

THE PRICE OF NEW TECHNOLOGIES

Performance Standards 13B/12A-F/11A/11B.J

Students will apply the processes of scientific inquiry and/or technological design, to analyze policies and progress associated with industrial technologies and life, physical, environmental, chemical, earth and space sciences in terms of costs, benefits, effects, job markets and everyday life accordingly:

- *Knowledge*: develop a basic understanding of engineering designs, purpose(s) and operation of science technologies.
- *Application*: correlate engineering technologies to the costs, benefits, effects, job markets and everyday life.
- *Communication*: explain the design, operation and societal impact of an engineering technology that has emerged from a societal need or demand.

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 (Goal 12); and know and apply the concepts, principles and processes of scientific inquiry (11A) or technological design (11B)***, students should experience sufficient learning opportunities to develop the following:

- Formulate questions about the issues of the impact of specific engineering technologies and/or consider design parameters and constraints from recent past, current and projected engineering innovations.
- Review a variety of resources to explore the context of societal issues, engineering designs and their scientific concepts, possibly including:
 - Original setting for the need, purpose or anticipated benefits of the technology.
 - Original or current design constraints due to materials, tools, time, funding, etc.
 - Develop a visualization/sequence of the design.
 - Identify the safety parameters that are/were considered.
 - Identify the predicted (and possibly unanticipated) geographic or demographic constraints.
 - Consider effect on job markets, (including training) and everyday life.
 - Collect and display applicable variables and data that were involved in the original and/or follow-up design features, impact or costs.
- Report and display process and findings of investigation.
- Generate further questions or issues related to the costs.

Note to teacher: This activity relates to applications associated with Standard 13B, while addressing Performance Descriptors for Stage J within possibly each of the Standards in Goal 12. The activity slightly modifies the processes described in Standards 11A or 11B as needed.

2. Have students review and discuss the assessment task and how the rubric will be used to evaluate their work.
3. This activity is designed to investigate the societal issues associated with advancing engineering technologies. The following activity focuses on the societal impact associated with regulatory policies, requiring new or modifying technology responses, their underlying scientific concepts and (possibly) unanticipated effects. POSSIBLE SCENARIO: Students could brainstorm ways that the nation has responded to the September 11, 2001, tragedies in the form of homeland security requirements. Each of the different sciences addressed in Goal 12 could provide the foundational scientific concepts to issues or technologies, such as:
 - Biochemical hazard detection and response (12A)
 - Environmental hazards or contamination of water, land, air or energy resources (12B)
 - Devices that detect, analyze or produce nuclear structures or processes (12C)
 - Thermodynamic or electromagnetic interruptions (12D)
 - Water purification or treatment facility protection (12E)
 - Satellite observation capabilities (12F)

Students may work in groups or individually to research their assigned or selected technology according to the following outline or steps:

- What was the original setting that established the need or defined the purpose of the technology?
 - What were the anticipated benefits for it?
 - What were the original design constraints for the technology? (time, materials, funding, etc.)
 - What safety precautions or regulations must be considered?
 - Who (individuals and communities) will be affected? Where will the effect be localized?
 - What kind of training is/was necessary to use or maintain the technology?
 - How will everyday life be affected?
 - Provide a visualization for the final technology, a sequence of modifications, if possible, and its operational process or sequence.
 - Collect and display applicable variables and data that were involved in creating, modifying or using the technology.
 - Present findings for classroom discussion.
 - Consider additional unanticipated effects or modifications that will change the use of this technology.
4. Evaluate each student's work using the Science Rubric as follows, and add the scores to determine the performance level:
- *Knowledge*: A basic understanding of engineering designs, purpose(s) and operation of science technologies is explained accurately.
 - *Application*: The correlation of the engineering technologies to the costs, benefits, effects, job markets and everyday life is clear and accurate.
 - *Communication*: The design, operation and societal impact of an engineering technology is represented clearly and explained accurately.

Examples of Student Work

- [Meets](#)
- [Exceeds](#)

Time requirements

- One-to-two class period(s) to orient students to the activity
- At least one week of class time to research and prepare the report (could be one week of out-of-class time)
- Two-to-three days for student presentations and discussion

Resources

- Books, journals and magazines related to the selected technology
- Internet access
- Science Rubric

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	APPLICATION	COMMUNICATION
	Knows and understands scientific terms, facts, concepts, principles, theories and methods.	Applies scientific knowledge, skills and methods to manipulate, analyze, synthesize, create and evaluate.	Communicates scientific knowledge and applications through writing, speech and visual displays.
4	<ul style="list-style-type: none"> • Descriptions of scientific terms, facts, concepts, principles, theories and methods are complete and correct. 	<ul style="list-style-type: none"> • Applications are thorough, appropriate and accurate. 	<ul style="list-style-type: none"> • Written, oral and/or visual communication is well organized and effective.
3	<ul style="list-style-type: none"> • Descriptions of scientific terms, facts, concepts, principles, theories and methods are mostly complete and correct. 	<ul style="list-style-type: none"> • Applications are mostly thorough, appropriate and accurate. 	<ul style="list-style-type: none"> • Most of the written, oral and/or visual communication is well organized and effective.
2	<ul style="list-style-type: none"> • Descriptions of scientific terms, facts, concepts, principles, theories and methods are somewhat complete and correct. 	<ul style="list-style-type: none"> • Applications are somewhat appropriate and accurate. 	<ul style="list-style-type: none"> • Some of the written, oral and/or visual communication is organized and effective.
1	<ul style="list-style-type: none"> • Descriptions of scientific terms, facts, concepts, principles, theories and methods are minimally present or correct. 	<ul style="list-style-type: none"> • Applications are minimally appropriate and accurate. 	<ul style="list-style-type: none"> • Little of the written, oral and/or visual communication is organized and effective.
0	<ul style="list-style-type: none"> • All descriptions of scientific terms, facts, concepts, principles, theories and methods are missing and/or incorrect. 	<ul style="list-style-type: none"> • All applications are missing and/or incorrect. 	<ul style="list-style-type: none"> • All of the written, oral or visual communication is missing and/or lacks organization.
Score			