

## Norton City Schools Standards-Based Science Course of Study 2003

### ELEVENTH/TWELFTH GRADES

**NATURE OF SCIENCE-These scientific process skills should be integrated into High School Elective courses.**

**Science and Technology Standard (ST)**

**Scientific Inquiry Standard (SI)**

**Scientific Ways of Knowing Standard (SK)**

11-12 Benchmarks	Grade Level Indicators and Sub-Objectives	Teaching Strategies/Resources
<p>By the end of the 11-12 program, the student will:</p> <p><b><u>Science and Technology</u></b>            ★ Predict how human choices today will determine the quality and quantity of life on Earth. (ST-A)</p> <p><b><u>Scientific Inquiry</u></b>            ★ Make appropriate choices when designing and participating in scientific investigations by using cognitive and manipulative skills when collecting data and formulating conclusions from the data. (SI-A)</p> <p><b><u>Scientific Ways of Knowing</u></b>            ★ Explain how scientific evidence is used to develop and revise scientific predictions, ideas or theories. (SK-A)            ★ Explain how ethical</p>	<p>By the end of Eleventh/Twelfth Grades, the student will:</p> <p><b><u>Understanding Technology</u></b>            ★ Identify that science and technology are essential social enterprises but alone they can only indicate what can happen, not what should happen. Realize the latter involves human decisions about the use of knowledge. (ST-11-1)            ★ Predict how decisions regarding the implementation of technologies involve the weighing of trade-offs between predicted positive and negative effects on the environment and/or humans. (ST-11-2)            ★ Explore and explain any given technology that may have a different value for different groups of people and at different points in time (e.g., new varieties of farm plants and animals have been engineered by manipulating their genetic instructions to reproduce new characteristics). (ST-11-3)            ★ Explain why basic concepts and principles of science and technology should be a part of active debate about the economics, policies, politics and ethics of various science-related and technology-related challenges. (ST-11-4)            ★ Investigate that all fuels (e.g., fossil, solar and nuclear) have advantages and disadvantages; therefore society must consider the trade-offs among them (e.g., economic costs and environmental impact). (ST-11-5)            ★ Research sources of energy beyond traditional fuels and the advantages, disadvantages and trade-offs society must consider when</p>	

Note: Ohio Academic Content Standards, Benchmarks and Indicators, are typed in bold print and designated by a “★”.

## Norton City Schools Standards-Based Science Course of Study 2003

<p>considerations shape scientific endeavors. (SK-B)</p> <p>★ Explain how societal issues and considerations affect the progress of science and technology. (SK-C)</p>	<p>using alternative sources (e.g., biomass, solar, hybrid engines, wind and fuel cells). (ST-11-6)</p> <p>★ Explain how science often advances with the introduction of new technologies and how solving technological problems often results in new scientific knowledge. (ST-12-1)</p> <p>★ Describe how new technologies often extend the current levels of scientific understanding and introduce new areas of research. (ST-12-2)</p> <p>★ Research how scientific inquiry is driven by the desire to understand the natural world and how technological design is driven by the need to meet human needs and solve human problems. (ST-12-3)</p> <p>★ Explain why basic concepts and principles of science and technology should be a part of active debate about the economics, policies, politics and ethics of various science-related and technology-related challenges. (ST-12-4)</p> <p><b><u>Doing Scientific Inquiry</u></b></p> <p>★ Formulate testable hypotheses. Develop and explain the appropriate procedures, controls and variables (dependent and independent) in scientific experimentation. (SI-11-1)</p> <p>★ Evaluate assumptions that have been used in reaching scientific conclusions. (SI-11-2)</p> <p>★ Design and carry out scientific inquiry (investigation), communicate and critique results through peer review. (SI-11-3)</p> <p>★ Explain why the methods of an investigation are based on the questions being asked. (SI-11-4)</p> <p>★ Summarize data and construct a reasonable argument based on those data and other known information. (SI-11-5)</p> <p>★ Formulate testable hypotheses. Develop and explain the appropriate procedures, controls and variables (dependent and independent) in scientific experimentation. (SI-12-1)</p> <p>★ Derive simple mathematical relationships that have predictive power from experimental data (e.g., derive an equation from a graph and vice versa, determine whether a linear or exponential relationship exists among the data in a table). (SI-12-2)</p> <p>★ Research and apply appropriate safety precautions when designing and/or conducting scientific investigations (e.g., OSHA, MSDS, eyewash, goggles and ventilation). (SI-12-3)</p>	
--	--	--

## Norton City Schools Standards-Based Science Course of Study 2003

- ★ Create and clarify the method, procedures, controls and variables in complex scientific investigations.
  - ★ Use appropriate summary statistics to analyze and describe data. (SI-12-4)
- Nature of Science
- ★ Analyze a set of data to derive a hypothesis and apply that hypothesis to a similar phenomenon (e.g., biome data). (SK-11-1)
  - ★ Apply scientific inquiry to evaluate results of scientific investigations, observations, theoretical models and the explanations proposed by other scientists. (SK-11-2)
  - ★ Demonstrate that scientific explanations adhere to established criteria, for example a proposed explanation must be logically consistent, it must abide by the rules of evidence and it must be open to questions and modifications. (SK-11-3)
  - ★ Explain why scientists can assume that the universe is a vast single system in which the basic rules are the same everywhere. (SK-11-4)
  - ★ Give examples that show how science is a social endeavor in which scientists share their knowledge with the expectation that it will be challenged continuously by the scientific community and others. (SK-12-1)
  - ★ Evaluate scientific investigations by reviewing current scientific knowledge and the experimental procedures used, examining the evidence, identifying faulty reasoning, pointing out statements that go beyond the evidence and suggesting alternative explanations for the same observations. (SK-12-2)
  - ★ Select a scientific model, concept or theory and explain how it has been revised over time based on new knowledge, perceptions or technology. (SK-12-3)
  - ★ Analyze a set of data to derive a principle and then apply that principle to a similar phenomenon (e.g., predator/prey relationships and properties of semiconductors). (SK-12-4)
  - ★ Describe how individuals and teams contribute to science and engineering at different levels of complexity (e.g., an individual may conduct basic field studies, hundreds of people may work together on major scientific questions or technical problems). (SK-12-5)

## Norton City Schools Standards-Based Science Course of Study 2003

### Ethical Practices

- ★ Recognize that bias affects outcomes. People tend to ignore evidence that challenges their beliefs but accept evidence that supports their beliefs. Scientists attempt to avoid bias in their work. (SK-11-5)
- ★ Describe the strongly held traditions of science that serve to keep scientists within the bounds of ethical professional behavior. (SK-11-6)
- ★ Explain that scientists may develop and apply ethical tests to evaluate the consequences of their research when appropriate. (SK-12-6)

### Scientific Theories

- ★ Explain how theories are judged by how well they fit with other theories, the range of included observations, how well they explain observations and how effective they are in predicting new findings. (SK-11-7)

### Science and Society

- ★ Explain that the decision to develop a new technology is influenced by societal opinions and demands and by cost benefit considerations. (SK-11-8)
- ★ Explain how natural and human-induced hazards present the need for humans to assess potential danger and risk. Many changes in the environment designed by humans bring benefits to society as well as cause risks. (SK-11-9)
- ★ Describe costs and trade-offs of various hazards-ranging from those with minor risk to a few people, to major catastrophes with major risk to many people. The scale of events and the accuracy with which scientists and engineers can (and cannot) predict events are important considerations. (SK-11-10)
- ★ Research the role of science and technology in careers that students plan to pursue. (SK-11-11)
- ★ Describe the current and historical contributions of diverse peoples and cultures to science and technology and the scarcity and inaccessibility of information on some of these contributions. (SK-12-7)
- ★ Recognize that individuals and society must decide on proposals involving new research and the introduction of new technologies into society. Decisions involve assessment of alternatives, risks, costs and

## Norton City Schools Standards-Based Science Course of Study 2003

	<p>benefits and consideration of who benefits and who suffers, who pays and gains, and what the risks are and who bears them. (SK-12-8)</p> <ul style="list-style-type: none"><li>★ Recognize the appropriateness and value of basic questions “What can happen?” “What are the odds?” and “How do scientists and engineers know what will happen?” (SK-12-9)</li><li>★ Recognize that social issues and challenges can affect progress in science and technology (e.g., funding priorities for specific health problems serve as examples of ways that social issues influence science and technology). (SK-12-10)</li><li>★ Research how advances in scientific knowledge have impacted society on a local, national or global level. (SK-12-11)</li></ul>	
--	--	--