THE REAL SCIENCE INSIDE INDUSTRIAL TECHNOLOGIES

Performance Standards 13B/12A-F/13A.I

Students will apply the interactions of the concepts, principles and interconnections of the life, physical and earth/space sciences to analyze decisions within industrial technology occupations and careers accordingly:

- *Knowledge*: identify and describe the interconnections of science and their applications to careers in the industrial technology field.
- *Application*: examine how scientific concepts influence specific industrial technology career and occupation decisions.
- *Communication*: present foundational scientific concepts and applications in specific on-the-job processes.

Procedures

1. ***In order to know and apply concepts that describe the interaction between science, technology and society (13B); understand the fundamental concepts, principles and interconnections of the life, physical and earth/space sciences (12A-F); and know and apply the accepted practices of science (13A),*** students should experience sufficient learning opportunities to develop the following:
   - Identify and describe the science-related knowledge in common use in the industrial technology occupational skill clusters.
   - Interview people from a variety of industrial technology occupations to determine how knowledge of science influences their daily work.
   - Correlate the pure science foundations to the applied science connections in daily use with the industrial technology career and technical fields.

   Note to teacher: This activity integrates information as suggested in Standard 13B at Stage I. It should incorporate information from the life, environmental, chemical, physical, earth and space concepts from Goal 12. The format for this activity could be incorporated into all Goal 12 units to assure the understanding of the applications of science in the real world as it relates to career and technical education. Additional applications into the accepted practices of science in Standard 13A may be integrated as well. Understanding and realizing the connection between industrial related occupations and various sciences is important to a student's education. When students interested in industrial occupations as a career choice see the connection, their interest and attentiveness to science courses will increase. This assessment is also an opportunity to reinforce the many general employability skills critical to success in such occupations.
2. Begin this activity by explaining that the disciplines of science relate to the fields in career and technical education in many ways and the students' knowledge of science has a direct effect on how well they will perform the responsibilities in their career choice.
3. Have students review and discuss the assessment task and how the rubric will be used to evaluate their work.
4. Set the scope for this careers research project. Each student will gather information about the particular application of scientific concepts and how they relate to careers through research and interviews. An interview format is provided. Students should present their findings with appropriate visual aids and documented occupational skill standards that require knowledge and application of performance elements. Following presentations, students should infer the common denominators associated with scientific knowledge, skills and behaviors in career settings for discussion and personal journal reflections.
5. Suggestions from the Illinois Occupational Skill Standards in Industrial Technology include:
   - From the Life Sciences: In the graphic communications area, students learn distribution practices for the industry. (See Illinois Finishing and Distribution occupational skill standard #14 – Mailing and Distribution Operations/Perform distribution operations.) Areas of study include the technologies and devices used in life sciences for microscopy, genetics and genetic engineering studies.
   - From the Environmental Sciences: In architectural drafting, students do research into plot designs and work on plot plans for specific lots and subdivisions. (See Illinois Architectural Drafting Cluster occupational skill standard #11 – Architectural Plans/Draw a plot.) Areas of study include the operation of smoke, Radon, Carbon monoxide, motion detectors; modeling technologies for population studies, ecosystem projections, etc.; environmental biome comparisons and measurements.
   - From the Chemical Sciences: When working in the plastics field, work is done blending additives to make resin used to make specific plastics. (See Illinois Plastics Molding Cluster occupational skill standard #6 –

Material Handling/Blend additives into resin.) Areas of study include the technologies for detection and utility of electromagnetic energies, heat and sound mechanics, atomic and nuclear research, chemical and physical bonding (solder, conductivity, PVC pipes, etc.) and thermodynamics.

- From the Physical Sciences: Technicians working in the heating and air conditioning field work with different types of materials to read temperatures. (See Illinois HVAC/R Technician Cluster occupational skill standard #26 – Air Conditioning, Heat Pumps, Refrigeration/Evaluate bimetal outdoor coil temperature sensor and replace.) Areas of study include expansion valves in air conditioning units; motion, force and pressure system applications; and all electrical and magnetic applications.
- From the Earth Sciences: When working in the machine technology field, technicians work with a wide variety of exotic metals. As a result, they have to have knowledge of the make-up of the metals. (See Illinois Machining Skills Cluster occupational skill standard #53 – Turning Operations: Difficult Metals/Set up and perform turning of refractory materials). Areas of study include effect of altitudes, salt and fresh water contact, weather and climate variations, and satellite technologies for earth research.
- From the Space Sciences: Students studying the transportation cluster look at all forms of travel and have an opportunity to look into the future of travel which includes travel into space.
- From Safety policies in 13B: (See Illinois Chemical Process Technical Operator occupational skill standards #1-6 – Maintain Safety, Health and Environmental Standards in the Plant). Areas of study include all storage, handling and disposal requirements for industrial chemicals.

All Occupational Skill Standards may be accessed through *http://www.ioes.org/cte_curr/oss.htm*

6. Evaluate each student's work using the Science to determine the performance level:
   - *Knowledge*: The descriptions of the interconnections of science with occupational skills were complete, detailed and accurate.
   - *Application*: The scientific influences in specific career and occupational decisions were insightful and thorough.
   - *Communication*: The presentation was well focused, well organized and thoroughly explained through on-the-job process applications.

Examples of Student Work

- **Meets**
- **Exceeds**

Time Requirements

- One day to orient expectations
- Three-to-five days for research (in or out of class)
- Two-to-three days for 10-minute career presentations, discussions and reflections

Resources

- Career interview suggestion page
- Career Interest Areas Overview (for teachers)
- Science Rubric

INTEGRATING SCIENCE AND INDUSTRIAL TECHNOLOGIES
SAMPLE INTERVIEW FORMAT

STUDENT DIRECTIONS

Conduct an interview with an individual in an industrial technology career. Develop a list of questions to use during the interview. Use the questions given below as a guide; modify or add to them to meet your needs. Be prepared to present your findings from the interview, either written or orally, to the class.

SAMPLE INTERVIEW QUESTIONS

Career Description

- Describe your job.
- How does knowledge of science affect your job?
- Describe any specific regulations in your job that have a scientific basis. What is the regulatory agency, which enforces these regulations?
- How do you see technology affecting your job in the past 5-10 years? In the next 5-10 years?

Education and Training Requirements

- What special education or training is required to perform your job? What kind of high school, post-secondary or on-the-job training have you had or would be helpful?
- What science skills are needed in your job? Does your job require expertise in assembling, maintaining and repairing instruments? Does your job require you to do troubleshooting, analysis, recording, collecting data or monitoring equipment or processes? How did you learn to do this?
- What kinds of mathematics skills are needed in your job?
- What communication skills are needed in your job?
- What were your career goals when you were in elementary, middle and high school? What about summer or part-time jobs?

Teamwork, Problem Solving and Decision Making

- In your position, do you more often function as an individual or as part of a team?
- When working on a team, do you have the responsibility for making final decisions? How is the responsibility shared?
- Do you generate new ideas, solve problems and make decisions? Please describe the kind of processes you use with your colleagues to follow through with the new ideas, reach cooperative consensus or find answers.
- Describe the ideal work atmosphere for teamwork, problem solving and decision making.

SCIENCE RUBRIC

Exceeds - must receive no more than one 3 and the rest 4s in the other areas of the rubric.
Meets - may receive no more than one 2 and a combination of 3s and 4s in the other areas of the rubric.
Approaches - may receive no more than one 1 and a combination of 2s, 3s or 4s, in the other areas of the rubric.
Begins - must receive at least a 1 in all 3 areas of the rubric.

	KNOWLEDGE Knows and understands scientific terms, facts, concepts, principles, theories and methods.	**APPLICATION** Applies scientific knowledge, skills and methods to manipulate, analyze, synthesize, create and evaluate.	**COMMUNICATION** Communicates scientific knowledge and applications through writing, speech and visual displays.
4	• Descriptions of scientific terms, facts, concepts, principles, theories and methods are complete and correct.	• Applications are thorough, appropriate and accurate.	• Written, oral and/or visual communication is well organized and effective.
3	• Descriptions of scientific terms, facts, concepts, principles, theories and methods are mostly complete and correct.	• Applications are mostly thorough, appropriate and accurate.	• Most of the written, oral and/or visual communication is well organized and effective.
2	• Descriptions of scientific terms, facts, concepts, principles, theories and methods are somewhat complete and correct.	• Applications are somewhat appropriate and accurate.	• Some of the written, oral and/or visual communication is organized and effective.
1	• Descriptions of scientific terms, facts, concepts, principles, theories and methods are minimally present or correct	• Applications are minimally appropriate and accurate.	• Little of the written, oral and/or visual communication is organized and effective.
0	• All descriptions of scientific terms, facts, concepts, principles, theories and methods are missing and/or incorrect.	• All applications are missing and/or incorrect.	• All of the written, oral or visual communication is missing and/or lacks organization.
Score			