Correlation to Ohio's Academic Content Standards for the OGT

Book Title: **_Physics in Context_**
Subject/Course: **Physics or Principles of Technology**
Publisher: **CORD Communications**
Grade Level: **10-12**

Physical Science – Grade 11/12

Nature of Matter	***Correlation Notations***
Explain that elements with the same number of protons may or may not have the same mass and those with different masses (different numbers of neutrons) are called isotopes. Some of these are radioactive.	404-420
Explain that humans have used unique bonding of carbon atoms to make a variety of molecules (e.g., plastics).	404-420
Explain how atoms join with one another in various combinations in distinct molecules or in repeating crystal patterns.	201-202
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.	9-26, 34-46, 54-56, 64-70, 170-173, 248-251, 355-357 and corresponding lab material
Explain how all matter tends toward more disorganized states and describe real world examples (e.g., erosion of rocks and expansion of the universe).	216-220,244-247,251-253,265-276,277-294
Recognize that at low temperatures some materials become superconducting and offer little or no resistance to the flow of electrons.	200-215
Forces and Motion	***Correlation Notations***
Describe real world examples showing that all energy transformations tend toward disorganized states (e.g. fossil fuel combustion, food pyramids and electrical use).	236-252, 258-261, 268-276, 279-294, 298-323, 385, 392-403, 407-421, 470-477, 482-492 and corresponding lab material

Explain how electric motors and generators work (e.g. relate that electricity and magnetism are two aspects of a single electromagnetic force). Investigate that electric charges in motion produce magnetic fields and a changing magnetic field creates an electric field.	54-55, 62, 109-113, 116-117, 152-156, 266-276, 300-304, 313-315, 320 and corresponding lab material
Use and apply the laws of motion to analyze, describe, and predict the effects of forces on the motions of objects mathematically.	12, 170-172, 328-330, 332-338, 341-345 and corresponding lab material
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.	407-420
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).	52-56, 268-269, 407-420, 468-469
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, and police radar).	352-403, 422-423 and corresponding lab material (lab 9.1)
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.	10, 12, 48-49, 52-53, 173-183, 189 and corresponding lab material (labs 1.1, 2.2, 4.1, 6.1, 6.2)
Nature of Energy	***Correlation Notations***
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.	404-420, 468-473, lab 9.2

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.	410-413, lab 9.2
Describe how different atomic energy levels are associated with the electron configurations of atoms and electron configurations (and/or conformations) of molecules.	468-480, 487-489
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.	388-403, 470-480
Historical Perspectives & Scientific Revolutions	***Correlation Notations***
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, and theory of relativity).	36-37, 48, 51, 191, 203, 288-291, 299, 388, 399, 408, 410, 423, 436-437, 451, 453-455, 463, 469-475
Describe concepts/ideas in physical sciences that have important long-lasting effects on science and society (e.g., quantum theory, theory of relativity, and age of the universe).	12, 34-37, 48, 50-51, 71, 188-189, 191,203, 252, 254-256, 288, 329, 332, 334, 371, 388, 398-399, 405-406, 413-417, 432, 434-436, 442, 4554-456, 463, 469-480

Science and Technology – Grade 10/11/12

Understanding technology	***Correlation Notations***
Cite examples of ways that scientific inquiry is driven by the desire to understand the natural world and how technology is driven by the need to meet human needs and solve human problems.	48, 188, 203, 254, 289-290, 388, 398-400, 410-417, 436-438, 451, 469-480
Describe examples of scientific advances and emerging technologies and how they may impact society.	120-121, 410-417, 469-480
Identify that science and technology are essential social enterprises but alone they can only indicate	413-418

what can happen, not what should happen. Realize the latter involves human decisions about the use of knowledge.	
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.	413-418
Explore and explain any given technology that may have a different value for different groups of people and at different point in time (e.g., new varieties of farm plants and animals have been engineered by manipulating their genetic instructions to reproduce new characteristics).	36, 38, 51-53, 217-223, 232-237, 335, 342, 375-379, 388-400, 410-417, 454-464, 476-486
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.	413, 416, 476-486
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).	28-29, 41, 88, 102-105, 113-116, 282, 284-290, 413-417
Research sources of energy beyond traditional fuels and the advantages, disadvantages and trade-offs society must consider when using alternative sources (e.g., biomass, solar, hybrid engines, wind and fuel cells).	284-287, 413-417
Explain how science often advances with the introduction of new technologies and how solving technological problems often results in new scientific knowledge.	39, 48-49, 73-75, 188-195, 205, 220-223, 256-257, 266-274, 284-287
Describe how new technologies often extend the current levels of scientific understanding and introduce new areas of research.	73-75, 205, 256-257, 266-274, 284-287

Ability To Do Technological Design	*Correlation Notations*
Explain that when evaluating a design for a device or process, thought should be given to how it will be manufactured, operated, maintained, replaced and disposed of in addition to who will sell, operate and take care of it. Explain how the costs associated with these considerations may introduce additional constraints on the design.	8-9, 12, 18-22, 25-26, 34, 37-38, 45-46, 58-60, 63, 71, 75, 77-79, 88-89, 92, 97-102, 104-105, 111, 114-117, 130, 133, 139-140, 144, 147-148, 154, 159-161, 164-165, 178-183, 188, 198-199, 215, 220-226, 236, 241, 247, 257, 261, 290, 293-294, 300-303, 306, 312-315, 318-320, 322, 329-330, 338, 342, 378-379, 401-403, 413-414, 417, 420, 439-444, 456-454, 467, 478-480, 484-486, 490

Scientific Inquiry – Grade 10/11/12

Doing Scientific Inquiry	*Correlation Notations*
Research and apply appropriate safety precautions when designing and conducting scientific investigations (e.g., OSHA, MSDS, eyewash, goggles, and ventilation).	Embedded throughout the lab components and safety sections in lab manual)
Present scientific findings using clear language, accurate data, appropriate graphs, tables, maps, and available technology.	Embedded in all labs
Use mathematical models to predict and analyze natural phenomena.	Embedded throughout the course components, especially the lab materials.
Draw conclusions from inquiries based on scientific knowledge and principles, the use of logic and evidence (data) from investigations.	Embedded in all labs
Explain how new scientific data can cause any existing scientific explanation to be supported, revised, or rejected.	Embedded throughout the course components, especially the labs.
Formulate testable hypotheses. Develop and explain the appropriate procedures, controls, and variables (dependent and independent) in scientific experimentation.	Embedded in all labs

Evaluate assumptions that have been used in reaching scientific conclusions.	Embedded throughout the course components, especially the labs.
Design and carry out scientific inquiry (investigation), communicate and critique results through peer review.	Embedded throughout the course components, especially the labs.
Explain why the methods of an investigation are based on the questions being asked.	Embedded throughout the course components, especially the labs.
Summarize data and construct a reasonable argument based on those data and other know information.	Embedded in all labs
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).	Embedded in all labs (except lab 1.4, 5.1)
Create and clarify the method, procedures, controls, and variables in complex scientific investigations.	Embedded throughout the course components, especially the labs.
Use appropriate summary statistics to analyze and describe data.	Embedded throughout the course components (e.g., 125-129), especially in the labs.

Scientific Ways of Knowing – Grade 10/11/12

Nature of Science	***Correlation Notations***
Discuss science as a dynamic body of knowledge that can lead to the development of entirely knew disciplines.	316-317, 376-379, 388-390, 398-400, 408-410, 416, 455-464, 470-477
Describe that scientists may disagree about explanations of phenomena, about interpretation of data or about the value of rival theories, but they do agree that questioning, response to criticism and open communications are integral to the process of science.	423, 451, 469-477
Recognize that science is a systematic method of continuing investigation, based on observation, hypothesis testing, measurement, experimentation,	Embedded throughout the course components (e.g., 450-477)

and theory building, which leads to more adequate explanations of natural phenomena.	
Analyze a set of data to derive a hypothesis and apply that hypothesis to a similar phenomenon (e.g., biome data).	Embedded throughout the course components, especially the labs
Apply scientific inquiry to evaluate results of scientific investigations, observations, theoretical models and the explanations proposed by other scientists.	Embedded throughout the course components, especially the labs
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.	Embedded throughout the course components, especially the labs
Explain why scientists can assume that the universe is a vast single system in which the basic rules are the same everywhere.	Implied throughout the course by presentations of laws and equations (e.g., 12, 36-37, 48, and so forth)
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.	Implied throughout the course by presentations of discoveries and improvements to theories (e.g., 48, 398-399, 423)
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.	Embedded throughout the course components, especially the labs
Select a scientific model, concept or theory and explain how it has been revised over time based on new knowledge, perceptions or technology.	Embedded throughout the course components
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).	Embedded throughout the course components (e.g., 201-206)
Describe how individuals and teams contribute to science and engineering at different levels of	Embedded throughout the course components

complexity (e.g., an individual may conduct basic field studies, hundreds of people may work together on major scientific questions or technical problems).	
Ethical Practices	***Correlation Notations***
Recognize that ethical considerations limit what scientists can do.	414, 416, lab 9.2
Recognize that research involving voluntary human subjects should be conducted only with the informed consent of the subjects and follow rigid guideline and/or laws.	N/A
Recognize that animal-based research must be conducted according to currently accepted professional standards and laws.	N/A
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.	48, 254-255, 388, 399, 423
Describe the strongly held traditions of science that serve to keep scientists within the bounds of ethical professional behavior.	Implied throughout the course by presentations of discoveries and developments (e.g., 48, 398-399, 423)
Explain that scientists may develop and apply ethical tests to evaluate the consequences of their research when appropriate.	
Scientific Theories	***Correlation Notations***
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.	399-400, 410, 451, 454-456
Science and Society	***Correlation Notations***
Investigate how the knowledge, skills and interests learned in science classes apply to the careers students plan to pursue.	Embedded throughout the course components, especially illustrations and exercises
Explain that the decision to develop a new technology is influenced by societal opinions and demands and by cost benefit considerations.	28-29, 38, 70, 77, 88, 97, 102, 145-146, 165, 179-180, 223, 311-312, 392-

	397, 413-416, 480-486
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.	397, 410, 414
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.	N/A
Research the role of science and technology in careers that students plan to pursue.	Embedded throughout the course components, especially illustrations and exercises
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.	Embedded throughout the course components by frequent references to discoveries and theories made by diverse scientists.
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 who gains, and what the risks are and who bears them.	
Recognize that appropriateness and value of basic questions “What can happen?” “What are the odds?” and “How do scientists and engineers know what will happen?”	Embedded throughout the course components, especially the labs.
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.)	
Research how advances in scientific knowledge have impacted society on a local, national, or global level	48, 388, 410, 413-416, 463-464, 470-476