

SCIENCE GRADE 12

Adams County/Ohio Valley
Course of Study

Content Standard: Earth and Space Science
Grade 11-12 Benchmarks: A. Explain how technology can be used to gather evidence and increase our understanding of the universe.
Content Organizer: The Universe

Grade level Indicator	OGT Competency Focus	Resources	Instructional Activities/Strategies	Assessment
1. Explain how scientists obtain information about the universe by using technology to detect electromagnetic radiation that is emitted, reflected or absorbed by stars and other objects.				

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2. Explain how the large-scale motion of objects in the universe is governed by gravitational forces and detected by observing electromagnetic radiation.				

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Content Organizer: The Universe

Grade level Indicator	OGT Competency Focus	Resources	Instructional Activities/Strategies	Assessment
3. Explain how information about the universe is inferred by understanding that stars and other objects in space emit, reflect or absorb electromagnetic radiation, which we then detect.				

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Grade level Indicator	OGT Competency Focus	Resources	Instructional Activities/Strategies	Assessment
<p>4. Explain how astronomers infer that the whole universe is expanding by understanding how light seen from distant galaxies has longer apparent wavelengths than comparable light sources close to Earth.</p>				

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Content Standard: Earth and Space Science
Grade 11-12 Benchmarks: B. Describe how Earth is made up of a series of interconnected systems and how a change in one system affects other systems.
Content Organizer: Earth Systems

Grade level Indicator	OGT Competency Focus	Resources	Instructional Activities/Strategies	Assessment
<p>5. Investigate how thermal energy transfers in the world's oceans impact physical features (e.g., ice caps, oceanic and atmospheric currents) and weather patterns.</p>				

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Content Organizer: Earth Systems

Grade level Indicator	OGT Competency Focus	Resources	Instructional Activities/Strategies	Assessment
6. Describe how scientists estimate how much of a given resource is available on Earth.				

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Content Standard: Life Science
Grade 11-12 Benchmarks: A. Explain how processes at the cellular level affect the functions and characteristics of an organism.
Content Organizer: Characteristics and Structure of Life

Grade level Indicator	OGT Competency Focus	Resources	Instructional Activities/Strategies	Assessment
1. Recognize that information stored in DNA provides the instructions for assembling protein molecules used by the cells that determine the characteristics of the organism.				

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Content Organizer: Characteristics and Structure of Life

Grade level Indicator	OGT Competency Focus	Resources	Instructional Activities/Strategies	Assessment
2. Explain why specialized cells/structures are useful to plants and animals (e.g., stoma, phloem, xylem, blood, nerve, muscle, egg and sperm).				

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Content Organizer: Characteristics and Structure of Life

Grade level Indicator	OGT Competency Focus	Resources	Instructional Activities/Strategies	Assessment
<p>3. Explain that the sun is essentially the primary source of energy for life. Plants capture energy by absorbing light and using it to form strong (covalent) chemical bonds between the atoms of carbon-containing (organic) molecules.</p>				

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Grade 11-12 Benchmarks: A. Explain how processes at the cellular level affect the functions and characteristics of an organism.
Content Organizer: Characteristics and Structure of Life

Grade level Indicator	OGT Competency Focus	Resources	Instructional Activities/Strategies	Assessment
<p>4. Explain that carbon-containing molecules can be used to assemble larger molecules with biological activity (including proteins, DNA, sugars and fats). In addition, the energy stored in bonds between the atoms (chemical energy) can be used as sources of energy for life processes.</p>				

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Content Standard: Life Science

Grade 11-12 Benchmarks: C. Explain how the molecular basis of life and the principles of genetics determine inheritance.

Content Organizer: Heredity

Grade level Indicator	OGT Competency Focus	Resources	Instructional Activities/Strategies	Assessment
5. Examine the inheritance of traits through one or more genes and how a single gene can influence more than one trait.				

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Content Standard: Life Science

Grade 11-12 Benchmarks: C. Explain how the molecular basis of life and the principles of genetics determine inheritance.

Content Organizer: Heredity

Grade level Indicator	OGT Competency Focus	Resources	Instructional Activities/Strategies	Assessment
6. Explain how developmental differentiation is regulated through the expression of different genes.				

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Content Standard: Life Science
Grade 11-12 Benchmarks: E. Explain the interconnectedness of the components of a natural system.
Content Organizer: Diversity and Interdependence of Life

Grade level Indicator	OGT Competency Focus	Resources	Instructional Activities/Strategies	Assessment
7. Relate diversity and adaptation to structures and functions of living organisms at various levels of organization.				

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Content Standard: Life Science
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Content Organizer: Diversity and Interdependence of Life

Grade level Indicator	OGT Competency Focus	Resources	Instructional Activities/Strategies	Assessment
<p>8. Based on the structure and stability of ecosystems and their nonliving components, predict the biotic and abiotic changes in such systems when disturbed (e.g. introduction of non-native species, climatic change, etc.).</p>				

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Content Standard: Life Science
Grade 11-12 Benchmarks: E. Explain the interconnectedness of the components of a natural system.
Content Organizer: Diversity and Interdependence of Life

Grade level Indicator	OGT Competency Focus	Resources	Instructional Activities/Strategies	Assessment
<p>9. Explain why and how living systems require a continuous input of energy to maintain their chemical and physical organization. Explain that with death and the cessation of energy input, living systems rapidly disintegrate toward more disorganized states.</p>				

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Content Standard: Life Science
Grade 11-12 Benchmarks: D. Relate how biotic and abiotic global changes have occurred in the past and will continue to do so in the future.
Content Organizer: Evolutionary Theory

Grade level Indicator	OGT Competency Focus	Resources	Instructional Activities/Strategies	Assessment
10. Explain additional components of the evolution theory, including genetic drift, immigration, emigration and mutation.				

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Adams County/Ohio Valley
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Content Standard: Life Science
Grade 11-12 Benchmarks: G. Summarize the historical development of scientific theories and ideas within the study of life sciences.
Content Organizer: Historical Perspectives and Scientific Revolutions

Grade level Indicator	OGT Competency Focus	Resources	Instructional Activities/Strategies	Assessment
11. Trace the historical development of a biological theory or idea (e.g., genetics, cytology and germ theory).				

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Content Standard: Life Science
Grade 11-12 Benchmarks: G. Summarize the historical development of scientific theories and ideas within the study of life sciences.
Content Organizer: Historical Perspectives and Scientific Revolutions

Grade level Indicator	OGT Competency Focus	Resources	Instructional Activities/Strategies	Assessment
12. Describe advances in life sciences that have important, long-lasting effects on science and society (e.g., biotechnology).				

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Adams County/Ohio Valley
Course of Study

Content Standard: Physical Science
Grade 11-12 Benchmarks: A. Explain how variations in the arrangement and motion of atoms and molecules form the basis of a variety of biological, chemical and physical phenomena.
Content Organizer: Nature of Matter

Grade level Indicator	OGT Competency Focus	Resources	Instructional Activities/Strategies	Assessment
1. Explain how atoms join with one another in various combinations in distinct molecules or in repeating crystal patterns.				

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Content Organizer: Nature of Matter

Grade level Indicator	OGT Competency Focus	Resources	Instructional Activities/Strategies	Assessment
<p>2. Describe how a physical, chemical or ecological system in equilibrium may return to the same state of equilibrium if the disturbances it experiences are small. Large disturbances may cause it to escape that equilibrium and eventually settle into some other state of equilibrium.</p>				

SCIENCE GRADE 12

Adams County/Ohio Valley
Course of Study

Content Standard: Physical Science
Grade 11-12 Benchmarks: D. Apply principles of forces and motion to mathematically analyze, describe and predict the net effects on objects or systems.
Content Organizer: Nature of Matter

Grade level Indicator	OGT Competency Focus	Resources	Instructional Activities/Strategies	Assessment
3. Explain how all matter tends toward more disorganized states and describe real world examples (e.g., erosion of rocks, expansion of the universe).				

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Adams County/Ohio Valley
Course of Study

Content Standard: Physical Science
Grade 11-12 Benchmarks: A. Explain how variations in the arrangement and motion of atoms and molecules form the basis of a variety of biological, chemical and physical phenomena.
Content Organizer: Nature of Matter

Grade level Indicator	OGT Competency Focus	Resources	Instructional Activities/Strategies	Assessment
4. Recognize that at low temperatures some materials become superconducting and offer little or no resistance to the flow of electrons.				

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Adams County/Ohio Valley
Course of Study

Content Standard: Physical Science
Grade 11-12 Benchmarks: D. Apply principles of forces and motion to mathematically analyze, describe and predict the net effects on objects or systems.
Content Organizer: Forces & Motion

Grade level Indicator	OGT Competency Focus	Resources	Instructional Activities/Strategies	Assessment
5. Use and apply the laws of motion to analyze, describe and predict the effects of forces on the motions of objects mathematically.				

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Adams County/Ohio Valley
Course of Study

Content Standard: Physical Science
Grade 11-12 Benchmarks: D. Apply principles of forces and motion to mathematically analyze, describe and predict the net effects on objects or systems.
Content Organizer: Forces & Motion

Grade level Indicator	OGT Competency Focus	Resources	Instructional Activities/Strategies	Assessment
<p>6. Recognize that the nuclear forces that hold the nucleus of an atom together, at nuclear distances, are stronger than the electric forces that would make it fly apart.</p>				

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Adams County/Ohio Valley
Course of Study

Content Standard: Physical Science
Grade 11-12 Benchmarks: D. Apply principles of forces and motion to mathematically analyze, describe and predict the net effects on objects or systems.
Content Organizer: Forces & Motion

Grade level Indicator	OGT Competency Focus	Resources	Instructional Activities/Strategies	Assessment
<p>7. Recognize that nuclear forces are much stronger than electromagnetic forces, and electromagnetic forces are vastly stronger than gravitational forces. The strength of the nuclear forces explains why greater amounts of energy are released from nuclear reactions (e.g., from atomic and hydrogen bombs and in the Sun and other stars).</p>				

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Course of Study

Content Standard: Physical Science
Grade 11-12 Benchmarks: D. Apply principles of forces and motion to mathematically analyze, describe and predict the net effects on objects or systems.
Content Organizer: Forces & Motion

Grade level Indicator	OGT Competency Focus	Resources	Instructional Activities/Strategies	Assessment
<p>8. Describe how the observed wavelength of a wave depends upon the relative motion of the source and the observer (Doppler effect). If either is moving towards the other, the observed wavelength is shorter; if either is moving away, the observed wavelength is longer (e.g., weather radar, bat echoes, police radar).</p>				

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Content Standard: Physical Science
Grade 11-12 Benchmarks: D. Apply principles of forces and motion to mathematically analyze, describe and predict the net effects on objects or systems.
Content Organizer: Forces & Motion

Grade level Indicator	OGT Competency Focus	Resources	Instructional Activities/Strategies	Assessment
<p>9. Describe how gravitational forces act between all masses and always create a force of attraction. Recognize that the strength of the force is proportional to the masses and weakens rapidly with increasing distance between them.</p>				

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Adams County/Ohio Valley
Course of Study

Content Standard: Physical Science
Grade 11-12 Benchmarks: B. Recognize that some atomic nuclei are unstable and will spontaneously break down.
Content Organizer: Nature of Energy

Grade level Indicator	OGT Competency Focus	Resources	Instructional Activities/Strategies	Assessment
<p>10. Explain the characteristics of isotopes. The nuclei of radioactive isotopes are unstable and spontaneously decay emitting particles and/or wavelike radiation. It cannot be predicted exactly when, if ever, an unstable nucleus will decay, but a large group of identical nuclei decay at a predictable rate.</p>				

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Course of Study

Content Standard: Physical Science
Grade 11-12 Benchmarks: B. Recognize that some atomic nuclei are unstable and will spontaneously break down.
Content Organizer: Nature of Energy

Grade level Indicator	OGT Competency Focus	Resources	Instructional Activities/Strategies	Assessment
11. Use the predictability of decay rates and the concept of half-life to explain how radioactive substances can be used in estimating the age of materials.				

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Course of Study

Content Standard: Physical Science
Grade 11-12 Benchmarks: C. Describe how atoms and molecules can gain or lose energy only in discrete amounts.
Content Organizer: Nature of Energy

Grade level Indicator	OGT Competency Focus	Resources	Instructional Activities/Strategies	Assessment
12. Describe how different atomic energy levels are associated with the electron configurations of atoms and electron configurations (and/or conformations) of molecules.				

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Content Standard: Physical Science
Grade 11-12 Benchmarks: C. Describe how atoms and molecules can gain or lose energy only in discrete amounts.
Content Organizer: Nature of Energy

Grade level Indicator	OGT Competency Focus	Resources	Instructional Activities/Strategies	Assessment
<p>13. Explain how atoms and molecules can gain or lose energy in particular discrete amounts (quanta or packets); therefore they can only absorb or emit light at the wavelengths corresponding to these amounts.</p>				

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Content Standard: Physical Science
Grade 11-12 Benchmarks: ; E. Summarize the historical development of scientific theories and ideas within the study of physical sciences.
Content Organizer: Historical Perspectives and Scientific Revolutions

Grade level Indicator	OGT Competency Focus	Resources	Instructional Activities/Strategies	Assessment
<p>14. Use historical examples to explain how new ideas are limited by the context in which they are conceived; are often initially rejected by the scientific establishment; sometimes spring from unexpected findings; and usually grow slowly through contributions from many different investigators (e.g., nuclear energy, quantum theory, theory of relativity).</p>				

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Content Organizer: Historical Perspectives and Scientific Revolutions

Grade level Indicator	OGT Competency Focus	Resources	Instructional Activities/Strategies	Assessment
15. Describe concepts/ideas in physical sciences that have important, long-lasting effects on science and society (e.g., quantum theory, theory of relativity, age of the universe).				

SCIENCE GRADE 12

Adams County/Ohio Valley
Course of Study

Content Standard: Science and Technology
Grade 11-12 Benchmarks: A. Predict how human choices today will determine the quality and quantity of life on Earth.
Content Organizer: Understanding Technology

Grade level Indicator	OGT Competency Focus	Resources	Instructional Activities/Strategies	Assessment
1. Explain how science often advances with the introduction of new technologies and how solving technological problems often results in new scientific knowledge.				

SCIENCE GRADE 12

Adams County/Ohio Valley
Course of Study

Content Standard: Science and Technology
Grade 11-12 Benchmarks: A. Predict how human choices today will determine the quality and quantity of life on Earth.
Content Organizer: Understanding Technology

Grade level Indicator	OGT Competency Focus	Resources	Instructional Activities/Strategies	Assessment
2. Describe how new technologies often extend the current levels of scientific understanding and introduce new areas of research.				

SCIENCE GRADE 12

Adams County/Ohio Valley
Course of Study

Content Standard: Science and Technology
Grade 11-12 Benchmarks: A. Predict how human choices today will determine the quality and quantity of life on Earth.
Content Organizer: Understanding Technology

Grade level Indicator	OGT Competency Focus	Resources	Instructional Activities/Strategies	Assessment
<p>3. 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.</p>				

SCIENCE GRADE 12

Adams County/Ohio Valley
Course of Study

Content Standard: Science and Technology
Grade 11-12 Benchmarks: A. Predict how human choices today will determine the quality and quantity of life on Earth.
Content Organizer: Understanding Technology

Grade level Indicator	OGT Competency Focus	Resources	Instructional Activities/Strategies	Assessment
4. 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.				

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Adams County/Ohio Valley
Course of Study

Content Standard: Scientific Inquiry
Grade 11-12 Benchmarks: A. 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.
Content Organizer: Doing Scientific Inquiry

Grade level Indicator	OGT Competency Focus	Resources	Instructional Activities/Strategies	Assessment
<p>1. Formulate testable hypotheses. Develop and explain the appropriate procedures, controls and variables (dependent and independent) in scientific experimentation.</p>				

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Content Organizer: Doing Scientific Inquiry

Grade level Indicator	OGT Competency Focus	Resources	Instructional Activities/Strategies	Assessment
2. 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).				

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Content Organizer: Doing Scientific Inquiry

Grade level Indicator	OGT Competency Focus	Resources	Instructional Activities/Strategies	Assessment
<p>3. Research and apply appropriate safety precautions when designing and/or conducting scientific investigations (e.g., OSHA, MSDS, eyewash, goggles, ventilation).</p>				

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Adams County/Ohio Valley
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Content Standard: Scientific Inquiry
Grade 11-12 Benchmarks: A. 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.
Content Organizer: Doing Scientific Inquiry

Grade level Indicator	OGT Competency Focus	Resources	Instructional Activities/Strategies	Assessment
4. Create and clarify the method, procedures, controls and variables in complex scientific investigations.				

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Adams County/Ohio Valley
Course of Study

Content Standard: Scientific Inquiry
Grade 11-12 Benchmarks: A. 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.
Content Organizer: Doing Scientific Inquiry

Grade level Indicator	OGT Competency Focus	Resources	Instructional Activities/Strategies	Assessment
5. Use appropriate summary statistics to analyze and describe data.				

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Adams County/Ohio Valley
Course of Study

Content Standard: Scientific Ways of Knowing
Grade 11-12 Benchmarks: A. Explain how scientific evidence is used to develop and revise scientific predictions, ideas or theories.
Content Organizer: Nature of Science

Grade level Indicator	OGT Competency Focus	Resources	Instructional Activities/Strategies	Assessment
<p>1. 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.</p>				

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Content Standard: Scientific Ways of Knowing
Grade 11-12 Benchmarks: A. Explain how scientific evidence is used to develop and revise scientific predictions, ideas or theories.
Content Organizer: Nature of Science

Grade level Indicator	OGT Competency Focus	Resources	Instructional Activities/Strategies	Assessment
<p>2. 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.</p>				

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Content Standard: Scientific Ways of Knowing
Grade 11-12 Benchmarks: A. Explain how scientific evidence is used to develop and revise scientific predictions, ideas or theories.
Content Organizer: Nature of Science

Grade level Indicator	OGT Competency Focus	Resources	Instructional Activities/Strategies	Assessment
<p>3. Select a scientific model, concept or theory and explain how it has been revised over time based on new knowledge, perceptions or technology.</p>				

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Content Standard: Scientific Ways of Knowing
Grade 11-12 Benchmarks: A. Explain how scientific evidence is used to develop and revise scientific predictions, ideas or theories.
Content Organizer: Nature of Science

Grade level Indicator	OGT Competency Focus	Resources	Instructional Activities/Strategies	Assessment
4. Analyze a set of data to derive a principle and then apply that principle to a similar phenomenon (e.g., predator-prey relationships, properties of semiconductors).				

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Content Standard: Scientific Ways of Knowing
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Content Organizer: Nature of Science

Grade level Indicator	OGT Competency Focus	Resources	Instructional Activities/Strategies	Assessment
5. 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 problem).				

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Adams County/Ohio Valley
Course of Study

Content Standard: Scientific Ways of Knowing
Grade 11-12 Benchmarks: C. Explain how societal issues and considerations affect the progress of science and technology.
Content Organizer: Ethical Practices

Grade level Indicator	OGT Competency Focus	Resources	Instructional Activities/Strategies	Assessment
6. Explain that scientists may develop and apply ethical tests to evaluate the consequences of their research when appropriate.				

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Adams County/Ohio Valley
Course of Study

Content Standard: Scientific Ways of Knowing
Grade 11-12 Benchmarks: C. Explain how societal issues and considerations affect the progress of science and technology.
Content Organizer: Science and Society

Grade level Indicator	OGT Competency Focus	Resources	Instructional Activities/Strategies	Assessment
<p>7. 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.</p>				

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Adams County/Ohio Valley
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Content Standard: Scientific Ways of Knowing
Grade 11-12 Benchmarks: C. Explain how societal issues and considerations affect the progress of science and technology.
Content Organizer: Science and Society

Grade level Indicator	OGT Competency Focus	Resources	Instructional Activities/Strategies	Assessment
<p>8. 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 benefits and consideration of who benefits and who suffers, who pays and gains, and what the risks are and who bears them.</p>				

SCIENCE GRADE 12

Adams County/Ohio Valley
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Content Standard: Scientific Ways of Knowing
Grade 11-12 Benchmarks: C. Explain how societal issues and considerations affect the progress of science and technology.
Content Organizer: Science and Society

Grade level Indicator	OGT Competency Focus	Resources	Instructional Activities/Strategies	Assessment
9. 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?”				

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Content Standard: Scientific Ways of Knowing
Grade 11-12 Benchmarks: C. Explain how societal issues and considerations affect the progress of science and technology.
Content Organizer: Science and Society

Grade level Indicator	OGT Competency Focus	Resources	Instructional Activities/Strategies	Assessment
<p>10. 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.)</p>				

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Content Standard: Scientific Ways of Knowing
Grade 11-12 Benchmarks: C. Explain how societal issues and considerations affect the progress of science and technology.
Content Organizer: Science and Society

Grade level Indicator	OGT Competency Focus	Resources	Instructional Activities/Strategies	Assessment
11. Research how advances in scientific knowledge have impacted society on a local, national or global level.				