

# Dublin City Schools Science Graded Course of Study

## Advanced Research in Science

### I. Standard: Scientific Inquiry

Students develop scientific habits of mind as they use the processes of scientific inquiry to ask valid questions and to gather and analyze information. They understand how to develop hypotheses and make predictions. They are able to reflect on scientific practices as they develop plans of action to create and evaluate a variety of conclusions. Students are also able to demonstrate the ability to communicating their findings to others.

<b>Benchmark</b>	<b>Advanced Research Indicator(s)</b>
<p><b>Benchmark A</b>  <b>11-12 Grade Level Band</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.</p>	<p><b>Benchmark A Indicator(s)</b></p> <ul style="list-style-type: none"> <li>• Formulate testable hypotheses. Develop and explain the appropriate procedures, controls and variables (dependent and independent) in scientific experimentation. (Ohio Indicator 1, Grade 11)</li> <li>• Evaluate assumptions that have been used in reaching scientific conclusions. (Ohio Indicator 2, Grade 11)</li> <li>• Present scientific findings using clear languages, accurate data, appropriate graphs, tables, maps and available technology. (Dublin Indicator)</li> <li>• Design and carry out scientific inquiry (investigation), communicate and critique results through peer review. (Ohio Indicator 3, Grade 11)</li> <li>• Summarize data and construct a reasonable argument based on those data and other known information. (Ohio Indicator 5, Grade 11)</li> </ul>



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<b>Benchmark A <i>Continued</i></b>	<b>Advanced Research Indicator(s)</b>
<b>Benchmark A <i>Continued</i></b>	<p><b>Benchmark A Indicator(s)</b></p> <ul style="list-style-type: none"> <li>• 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). (Ohio Indicator 2, Grade 12)</li> <li>• Research and apply appropriate safety precautions when designing and/or conducting scientific investigations (e.g., OSHA, MSDS, eyewash, goggles, ventilation). (Ohio Indicator 3, Grade 12)</li> <li>• Use appropriate summary statistics to analyze and describe data. (Ohio Indicator 5, Grade 12)</li> <li>• Draw conclusions from inquiries based on scientific knowledge and principles, the use of logic and evidence (data) from investigations. (Dublin Indicator)</li> </ul>

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### II. Standard: Scientific Ways of Knowing

Students realize that the current body of scientific knowledge must be based on evidence, be predictive, logical, subject to modification, and limited to the natural world. This includes demonstrating an understanding that scientific knowledge grows and advances as new evidence is discovered to support or modify existing theories, as well as to encourage the development of new theories. Students are able to reflect on ethical scientific practices and demonstrate an understanding of how the current body of scientific knowledge reflects the historical and cultural contributions of women and men who provide us with a more reliable and comprehensive understanding of the natural world.

<b>Benchmark</b>	<b>Advanced Research Indicator(s)</b>
<p><b>Benchmark A</b>  <b>11-12 Grade Level Band</b>            Explain how scientific evidence is used to develop and revise scientific predictions, ideas, or theories.</p>	<p><b>Benchmark A Indicator(s)</b></p> <ul style="list-style-type: none"> <li>• Describe that scientist may disagree about explanations of phenomenon, about interpretation of data or about the value of rival theories, but they do agree that questioning, response to criticism and open communication are integral to the process of science. (Dublin Indicator)</li> <li>• 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. (Ohio Indicator 2, Grade 12)</li> </ul>

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<b>Benchmark <i>Continued</i></b>	<b>Advanced Research Indicator(s)</b>
<p><b>Benchmark B</b>  <b>11-12 Grade Level Band</b>            Explain how ethical considerations shape scientific endeavors.</p>	<p><b>Benchmark B Indicator(s)</b></p> <ul style="list-style-type: none"> <li>• Recognize that bias affects outcomes. People tend to ignore evidence that challenges their beliefs but accept evidence that supports their beliefs. Scientist attempt to avoid bias in their work. (Ohio Indicator 5, Grade 11)</li>   <li>• Describe the strongly held traditions of science that serve to keep scientists within the bounds of ethical professional behavior. (Ohio Indicator 6, Grade 11)</li>   <li>• Recognize that research involving voluntary human subjects should be conducted only with the informed consent of the subjects and follow rigid guidelines and/or laws. (Dublin Indicator)</li>   <li>• Recognize that animal-based research must be conducted according to currently accepted professional standards and laws. (Dublin Indicator)</li> </ul>