

OHIO DEPARTMENT OF EDUCATION  
ACADEMIC CONTENT STANDARDS  
TECHNOLOGY CHECKLIST

~GRADE 9~

**Nature of Technology—Students develop an understanding of technology, its characteristics, scope, core concepts and relationships between technologies and other fields.**

***Benchmark A:*** Synthesize information, evaluate and make decisions about technologies.

- \_\_\_\_ 1. List and describe factors that may influence the development of technology.
- \_\_\_\_ 2. Describe goal-directed research, define invention and innovation, and explain the relationship among them.
- \_\_\_\_ 3. Make informed choices among technology systems, resources and services.

***Benchmark B:*** Apply technological knowledge in decision-making.

- \_\_\_\_ 1. Demonstrate how the stability of a technological system is influenced by all system components, especially those in the feedback loop.

***Benchmark C:*** Examine the synergy between and among technologies and other fields of study when solving technological problems.

- \_\_\_\_ 1. Describe how technology transfer occurs when an innovation in one setting is applied in a different setting.
- \_\_\_\_ 2. Describe how technologies are, or can be, combined (e.g., a computer-controlled surgical laser scalpel represents the combination of physical, information and bio-related technology).

**Technology and Society Interaction—Students recognize interactions among society, the environment and technology, and understand technology's relationship with history. Consideration of these concepts forms a foundation for engaging in responsible and ethical use of technology.**

***Benchmark A:*** Interpret and practice responsible citizenship relative to technology.

- \_\_\_\_ 1. Explain how making decisions about the use of technology involves weighing the trade-offs between the positive and negative effects.
- \_\_\_\_ 2. Understand that ethical considerations are important in the development, selection and use of technologies.
- \_\_\_\_ 3. Review how different factors, such as individual curiosity, advertising, the strength of the economy, the goals of a company and the current trends, contribute to shaping the design of and demand for various technologies.
- \_\_\_\_ 4. Understand how different cultures develop their own technologies to satisfy their individual and shared needs, wants and values.
- \_\_\_\_ 5. Provide examples of technology transfer from a government agency to private industry, and discuss the benefits (e.g., global positioning systems—GPS, Internet).

***Benchmark B:*** Demonstrate the relationship among people technology and the environment.

- \_\_\_\_ 1. Design, model/build and evaluate a plan/method for conserving resources.
- \_\_\_\_ 2. Investigate the use and development of appropriate technologies to meet the needs of persons living in developing countries (e.g., hand-crank-powered radio for communication).
- \_\_\_\_ 3. Describe the economic impact of invasive foreign species present in Ohio as a result of technology activity or other human intervention.

***Benchmark C:*** Interpret and evaluate the influence of technology throughout history, and predict its impact on the future.

- \_\_\_\_ 1. Describe how some technological

development has been evolutionary, the result of a series of refinements to basic inventions or innovations over time.

- \_\_\_\_ 2. Select a technology or tool and predict how it will change in the future.

***Benchmark D:*** Analyze ethical and legal technology issues and formulate solutions and strategies that foster responsible technology usage.

- \_\_\_\_ 1. Practice responsible usage of technologies (e.g., download legally, install licensed software, adhere to copyright restrictions).
- \_\_\_\_ 2. Discuss access to information in a democratic society.

***Benchmark E:*** Forecast the impact of technological products and systems.

- \_\_\_\_ 1. Collect information about products and systems and evaluate the quality of that information.
- \_\_\_\_ 2. Describe criteria for assessing the quality of information.
- \_\_\_\_ 3. Compare and contrast the past, present and future developments of a technological system.

**Technology for Productivity Applications—Students learn the operations of technology through the usage of technology and productivity tools.**

***Benchmark A:*** Integrate conceptual knowledge of technology systems in determining practical applications for learning and technical problem-solving.

- \_\_\_\_ 1. Explore state-of-the-art devices to store data that will be used for researching projects.
- \_\_\_\_ 2. Create a design for a basic network and list skills needed to manage networks.
- \_\_\_\_ 3. Describe strategies for identifying and solving routine hardware and software problems that occur during everyday use.

***Benchmark B:*** Identify, select and apply appropriate technology tools and resources to produce creative works and to construct technology-enhanced models.

- \_\_\_1. Identify and use input and output devices to operate and interact with computers and multimedia technology resources (e.g., digital video camera, mobile cameras-a camera on a robot base, like a Mars rover, how to connect analog equipment to digital equipment).
- \_\_\_2. Demonstrate proficiency in all productivity tools (e.g., word processing, spreadsheet, database, desktop publishing).

## **Technology and Communication**

**Applications—Students use an array of technologies and apply design concepts to communicate with multiple audiences, acquire and disseminate information and enhance learning.**

*Benchmark A: Apply appropriate communication design principles in published and presented projects.*

- \_\_\_1. Format text, select color, insert graphics and include multimedia components in student-created media/communication products.
- \_\_\_2. Modify electronic publications and other communication products to meet accessibility guidelines so that access to information is not limited.
- \_\_\_3. Examine how and why image, language, sound and motion convey specific messages designed to influence the audience.
- \_\_\_4. Assess the accuracy of the communication product.

*Benchmark B: Create, publish and present information, utilizing formats appropriate to the content and audience.*

- \_\_\_1. Use e-mail in a teacher-moderated discussion group and in threaded discussion lists.
- \_\_\_2. Use technology to publish information in electronic form (e.g., Web, multimedia, digital video, electronic portfolio).
- \_\_\_3. Validate use of communication techniques.

*Benchmark C: Identify communication needs, select appropriate communication tools and design collaborative interactive projects and activities to communicate with others, incorporating emerging technologies.*

- \_\_\_1. Demonstrate communication clarity and use

elements and formats of email to communicate with others (e.g., discussion lists, message boards, chat, instant messaging).

- \_\_\_2. Identify and use the appropriate communication tool to collaborate with others (e.g., presentation, Web site, digital video).
- \_\_\_3. Investigate the uses of videoconferencing, Web casting, and other distance learning technologies (e.g., interviews, meetings, course work).
- \_\_\_4. Develop collaborative online projects to research a problem and disseminate results.

**Technology and Information Literacy—Students engage in information literacy strategies, use the Internet, technology tools and resources, and apply information-management skills to answer questions and expand knowledge.**

*Benchmark A: Determine and apply an evaluative process to all information sources chosen for a project.*

- \_\_\_1. Define terms which determine information validity:
  - a. Accuracy;
  - b. Authority;
  - c. Objectivity;
  - d. Currency; and
  - e. Coverage (including objectivity and bias).
- \_\_\_2. Determine the author's authority for all resources and identify points of agreement and disagreement among sources.

*Benchmark B: Apply a research process model to conduct research and meet information needs.*

- \_\_\_1. Determine the essential questions and plan research strategies.
- \_\_\_2. Select and evaluate appropriateness of information from a variety of resources, including online research databases and

Web sites to answer the essential questions.

- \_\_\_3. Integrate copyrighted information into an information product, following appropriate use of guidelines (e.g., quote using proper citation format, request permission for use).
- \_\_\_4. Identify relevant facts, check facts for accuracy and record appropriate information.
- \_\_\_5. Incorporate a list of sources used in a project using a standard bibliographic style manual (e.g., MLA and APA Style Manuals).
- \_\_\_6. Evaluate the research process and product as they apply to the information need (e.g., does the process reflect the actual information need).

*Benchmark C: Formulate advanced search strategies, demonstrating an understanding of the strengths and limitations of the Internet, and evaluate the quality and appropriate use of Internet resources.*

- \_\_\_1. Identify multiple directories and search engines matching curricular need (e.g., given an assignment, use knowledge of tools to pick an appropriate tool to search for information).
- \_\_\_2. Construct search strategies focused on the retrieval of specific search results by incorporating Boolean operators "AND" "OR" "NOT" and adjacency/proximity techniques.
- \_\_\_3. Compare and chart the search results from multiple Web sites to check for consistency of information (e.g., compare data on acid rain from more than one site).
- \_\_\_4. Establish a criteria for evaluating the information retrieved through Internet searching: author's expertise, bias, coverage of topic and timeliness.

*Benchmark D: Evaluate choices of electronic resources and determine their strengths and limitations.*

- \_\_\_1. Integrate search strategies within the electronic resource that targets retrieval for specific information need (e.g., limit by date of publication, focus on specific format such as image, sound file).
- \_\_\_2. Review strengths and weaknesses of various types of electronic resources for research need (e.g., compare subject-specific magazine database to general online index of articles).
- \_\_\_3. Demonstrate the difference between databases,

directories and database archives (e.g., free vs. fee-based, delivery mechanism, such as CD, DVD, network, Internet, and general vs. specific discipline).

- \_\_\_4. Select a specific database for an assignment and explain why it is the appropriate one to use (e.g., in researching a particular author, use a literary database of biographical and critical information about writers).

**Design—Students apply a number of problem-solving strategies demonstrating the nature of design, the role of engineering and the role of assessment.**

*Benchmark A: Identify and produce a product or system using a design process, evaluate the final solution and communicate the findings.*

- \_\_\_1. Explain and apply the methods and tools of inventive problem-solving to develop and produce a product or system.
- \_\_\_2. Define simulation in the design process.
- \_\_\_3. Identify the conceptual and technical principles that underpin design processes (e.g., analyze characteristics of technical systems that affect performance and identify principles that resolve design contradictions).
- \_\_\_4. Identify the elements of quality in a product/system (e.g., tolerances, fit, finish, function, form (aesthetics), repeatability, durability, material).
- \_\_\_5. Explain that design problems are seldom presented in a clearly defined form (e.g., problems often involve competing constituencies, undiscovered constraints and unidentified regulations).
- \_\_\_6. Brainstorm solutions to problems using common brainstorming techniques (e.g., select a leader, select a recorder, generate ideas, discuss and add-on to ideas of others and recognize all ideas are welcome).
- \_\_\_7. Demonstrate knowledge of pictorial and multi-view CAD drawings (e.g., orthographic projection, isometric, oblique, perspective using proper techniques).
- \_\_\_8. Recognize that patent, trademark and copyright laws protect technological ideas and intellectual property.

- \_\_\_9. Describe how the technological systems of manufacturing, construction, information and communication, energy and power, transportation, medical, and agricultural, and related biotechnologies can be used to solve practical problems.

*Benchmark B: Recognize the role of teamwork in engineering design and of prototyping in the design process.*

- \_\_\_1. Explain how established design principles are used to evaluate existing designs, collect data and guide the design process (e.g., design principles include flexibility, unity, emphasis, balance, function and proportion).
- \_\_\_2. Explain how a prototype is a working model used to test a design concept by making actual observations and necessary adjustments.
- \_\_\_3. Create a model of a design solution to an engineering problem (e.g., virtual, physical, graphic or mathematical model).
- \_\_\_4. Identify the factors that must be taken into account in the process of engineering design (e.g., safety, reliability, economic considerations, quality control, environmental concerns, manufacturability, maintenance and repair, and human factors in engineering, such as ergonomics).
- \_\_\_5. Describe how engineering design is influenced by personal characteristics, such as creativity, resourcefulness, and the ability to visualize and think abstractly.
- \_\_\_6. Describe the importance of teamwork, leadership, integrity, honesty, work habits and organizational skills of members during the design process.
- \_\_\_7. Explain the different engineering disciplines and how they relate to the major technological systems (e.g., mechanical—manufacturing, audio—communication, civil—construction).

*Benchmark C: Understand and apply research, development and experimentation to problem-solving.*

- \_\_\_1. Describe how business and industry use research and development to prepare devices and systems for the marketplace.
- \_\_\_2. Research consumer preferences for a new product.
- \_\_\_3. Explain that function is the purpose for which a product/system was designed and that focus on the function will expand the space in which solutions are available.
- \_\_\_4. Identify factors that inhibit creativity (e.g., perceptual, emotional, cultural, functional, environmental).
- \_\_\_5. Identify and apply a variety of conceptual block-busting techniques (e.g., goal charting, bug lists, brainstorming, forced connections and attribute listing).

**Designed World—Students understand how the physical, informational and bio-related technological systems of the designed world are brought about by the design process. Critical to this will be students' understanding of their role in the designed world: its processes, products, standards, services, history, future, impact, issues and career connections.**

*Benchmark A: Classify, demonstrate, examine, and appraise energy and power technologies.*

- \_\_\_1. Describe and demonstrate ways that energy can be converted from one form to another (e.g., heat to electrical, electrical to mechanical, electrical to heat).
- \_\_\_2. Identify the differences between open and closed thermal systems (e.g., humidity control systems, heating systems, cooling systems).
- \_\_\_3. Describe the careers available in energy and power technological systems and the training needed to pursue them.
- \_\_\_4. Identify and apply appropriate safety measures when working with energy and power technologies.
- \_\_\_5. Measure voltage, resistance and current in electrical systems and describe the different instruments used.

- \_\_\_6. Describe the application of the first and second laws of thermodynamics (e.g., the concept and function of a heat engine).
- \_\_\_7. Differentiate between hydraulic and pneumatic systems and provide examples of appropriate applications of each as they relate to manufacturing and transportation systems.
- \_\_\_8. Identify and investigate AC and DC circuits (e.g., sources, conductors, controls, loads, applications, purposes, safety, components, symbols, principles and operations).
- \_\_\_9. Employ energy and power technologies to resolve practical problems (e.g., efficient power production, conversion and transmission).
- \_\_\_10. Use and evaluate renewable and nonrenewable resources to operate a mechanism (e.g., petroleum, coal, biomass and solar).
- \_\_\_11. Investigate emerging (state-of-the-art) and innovative applications of energy and power technology (e.g., fuel cells, distributed generation).

**Benchmark B:** *Classify, demonstrate, examine and appraise transportation technologies.*

- \_\_\_1. Describe the careers available in transportation technological systems and the education needed to pursue them.
- \_\_\_2. Describe the vital role transportation plays in the operation of other technologies, such as manufacturing, construction, communication, health and safety, and agriculture (e.g., subsystems of aviation, rail transportation, water transportation, pedestrian walkways, roadways).
- \_\_\_3. Identify and apply appropriate safety measures when working with transportation technologies.
- \_\_\_4. Employ transportation technologies to resolve practical problems (e.g., getting students to athletic events).

**Benchmark C:** *Classify, demonstrate, examine and appraise manufacturing technologies.*

- \_\_\_1. Describe the careers available in manufacturing technological systems and the education needed to pursue them.
- \_\_\_2. Produce a product using the manufacturing system (e.g., customized production, batch production and continuous production) appropriate to the context.

- \_\_\_3. Identify and apply appropriate safety measures when working with manufacturing technologies.
- \_\_\_4. Classify materials as natural, synthetic or mixed (e.g., wood, plastic, cotton/polyester blend fabric).
- \_\_\_5. Employ manufacturing technologies to resolve practical problems (e.g., produce a product).
- \_\_\_6. Identify and investigate a variety of technological tools, equipment, machines, materials and technical processes used in manufacturing technologies to manufacture/fabricate products or systems.
- \_\_\_7. Investigate emerging (state-of-the-art) and innovative applications of manufacturing technology.

**Benchmark D:** *Classify, demonstrate, examine, and appraise construction technologies.*

- \_\_\_1. Describe the careers available in construction technological systems and the education needed to pursue them.
- \_\_\_2. Describe the importance of infrastructure in a construction system (e.g., how utilities and roads are extended into a parcel of land when it is developed).
- \_\_\_3. Identify and apply appropriate safety measures when working with construction technologies.
- \_\_\_4. Distinguish among the different forces acting upon structural components (e.g., tension, compression, shear and torsion).
- \_\_\_5. Identify and use a variety of technological tools, equipment, machines, materials and technical processes used in construction technologies to build/construct products or systems.
- \_\_\_6. Employ construction technologies to resolve practical problems (e.g., a shelter for a pet, emergency shelter for disaster victims).
- \_\_\_7. Differentiate the factors that affect the design and building of structures (e.g., material availability, zoning laws, the

need for riparian buffer, building codes and professional standards).

**Benchmark E:** *Classify, demonstrate, examine, and appraise information and communication technologies.*

- \_\_\_1. Describe the careers available in information and communication technological systems and the training needed to pursue them.
- \_\_\_2. Identify and apply appropriate safety measures when working with information and communication technologies (e.g., making sure that power is disconnected before working on the internal parts of a computer and taking proper static safeguards, protection from the effects of electromagnetic radiation).
- \_\_\_3. Use a variety of information and communication technologies to demonstrate the inputs, processes, and outputs associated with sending and receiving information (e.g., computer and related devices, graphic—technical and communication—media, electronic transmitters and receiving devices, entertainment products, and various other systems).
- \_\_\_4. Employ information and communication technologies to resolve practical problems (e.g., providing radio communication at a school function, communicating a school event to the community).
- \_\_\_5. Describe the factors that influence the cost of producing technological products and systems in information and communication technologies.
- \_\_\_6. Investigate emerging (state-of-the-art) and innovative applications of information and communication technology.

**Benchmark F:** *Classify, demonstrate, examine and appraise medical technologies.*

- \_\_\_1. Appraise the careers available in medical technological systems and the training needed to pursue them.
- \_\_\_2. Identify and apply appropriate safety measures when working with medical technologies.
- \_\_\_3. Describe how the design process can be used to produce technological products to replace or repair human physical structures (e.g., prostheses, DNA therapy, pacemakers, lasers).

- \_\_\_\_ 4. Examine new sensing technologies being used to diagnose medical conditions less invasively (e.g., CT-Scan, MRI, MRA).
- \_\_\_\_ 5. Investigate emerging (state-of-the-art) and innovative applications of medical technologies.

**Benchmark G:** *Classify, demonstrate, examine, and appraise agricultural and related biotechnologies.*

- \_\_\_\_ 1. Evaluate the training required for various careers in agricultural and biotechnology systems (e.g., chemical applicators, farmer, plant biologist, groundskeeper).
- \_\_\_\_ 2. Describe how agriculture includes a combination of organizations that use a wide array of products and systems to produce, process, and distribute food, fiber, fuel, chemical and other useful products (e.g., individuals, corporations, financial institutions, and local, state and federal governments).
- \_\_\_\_ 3. Identify and apply appropriate safety measures when working with agricultural and related biotechnologies.
- \_\_\_\_ 4. Investigate emerging (state-of-the-art) and innovative applications of agricultural and related biotechnologies.