
• work with a virtual community to conduct a project or solve a problem using the network.	X	X	X



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• discuss how applications of information technology can address some major global problems and issues.	X	X	X
• discuss the environmental, ethical, moral, and social technology.	X	X	X
Standard 4 - Physical Setting			
4. Energy exists in many forms, and when these forms change energy is conserved.	XX	XX	XX
• observe and describe transmission of various forms of energy	XX	XX	XX
• explain heat in terms of kinetic molecular theory	XX	X	XX
• explain variations in wavelength and frequency in terms of the source of the vibrations that produce them, e.g., molecules, electrons, and nuclear particles	X	XX	X
• explain the uses and hazards of radioactivity		X	
5. Energy and matter interact through forces that result in changes in motion.		X	
• explain and predict different patterns of motion of objects (e.g., linear and angular motion, velocity and acceleration, momentum and inertia)		X	
• explain chemical bonding in terms of the motion of electrons	X	XX	XX
• compare energy relationships within an atom's nucleus to those outside the nucleus		XX	
Standard 5 - Technology Education			
Engineering Design			
1. Engineering design is an iterative process involving modeling and optimization used to develop technological solutions to problems within given constraints.			



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• initiate and carry out a thorough investigation of an unfamiliar situation and identify needs and opportunities for technological invention or innovation	X	X	X
• identify, locate, and use a wide range of information resources including subject experts, library references, magazines, videotapes, films, electronic data bases and online services, and discuss and document through notes and sketches how findings relate to the problem	XX	XX	XX
• generate creative solution ideas, break ideas into the significant functional elements, and explore possible refinements; predict possible outcomes using mathematical and functional modeling techniques; choose the optimal solution to the problem, clearly documenting ideas against design criteria and constraints; and explain how human values, economics, ergonomics, and environmental considerations have influenced the solution	XX	XX	XX
• develop work schedules and plans which include optimal use and cost of materials, processes, time, and expertise; construct a model of the solution, incorporating developmental modifications while working to a high degree of quality (craftsmanship)	XX	XX	XX
• in a group setting, devise a test of the solution relative to the design criteria and perform the test; record, portray, and logically evaluate performance test results through quantitative, graphic, and verbal means; and use a variety of creative verbal and graphic techniques effectively and persuasively to present conclusions, predict impacts and new problems, and suggest and pursue modifications	X	X	X

Tools, Resources and Technological Processes



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2. Technological tools, materials, and other resources should be selected on the basis of safety, cost, availability, appropriateness, and environmental impact; technological processes change energy, information, and material resources into more useful forms.	X	X	X
• test, use, and describe the attributes of a range of material (including synthetic and composite materials), information, and energy resources	XX	X	XX
• select appropriate tools, instruments, and equipment and use them correctly to process materials, energy, and information	XX	XX	XX
• explain tradeoffs made in selecting alternative resources in terms of safety, cost, properties, availability, ease of processing, and disposability	X	X	X
• describe and model methods (including computer-based methods) to control system processes and monitor system outputs			
Computer Technology			
3. Computers, as tools for design, modeling, information processing, communication, and system control, have greatly increased human productivity and knowledge.			
• understand basic computer architecture and describe the function of computer subsystems and peripheral devices			
• select a computer system that meets personal needs			
• attach a modem to a computer system and telephone line, set up and use communications software, connect to various online networks, including the Internet, and access needed information using email, telnet, gopher, ftp, and web searches			



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• use computer-aided drawing and design (CADD) software to model realistic solutions to design problems			
• develop an understanding of computer programming and attain some facility in writing computer programs			
Technology Systems			
4. Technological systems are designed to achieve specific results and produce outputs, such as products, structures, services, energy, or other systems.			
• explain why making tradeoffs among characteristics, such as safety, function, cost, ease of operation, quality of post-purchase support, and environmental impact, is necessary when selecting systems for specific purposes			
• model, explain, and analyze the performance of a feedback control system			
• explain how complex technological systems involve the confluence of numerous other systems			
History & Evolution of Technology			
5. Technology has been the driving force in the evolution of society from an agricultural to an industrial to an information base.			
• explain how technological inventions and innovations have caused global growth and interdependence, stimulated economic competitiveness, created new jobs, and made other jobs obsolete			
Impacts of Technology			
6. Technology can have positive and negative impacts on individuals, society, and the environment and humans have the capability and responsibility to constrain or promote technological development.			



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<ul style="list-style-type: none"> explain that although technological effects are complex and difficult to predict accurately, humans can control the development and implementation of technology. explain how computers and automation have changed the nature of work 			
<ul style="list-style-type: none"> explain how national security is dependent upon both military and nonmilitary applications of technology 			
Management of Technology			
7. Project management is essential to ensuring that technological endeavors are profitable and that products and systems are of high quality and built safely, on schedule, and within budget.			
<ul style="list-style-type: none"> develop and use computer-based scheduling and project tracking tools, such as flow charts and graphs explain how statistical process control helps to assure high quality output 			
<ul style="list-style-type: none"> discuss the role technology has played in the operation of successful U.S. businesses and under what circumstance they are competitive with other countries 			
<ul style="list-style-type: none"> explain how technological inventions and innovations stimulate economic competitiveness and how, in order for an innovation to lead to commercial success, it must be translated into products and services with marketplace demand 			



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<ul style="list-style-type: none"> describe new management techniques (e.g., computer-aided engineering, computer-integrated manufacturing, total quality management, just-in-time manufacturing), incorporate some of these in a technological endeavor, and explain how they have reduced the length of design-to-manufacture cycles, resulted in more flexible factories, and improved quality and customer satisfaction help to manage a group engaged in planning, designing, implementation, and evaluation of a project to gain understanding of the management dynamics 			
Standard 6—Interconnectedness: Common Themes			
Systems Thinking			
1. Through systems thinking, people can recognize the commonalities that exist among all systems and how parts of a system interrelate and combine to perform specific functions.			
Students:			
<ul style="list-style-type: none"> explain how positive feedback and negative feedback have opposite effects on system outputs. use an input-process-output-feedback diagram to model and compare the behavior of natural and engineered systems. define boundary conditions when doing systems analysis to determine what influences a system and how it 			
Models			
2. Models are simplified representations of objects, structures, or systems used in analysis, explanation, interpretation, or design.			
Students:			



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• revise a model to create a more complete or improved representation of the system.		X	
• collect information about the behavior of a system and use modeling tools to represent the operation of the system.			
• find and use mathematical models that behave in the same manner as the processes under investigation.			
• compare predictions to actual observations using test models.			
Students will understand the relationships and common themes that connect mathematics, science, and technology and apply the themes to these and other areas of learning.			
Magnitude and Scale			
3. The grouping of magnitudes of size, time, frequency, and pressures or other units of measurement into a series of relative order provides a useful way to deal with the immense range and the changes in scale that affect the behavior and design of systems.			
Students:			
• describe the effects of changes in scale on the functioning of physical, biological, or designed systems.			
• extend their use of powers of ten notation to understanding the exponential function and performing operations with exponential factors.			
Equilibrium and Stability			
4. Equilibrium is a state of stability due either to a lack of changes (static equilibrium) or a balance between opposing forces (dynamic equilibrium).			
Students:			



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• describe specific instances of how disturbances might affect a system's equilibrium, from small disturbances that do not upset the equilibrium to larger disturbances (threshold level) that cause the system to become unstable.	X	X	XX
• cite specific examples of how dynamic equilibrium is achieved by equality of change in opposing directions.	X	X	X
Patterns of Change			
5. Identifying patterns of change is necessary for making predictions about future behavior and conditions.			
Students:			
• use sophisticated mathematical models, such as graphs and equations of various algebraic or trigonometric functions.	X	XX	X
• search for multiple trends when analyzing data for patterns, and identify data that do not fit the trends.	X	XX	X
Optimization			
6. In order to arrive at the best solution that meets criteria within constraints, it is often necessary to make trade-offs.			
Students:			
• use optimization techniques, such as linear programming, to determine optimum solutions to problems that can be solved using quantitative methods.			
• analyze subjective decision making problems to explain the trade-offs that can be made to arrive at the best solution.			
Standard 7—Interdisciplinary Problem Solving			
Connections			



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1. The knowledge and skills of mathematics, science, and technology are used together to make informed decisions and solve problems, specially those relating to issues of science/technology/society, consumer decision making, design, and inquiry into phenomena.			
Students:			
• analyze science/technology/society problems and issues on a community, national, or global scale and plan and carry out a remedial course of action.	X	X	X
• analyze and quantify consumer product data, understand environmental and economic impacts, develop a method for judging the value and efficacy of competing products, and discuss cost/benefit and risk/benefit tradeoffs made in arriving at the optimal choice.			
• design solutions to real-world problems on a community, national, or global scale using a technological design process that integrates scientific investigation and rigorous mathematical analysis of the problem and of the solution.			
• explain and evaluate phenomena mathematically and scientifically by formulating a testable hypothesis, demonstrating the logical connections between the scientific concepts guiding the hypothesis and the design of an experiment, applying and inquiring into the mathematical ideas relating to investigation of phenomena, and using (and if needed, designing) technological tools and procedures to assist in the investigation and in the communication of results.	X	X	X
Strategies			



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2. Solving interdisciplinary problems involves a variety of skills and strategies, including effective work habits; gathering and processing information; generating and analyzing ideas; realizing ideas; making connections among the common themes of mathematics, science, and technology; and presenting results.	XX	XX	XX
Students participate in an extended, culminating mathematics, science, and technology project. The project would require students to:	XX	XX	XX
• work effectively	XX	XX	XX
• gather and process information	XX	XX	XX
• generate and analyze ideas	XX	XX	XX
• observe common themes	XX	XX	XX
• realize ideas	XX	XX	XX
• present results	XX	XX	XX