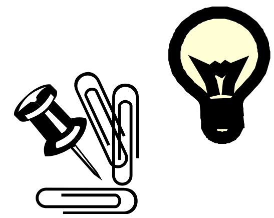
Price List for Materials



Item	Price
battery	85¢
battery holder	63¢
cardboard	4¢
coffee stirrer	3¢
construction paper	8¢
electrical tape	6¢
glue stick	28¢
light bulb	96¢
paper clip	10¢
paper triangles	1¢
plastic	32¢
plastic tray	45¢
popsicle stick	11¢
push pin	12¢
sandpaper	1¢
screw	7¢
socket	76¢
straw	5¢
Styrofoam®	62¢
syringe	14¢
tape	2¢
tubing	6¢ an inch
wire	2¢ an inch
wood	15¢
wooden beams	4¢ an inch

Store Supplies

Graph each item you purchase from the store.

Items in the Store

battery																
battery holder																
cardboard																
coffee stirrer																
construction paper																
electrical tape																
glue stick																
light bulb																
paper clip																
paper triangles																
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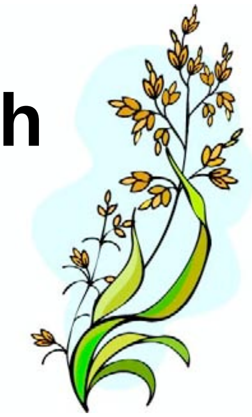
tubing																
wire																
wood																
wooden beams																
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

Number of Items Bought

Lunar Plant Growth Chamber Requirements



Length – The chamber must be between 4 inches and 6 inches long.

Width – The chamber must be between 4 inches and 6 inches wide.

Height – The chamber must be between 5 inches and 11 inches high.

You must include:

- an electrical circuit
- a watering system
- a chamber
- a compartment to hold your electrical circuit

Lunar Plant Growth Chamber Journal

Name ___________________________________

Date ______________________________

Battery
85¢

Battery Holder
63¢

Cardboard
4¢

Coffee Stirrer
3¢

Construction Paper
8¢

Electrical Tape
6¢

Glue Stick
28¢

Light Bulb
96¢

Paper Clip
10¢

Paper Triangles
1¢

Plastic
32¢

Plastic Tray
45¢

Popsicle Stick

11¢

Push Pin

12¢

Sandpaper

1¢

Screw

7¢

Socket

76¢

Straw

5¢

Styrofoam

62¢

Syringe

14¢

Tape

2¢

Tubing

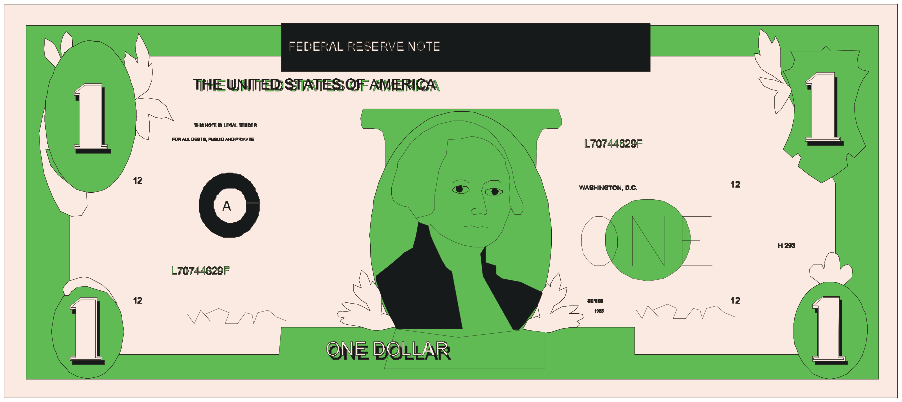
6¢ an inch

Wire

2¢ an inch

Wood
15¢

Wooden Beam
4¢ an inch


FEDERAL RESERVE NOTE
THE UNITED STATES OF AMERICA
L70744629F
WASHINGTON, D.C.
A
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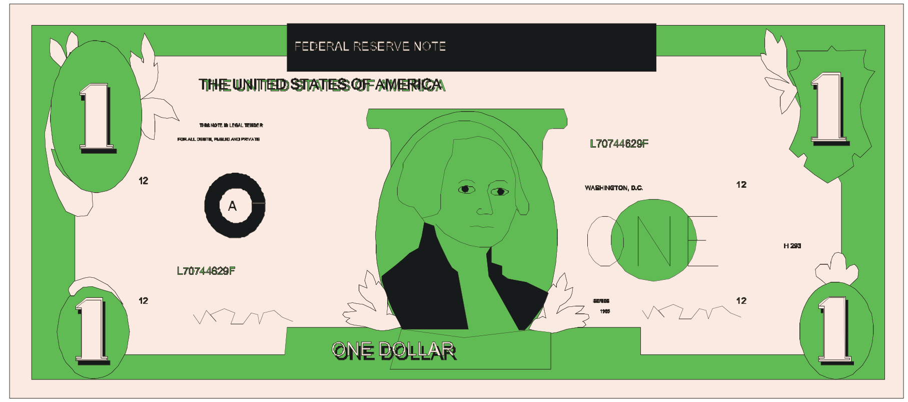
ONE DOLLAR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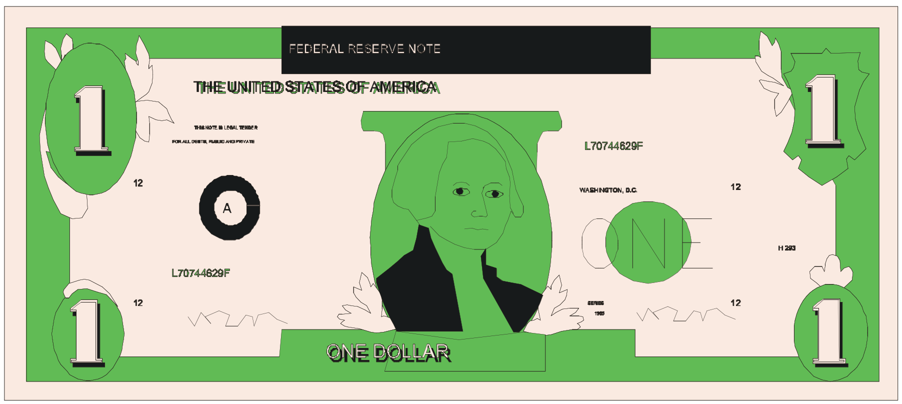
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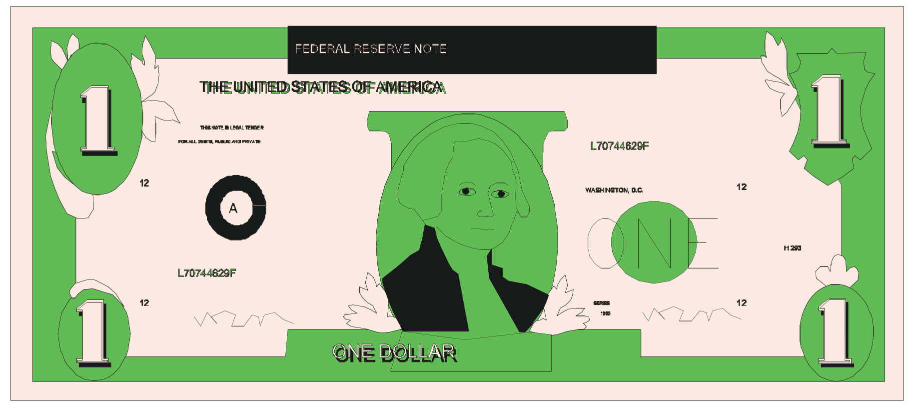
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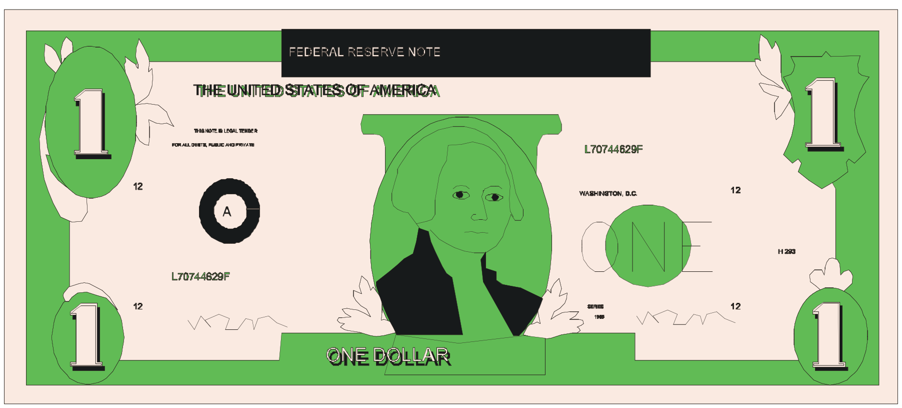
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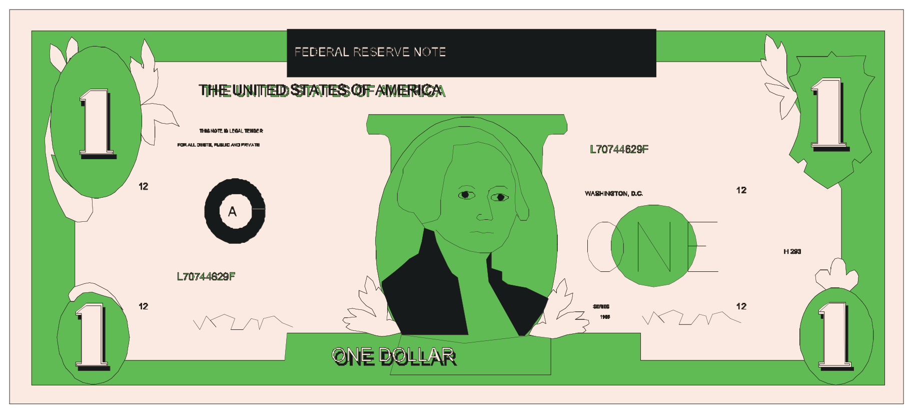
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ONE DOLLAR

Moon Munchies
A Standards-Based Elementary School Unit

Photographic Overview of Unit

Note: The teacher should discuss the safety rules with the students. Students should wear goggles when using tools.

Getting Started

Girl

If there are a variety of plastic trays ("pots"), the teacher may want students to decide which one they will use first, as the size of the "pots" may determine the size of student lunar growth chambers. The teacher may suggest that students measure their "pots" before beginning to build. This may all revolve around a question/answer session. (Questions such as: What must go inside your chamber? How will you determine how wide and long you will make your chamber? What can you do to make sure your "pot" will fit inside your chamber? Which material do you think you should purchase first? Why?) For the building process, students may choose to work on the chambers first and then the watering systems or vice versa. The electrical systems and their containers should be the final pieces that students construct. They will need to determine the length of the wires and the placement of the lights once the chambers have been constructed. The pictures below are intended to assist the teacher, but they are not meant to suggest a particular way that items should be built. (For example, some students may choose to measure and cut their tubing first and then poke a hole in their container.) When building the watering systems, chambers and electrical systems, students should be allowed to explore the materials and put materials together as they see fit.

Watering System

Students need to determine the best placement for their tubing. They need to remember that the water needs to soak into the soil so that all the seeds/plants can be watered. Once students have determined the placement of the tubing, a hole should be made in each "pot" using a pair of scissors, hole puncher or hammer and nail.

Boy

Boy

Students need to measure and cut a piece of tubing. They need to determine the length.

Boy

Boy

Using hammers, students need to hammer screws and/or nails in their tubing so they pierce holes through it. (The screws and nails need to be large enough to make the holes an appropriate size.) The teacher should make sure students have a piece of wood under their tubing so holes are not made in tables or the floor. They may also use scissors to cut holes in various places in their tubing. (Alternate the sides of the tubing.) This procedure will hopefully allow the water to disperse in their "pots" in various spots. When they test their tubing, they should have a "sprinkling" effect.

Boy

Boy

Students should have the opportunity to test their watering systems before everything is securely fastened. Larger holes and/or more holes may need to be added if systems are not working properly. The teacher may want to keep small paper cups by the sink so students can pour water into their syringes easily.

The pieces of tubing should reach into the center of the "pots." They should be glued securely. The teacher should make sure the holes the students make are filled in with glue to prevent dirt and water from leaking out and creating a mess.

Boy

Boy

The syringes should be securely glued to the pieces of tubing once the chambers are made and the students feel their watering systems are working properly. Some of the tubing and syringes will be on the outside of the chambers.

Electrical System

The teacher needs to remember that while students are creating their electrical circuit, there is not one correct way. It does need to be a complete loop, but students can connect parts differently. Some students will attach a longer wire to one of the battery holder wires, while some will connect that same battery wire directly to a push pin. The layout below is not in any particular order. Some students will purchase their wire first and then strip it. Others may purchase their light sockets and wood first and mark and drill the holes. Students should be permitted to create their circuits in their own way.

Boy

Girl

Students should measure and cut two pieces of wire. The length of the pieces should be determined by the placement of their lights in their lunar growth chambers and the placement of their battery holders and switches.

Students need to use wire strippers to strip the ends of their wires before attaching them to the various parts.

Boy

If students attach two wires together, they need to remember to wrap electrical tape around them carefully. They should not see bare wires.

Girl

Students will need to place their sockets on a 2" x 2" piece of wood and use a pencil to mark where they need to drill holes for the screws. (Make sure the drill bit is smaller than the diameter of the screw.)

Girls

Students can use a student drill to make holes in their wood pieces. (This will make it easier for the students when attaching their sockets to the wood pieces.)

Boy

Using a screwdriver, students need to attach their sockets to pieces of wood.

Students should loosen the screws that were on the sockets when they were purchased. Wires will need to be wrapped around the screws. Then the screws will need to be screwed back into the socket so the wires are securely tightened.

Boy

Boy

Two push pins should be hammered into the pieces of wood that are 2 ½" x 4". The students need to determine the distance using their paper clip.

Boy

Wires need to be wrapped around each push pin. It may be a battery wire or a wire that has been attached to the socket.

Hands

Paper clips should be configured so that one end is wrapped around a push pin while the other end is straightened to create the switch.

The battery holder wires need to be attached. Students need to determine what each wire will be attached to; another wire, a push pin or the socket.

Boy

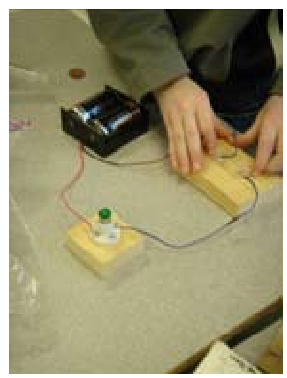
The batteries should be the last thing that the students place in their electrical circuit. They need to make sure the two battery wires do not touch each other. There will be smoke, and the batteries will get hot!

Hands

Once students have completed their circuits they need to make sure they work! Please remember that students will make their circuit loops differently. There are many ways to make the electrical circuit so that the lights turn on.

Girl and Boy

Students



Hands

Lunar Growth Chamber

While students are building their lunar growth chambers they need to be reminded of the size requirements. The length can be 4” to 6”, the width 4” to 6” and the height 5” to 11”. Students should be expected to keep their rulers on their desks at all times. The instructor may want to periodically check students’ measurements. Students will design and build their chambers in a variety of ways. It is highly recommended that each student/group be expected to have a top that opens up or lifts up. It is very difficult to place the soil inside, plant the seeds and check the soil without a top that opens.

Some students may use wooden beams to construct a frame that will hold other materials to create the sides, tops or bottoms.

Girl

Girl

Girl

These beams should be measured and then sawed.

Girls

Boy

Saw

A miter box should be clamped to a table in order for students to saw their wood pieces. Clamps should be used to hold the wooden pieces in place.

Beams

Girl

Jointers can be used to hold the wooden beams in place while students use "regular" white glue to glue triangles in the corners. The triangles should be added to the fronts and backs of the frames.

Boy

Styrofoam may be used as the sides, top or bottom of the lunar growth chambers.

Boy

Cardboard can be glued to create the sides of the lunar growth chambers.

Some chambers may have a handle to lift the top.

Student

Student

Some students may cut windows so that they can see what is happening inside their chambers.

Students need to decide where they will place their lights in their chambers. The piece of wood which holds the light should be glued inside the chambers.
Some students may glue them to the tops of the chambers, while others may glue them to the sides. Students should decide that place will provide the best warmth and light for their seeds/plants.

Girl

Compartment for the Electrical System

Students should add this part to the side or back of their lunar growth chamber. It should be the same length or width of the chamber and not protrude out more than 6”. The height should be 2”. This will allow students easy access to their batteries and switches.

Student

Student

Student

Finishing Touches

Students should pick off all the excess glue strings after they are done with their chambers.

Student

The instructor may want to provide time for the students to paint the outside of their chambers and electrical circuit containers. It is important to remind the students not to paint the wires and light sockets. Wires may be disconnected. If the instructor would prefer, students can paint their chambers and electrical circuit containers before the light system is attached.

Student

Girl

Completed Lunar Growth Chambers

Students will experience success and achievement when their lunar growth chambers are completed!

Girl

Evaluating the Lunar Growth Chambers

Engineering Worksheet 6 allows students to evaluate their lunar growth chambers, electrical circuits and their watering systems. Students should be expected to measure their chambers and document their information on this worksheet.

Student

Student

Planting the Seeds

Potting soil, seeds, paper cups and rulers are the items needed when the students plant their seeds. Basil seeds grow very quickly!

Boy

Student

Using a small paper cup, students can fill their "pots" up with soil.

The instructor may want to read the directions on the back of the seed packet so students know how deep to plant their seeds.

Student

Student

Students should count the number of seeds they are given so they can document the amount.

Once the seeds begin to grow, students can measure the height of the first sprout. Have students place a toothpick by their first sprout so they know which one to measure each time they observe their plants.

Student

Students should water their plants when their soil is dry. Students can use small paper cups to pour water into their syringes. They should use the measurement on the syringe to write how much water they used. Some students may have a difficult time holding the syringe and pouring the water in, so the instructor may want each student to have a partner when watering.

Girl

Girl

Students can place a thermometer into their chambers to compare the temperature before the light is turned on and after it has been on for a while.

Basil seeds grow quickly. Many will germinate within 6 to 10 days.

Plants

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		K-2	3-5	Exploring Technology	Invention & Innovation	Systems	Foundations	Impacts	Issues	Technological Design	Advanced Design Applications	Advanced Technological Applications	Engineering Design
	Course Total	172	232	212	147	166	202	154	97	182	236	209	187
The Nature of Technology													
STL-1	**Understanding the characteristics and scope of technology**	8	12	12	16	7	10	8	12	10	9	10	11
A	The natural world and human-made world are different.	4											
B	All people use tools and techniques to help them do things.	4											
C	Things that are found in nature differ from things that are human-made in how they are produced and used.		4										
D	Tools, materials, and skills are used to make things and carry out tasks.		4										
E	Creative thinking and economic and cultural influences shape technological development.		4										
F	New products and systems can be developed to solve problems or to help do things that could not be done without the help of technology.			4	4	4							
G	The development of technology is a human activity and is the result of individual or collective needs and the ability to be creative.			3	4								
H	Technology is closely linked to creativity, which has resulted in innovation.			3	4								
I	Corporations can often create demand for a product by bringing it onto the market and advertising it.			2	4	3							
J	The nature and development of technological knowledge and processes are functions of the setting.						4	2	2	4	3	4	4
K	The rate of technological development and diffusion is increasing rapidly.						2	4	3				
L	Inventions and innovations are the results of specific, goal-oriented research.						2	2	3	3	4	4	4
M	Most development of technologies these days is driven by the profit motive and the market.						2		4	3	2	2	3

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		K-2	3-5	Exploring Technology	Invention & Innovation	Systems	Foundations	Impacts	Issues	Technological Design	Advanced Design Applications	Advanced Technological Applications	Engineering Design
	The Nature of Technology												
STL-2	**Understanding the core concepts of technology**	**20**	**28**	**21**	**10**	**33**	**114**	**0**	**0**	**33**	**33**	**33**	**36**
A	Some systems are found in nature, and some are made by humans.	4											
B	Systems have parts or components that work together to accomplish a goal.	4											
C	Tools are simple objects that help humans complete tasks.	4											
D	Different materials are used in making things.	4											
E	People plan in order to get things done.	4											
F	A subsystem is a system that operates as a part of another system.		4										
G	When parts of a system are missing, it may not work as planned.		4										
H	Resources are the things needed to get a job done, such as tools and machines, materials, information, energy, people, capital, and time.		4										
I	Tools are used to design, make, use, and assess technology.		4										
J	Materials have many different properties.		4										
K	Tools and machines extend human capabilities, such as holding, lifting, carrying, fastening, separating, and computing.		4										
L	Materials have many different properties.		4										
M	Technological systems include input, processes, output, and, at times, feedback.			4		3							
N	Systems thinking involves considering how every part relates to others			4		3							
O	An open-loop system has no feedback path and requires human intervention, while a closed-loop system uses feedback.					4							
P	Technological systems can be connected to one another.			3		4							
Q	Malfunctions of any part of a system may affect the function and quality of the system.				3	4							
R	Requirements are the parameters placed on the development of a product or system.				3	4							
S	Trade-off is a decision process recognizing the need for careful compromises among competing factors.				4								
T	Trade-off is a decision process recognizing the need for careful compromises among competing factors.			4		3							
U	Different technologies involve different sets of processes.			3		4							

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	Course Total	172	232	212	147	166	202	154	97	182	236	209	187
STL-2	**Understanding the core concepts of technology (continued)**	20	28	21	10	33	14	0	0	33	33	33	36
V	Controls are mechanisms or particular steps that people perform using information about the system that causes systems to change.			3		4							
W	Systems thinking applies logic and creativity with appropriate compromises in complex real-life problems.									4	4	4	4
X	Systems, which are the building blocks of technology, are embedded within larger technological, social, and environmental systems.						4				3	4	
Y	The stability of a technological system is influenced by all of the components in the system, especially those in the feedback loop.						3			4	4	3	4
Z	Selecting resources involves trade-offs between competing values, such as availability, cost, desirability, and waste.						3			4	2	2	4
AA	Requirements involve the identification of the criteria and constraints of a product or system and the determination of how they affect the final design and development.									4	4	4	4
BB	Optimization is an ongoing process or methodology of designing or making a product and is dependent on criteria and constraints.									3	4	3	4
CC	New technologies create new processes.						4			4	3	4	4
DD	Quality control is a planned process to ensure that a product, service, or system meets established criteria.									3	3	2	4
EE	Management is the process of planning, organizing, and controlling work.									3	2	3	4
FF	Complex systems have many layers of controls and feedback loops to provide information.									4	4	4	4

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		K-2	3-5	Exploring Technology	Invention & Innovation	Systems	Foundations	Impacts	Issues	Technological Design	Advanced Design Applications	Advanced Technological Applications	Engineering Design
STL-3	**Understanding the relationships among technologies and connections with other fields of study**	**4**	**8**	**6**	**5**	**12**	**11**	**5**	**7**	**12**	**10**	**10**	**12**
A	The study of technology uses many of the same ideas and skills as other subjects.	4											
B	Technologies are often combined.		4										
C	Various relationships exist between technology and other fields of study.		4										
D	Technological systems often interact with one another.			3	2	4							
E	A product, system, or environment developed for one setting may be applied to another setting.				3	4							
F	Knowledge gained from other fields of study has a direct effect on the development of technological products and systems.			3		4							
G	Technology transfer occurs when a new user applies an existing innovation developed for one purpose in a different function.						3	2		4	4	3	4
H	Technological innovation often results when ideas, knowledge, or skills are shared within a technology, among						3			4	3	4	4
I	Technological ideas are sometimes protected through the process of patenting.						2		3	4			4
J	Technological progress promotes the advancement of science and mathematics.						3	3	4		3	3	
Technology and Society													
STL-4	**Understanding the cultural, social, economic and political effects of technology**	**4**	**8**	**14**	**11**	**3**	**2**	**13**	**10**	**6**	**7**	**8**	**4**
A	The use of tools and machines can be helpful or harmful.	4											
B	When using technology, results can be good or bad.		4										
C	The use of technology can have unintended consequences.		4										
D	The use of technology affects humans in various ways, including their safety, comfort, choices, and attitudes about technology's development and use.			4									
E	Technology, by itself, is neither good nor bad, but decisions about the use of products and systems can result in desirable or undesirable consequences.			4	3	3							
F	The development and use of technology poses ethical issues.			3	4								
G	Economic, political, and cultural issues are influenced by the development and use of technology.			3	4								
H	Changes caused by the use of technology can range from gradual to rapid and from subtle to obvious.							4		2	3	4	
I	Making decisions about the use of technology involves weighing the trade-offs between the positive and negative effects.						2	3	4				
J	Ethical considerations are important in the development, selection, and use of technologies.							3	2	4	4	4	4
I	The transfer of a technology from one society to another can cause cultural, social, economic, and political changes affecting both societies to varying degrees.							3	4				

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		K-2	3-5	Exploring Technology	Invention & Innovation	Systems	Foundations	Impacts	Issues	Technological Design	Advanced Design Applications	Advanced Technological Applications	Engineering Design
STL-5	**Understanding the effects of technology on the environment**	**4**	**8**	**8**	**6**	**9**	**3**	**18**	**6**	**11**	**13**	**13**	**11**
A	Some materials can be reused and/or recycled.	4											
B	Waste must be appropriately recycled or disposed of to prevent unnecessary harm to the environment.		4										
C	The use of technology affects the environment in good and bad ways.		4										
D	The management of waste produced by technological systems is an important societal issue.			4		3							
E	Technologies can be used to repair damage caused by natural disasters and to break down waste from the use of various products and systems.				3	4							
F	Decisions to develop and use technologies often put environmental and economic concerns in direct competition with one another.			4	3	2							
G	Humans can devise technologies to conserve water, soil, and energy through such techniques as reusing, reducing and recycling.								4	3	2	2	3
H	When new technologies are developed to reduce the use of resources, considerations of trade-offs are important.							3		4	2	3	4
I	With the aid of technology, various aspects of the environment can be monitored to provide information for decisionmak-ing.							4			2		
J	The alignment of technological processes with natural processes maximizes performance and reduces negative impacts on the environment.							4				2	
K	Humans devise technologies to reduce the negative consequences of other technologies. 3 4 3 3 4							3		4	3	3	4
L	Decisions regarding the implementation of technologies involve the weighing of trade-offs between predicted positive and negative effects on the environment.						3	4	2		4	3	
STL-6	**Understanding the role of society in the development and use of technology**	**4**	**8**	**13**	**12**	**2**	**4**	**10**	**2**	**4**	**3**	**3**	**4**
A	Products are made to meet individual needs and wants.	4											
B	Because people's needs and wants change, new technologies are developed, and old ones are improved to meet those changes.		4										
C	Individual, family, community, and economic concerns may expand or limit the development of technologies.		4										
D	Throughout history, new technologies have resulted from the demands, values, and interests of individuals, businesses, industries, and societies.			4									
E	The use of inventions and innovations has led to changes in society and the creation of new needs and wants.			3	4								
F	Social and cultural priorities and values are reflected in technological devices.			3	4								
G	Meeting societal expectations is the driving force behind the acceptance and use of products and systems.			3	4	2							
H	Different cultures develop their own technologies to satisfy their individual and shared needs, wants, and values.							4					
I	The decision whether to develop a technology is influenced by societal opinions and demands, in addition to corporate cultures.							3	2	4			4
J	A number of different factors, such as advertising, the strength of the economy, the goals of a company, and the latest fads contribute to shaping the design of and demand for various technologies.						4	3			3	3	

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		K-2	3-5	Exploring Technology	Invention & Innovation	Systems	Foundations	Impacts	Issues	Technological Design	Advanced Design Applications	Advanced Technological Applications	Engineering Design
	Course Total	172	232	212	147	166	202	154	97	182	236	209	187
	The Nature of Technology												
	STL-7 Understanding the influence of technology on history	4	4	6	12	4	28	22	9	0	3	3	0
A	The way people live and work has changed throughout history because of technology.	4											
B	People have made tools to provide food, to make clothing, and to protect themselves.		4										
C	Many inventions and innovations have evolved by using slow and methodical processes of tests and refinements.			3	4								
D	The specialization of function has been at the heart of many technological improvements.			3	4								
E	The design and construction of structures for service or convenience have evolved from the development of techniques for measurement, controlling systems, and the understanding of spatial relationships.					4							
F	In the past, an invention or innovation was not usually developed with the knowledge of science.				4								
G	Most technological development has been evolutionary, the result of a series of refinements to a basic invention..							4					
H	The evolution of civilization has been directly affected by, and has in turn affected, the development and use of tools and materials.								3	4			
I	Throughout history, technology has been a powerful force in reshaping the social, cultural, political, and economic landscape.								4	3			
J	Early in the history of technology, the development of many tools and machines was based not on scientific knowledge but on technological know-how.							4					
K	The Iron Age was defined by the use of iron and steel as the primary materials for tools.							4	3				
L	The Middle Ages saw the development of many technological devices that produced long-lasting effects on technology and society							4	3				
M	The Renaissance, a time of rebirth of the arts and humanities, was also an important development in the history of technology.							4	3				
N	The Industrial Revolution saw the development of continuous manufacturing, sophisticated transportation and communication systems, advanced construction practices, and improved education and leisure time.							4	3				
O	The Information Age places emphasis on the processing and exchange of information.							4	3	2		3	3

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	Design												
STL-8	**Understanding the attributes of design**	8	8	11	10	3	13	2	0	15	16	15	15
A	Everyone can design solutions to a problem.	4											
B	Design is a creative process.	4											
C	The design process is a purposeful method of planning practical solutions to problems.		4										
D	Requirements for a design include such factors as the desired elements and features of a product or system or the limits that are placed on the design.		4										
E	Design is a creative planning process that leads to useful products and systems.			3	4	3							
F	There is no perfect design.			4	3								
G	Requirements for a design are made up of criteria and constraints.			4	3								
H	The design process includes defining a problem, brainstorming, researching and generating ideas, identifying criteria and specifying constraints, exploring possibilities, selecting an approach, developing a design proposal, making a model or prototype.						4			3	4	4	3
I	Design problems are seldom presented in a clearly defined form.						3			4	4	3	4
J	The design needs to be continually checked and critiqued, and the ideas of the design must be redefined and improved.						3			4	4	4	4
K	Requirements of a design, such as criteria, constraints, and efficiency, sometimes compete with each other.						3	2		4	4	4	4

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STL-9	**Understanding engineering design**	8	12	11	10	0	13	2	0	14	10	10	15
A	The engineering design process includes identifying a problem, looking for ideas, developing solutions, and sharing solutions with others.	4											
B	Expressing ideas to others verbally and through sketches and models is an important part of the design process.	4											
C	The engineering design process involves defining a problem, generating ideas, selecting a solution, testing the solution(s), making the item, evaluating it, and presenting the results.		4										
D	When designing an object, it is important to be creative and consider all ideas.		4										
E	Models are used to communicate and test design ideas and processes.		4										
F	Design involves a set of steps, which can be performed in different sequences and repeated as needed.			4	3								
G	Brainstorming is a group problem-solving design process in which each person in the group presents his or her ideas in an open forum.			3	4								
H	Modeling, testing, evaluating, and modifying are used to transform ideas into practical solutions.			4	3								
I	Established design principles are used to evaluate existing designs, to collect data, and to guide the design process.						4			3	4	3	3
J	Engineering design is influenced by personal characteristics, such as creativity, resourcefulness, and the ability to visualize and think abstractly.						3			4	3	3	4
K	A prototype is a working model used to test a design concept by making actual observations and necessary adjustments.						3			4	3	4	4
L	The process of engineering design takes into account a number of factors.						3	2		3			4

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STL-10	**Understanding the role of troubleshooting, R&D, etc. in problem-solving**	8	12	9	10	6	4	7	11	3	14	14	3
A	Asking questions and making observations helps a person to figure out how things work. .	4											
B	All products and systems are subject to failure. Many products and systems, however, can be fixed.	4											
C	Troubleshooting is a way of finding out why something does not work so that it can be fixed.		4										
D	Invention and innovation are creative ways to turn ideas into real things.		4										
E	The process of experimentation, which is common in science, can also be used to solve technological problems.		4										
F	Troubleshooting is a problem-solving method used to identify the cause of a malfunction in a technological system.			3	2	4							
G	Invention is a process of turning ideas and imagination into devices and systems. Innovation is the process of modifying an existing product or system to improve it.			3	4	2							
H	Some technological problems are best solved through experimentation.			3	4								
I	Research and development is a specific problem-solving approach that is used intensively in business and industry to prepare devices and systems for the marketplace.						4			3	3	3	3
J	Technological problems must be researched before they can be solved.							4	3		4	4	
K	Not all problems are technological, and not every problem can be solved using technology.								4		4	3	
L	Many technological problems require a multidisciplinary approach.							3	4		3	4	

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	Abilities for a Technological World												
STL-11	**Abilities to apply the design process**	12	16	10	19	3	18	3	4	16	18	18	17
A	Brainstorm people's needs and wants and pick some problems that can be solved through the design process.	4											
B	Build or construct an object using the design process.	4											
C	Investigate how things are made and how they can be improved.	4											
D	Identify and collect information about everyday problems that can be solved by technology, and generate ideas and requirements for solving a problem.		4										
E	The process of designing involves presenting some possible solutions in visual form and then selecting the best solution(s) from many.		4										
F	Test and evaluate the solutions for the design problem.		4										
G	Improve the design solutions.		4										
H	Apply a design process to solve problems in and beyond the laboratory-classroom.			3	4								
I	Specify criteria and constraints for the design.			3	4								
J	Make two-dimensional and three-dimensional representations of the designed solution.				4								
K	Test and evaluate the design in relation to pre-established requirements, such as criteria and constraints, and refine as needed.				4								
L	Make a product or system and document the solution.			4	3	3							
M	Identify the design problem to solve and decide whether or not to address it.							3	4				
N	Identify criteria and constraints and determine how these will affect the design process.						4			3	4	3	3
O	Refine a design by using prototypes and modeling to ensure quality, efficiency, and productivity of the final product.						4			3	4	4	3
P	Evaluate the design solution using conceptual, physical, and mathematical models at various intervals of the design						3			3	3	4	4
Q	Develop and produce a product or system using a design process.						3			4	4	4	4
R	Evaluate final solutions and communicate observation, processes, and results of the entire design process, using verbal, graphic, quantitative, virtual, and written means, in addition to three-dimensional models.						4			3	3	3	3

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STL-12	**Abilities to use and maintain technological products and systems**	12	16	8	3	13	20	0	0	0	11	11	0
A	Discover how things work.	4											
B	Use hand tools correctly and safely and be able to name them correctly.	4											
C	Recognize and use everyday symbols.	4											
D	Follow step-by-step directions to assemble a product.		4										
E	Select and safely use tools, products, and systems for specific tasks.		4										
F	Use computers to access and organize information.		4										
G	Use common symbols, such as numbers and words, to communicate key ideas.		4										
H	Use information provided in manuals, protocols, or by experienced people to see and understand how things work.			4		3							
I	Use tools, materials, and machines safely to diagnose, adjust, and repair systems.					4							
J	Use computers and calculators in various applications.			4	3	2							
K	Operate and maintain systems in order to achieve a given purpose.					4							
L	Document processes and procedures and communicate them to different audiences using appropriate oral and written techniques.						4				3	3	
M	Diagnose a system that is malfunctioning and use tools, materials, machines, and knowledge to repair it.						4				4	4	
N	Troubleshoot, analyze, and maintain systems to ensure safe and proper function and precision.						4						
O	Operate systems so that they function in the way they were designed.						4						
P	Use computers and calculators to access, retrieve, organize, process, maintain, interpret, and evaluate data and information in order to communicate.						4				4	4	

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	STL-13 Abilities to assess the impact of products and systems	8	12	9	3	16	4	15	11	1	9	9	1
A	Collect information about everyday products and systems by asking questions.	4											
B	Determine if the human use of a product or system creates positive or negative results.	4											
C	Compare, contrast, and classify collected information in order to identify patterns.		4										
D	Investigate and assess the influence of a specific technology on the individual, family, community, and environment.		4										
E	Examine the trade-offs of using a product or system and decide when it could be used.		4										
F	Design and use instruments to gather data.			3		4							
G	Use data collected to analyze and interpret trends in order to identify the positive or negative effects of a technology.				3								
H	Identify trends and monitor potential consequences of technological development.			3		4							
I	Interpret and evaluate the accuracy of the information obtained and determine if it is useful.			3		4							
J	Collect information and evaluate its quality.						4	3	2	1	2	2	1
K	Synthesize data, analyze trends, and draw conclusions regarding the effect of technology on the individual, society, and environment.							4	3		3	3	
L	Use assessment techniques, such as trend analysis and experimentation to make decisions about the future development of technology.							4	3		4		
M	Design forecasting techniques to evaluate the results of altering natural systems.							4	3			4	

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	The Designed World												
STL-14	**Understanding of and abilities to select and use medical technologies**	12	12	14	0	8	4	4	4	0	0	12	0
A	Vaccinations protect people from getting certain diseases.	4											
B	Medicine helps people who are sick to get better.	4											
C	There are many products designed specifically to help people take care of themselves.	4											
D	Vaccines are designed to prevent diseases from developing and spreading; medicines are designed to relieve symptoms and stop diseases from developing.		4										
E	Technological advances have made it possible to create new devices, to repair or replace certain parts of the body, and to provide a means for mobility.		4										
F	Many tools and devices have been designed to help provide clues about health and to provide a safe environment.		4										
G	Advances and innovations in medical technologies are used to improve healthcare.			4									
H	Sanitation processes used in the disposal of medical products help to protect people from harmful organisms and disease, and shape the ethics of medical safety.			4									
I	The vaccines developed for use in immunization require specialized technologies to support environments in which a sufficient amount of vaccines are produced.			3		4							
J	Genetic engineering involves modifying the structure of DNA to produce novel genetic make-ups.			3		4							
K	Medical technologies include prevention and rehabilitation, vaccines and pharmaceuticals, medical and surgical procedures, genetic engineering, and the systems within which health is protected and maintained.							4				4	
L	Telemedicine reflects the convergence of technological advances in a number of fields, including medicine, telecommunications, virtual presence, computer engineering, informatics, artificial intelligence, robotics, materials science, and perceptual psycho						4					4	
M	The sciences of biochemistry and molecular biology have made it possible to manipulate the genetic information found in living creatures.								4			4	

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STL-15	**Understanding of and abilities to select and use agricultural and biotechnologies**	8	12	12	4	4	4	4	7	4	0	16	4
A	The use of technologies in agriculture makes it possible for food to be available year round and to conserve resources.	4											
B	There are many different tools necessary to control and make up the parts of an ecosystem.	4											
C	Artificial ecosystems are human-made environments that are designed to function as a unit and are comprised of humans, plants, and animals.		4										
D	Most agricultural waste can be recycled.		4										
E	Many processes used in agriculture require different procedures, products, or systems.		4										
F	Technological advances in agriculture directly affect the time and number of people required to produce food for a large population.			4									
G	A wide range of specialized equipment and practices is used to improve the production of food, fiber, fuel, and other useful products and in the care of animals.					4							
H	Biotechnology applies the principles of biology to create commercial products or processes.				4								
I	Artificial ecosystems are human-made complexes that replicate some aspects of the natural environment.			4									
J	The development of refrigeration, freezing, dehydration, preservation, and irradiation provide long-term storage of food and reduce the health risks caused by tainted food.			4									
K	Agriculture includes a combination of businesses that use a wide array of products and systems to produce, process, and distribute food, fiber, fuel, chemical, and other useful products.						4					4	
L	Biotechnology has applications in such areas as agriculture, pharmaceuticals, food and beverages, medicine, energy, the environment, and genetic engineering.							4	3			4	
M	Conservation is the process of controlling soil erosion, reducing sediment in waterways, conserving water, and improving water quality.								4			4	
N	The engineering design and management of agricultural systems require knowledge of artificial ecosystems and the effects of technological development on flora and fauna.									4		4	4

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	STL-16 Understanding of and abilities to select and use energy and power technologies	8	8	12	0	8	12	6	3	17	20	0	17
A	Energy comes in many forms.	4											
B	Energy should not be wasted.	4											
C	Energy comes in different forms.		4										
D	Tools, machines, products, and systems use energy in order to do work.		4										
E	Energy is the capacity to do work.			4									
F	Energy can be used to do work, using many processes.					4							
G	Power is the rate at which energy is converted from one form to another or transferred from one place to another, or the rate at which work is done.			4									
H	Power systems are used to drive and provide propulsion to other technological products and systems.					4							
I	Much of the energy used in our environment is not used efficiently.			4									
J	Energy cannot be created nor destroyed; however, it can be converted from one form to another.						4			3	4		3
K	Energy can be grouped into major forms: thermal, radiant, electrical, mechanical, chemical, nuclear, and others.						4			3	4		3
L	It is impossible to build an engine to perform work that does not exhaust thermal energy to the surroundings.							4		3	4		3
M	Energy resources can be renewable or nonrenewable.						1	2	3	4	4		4
N	Power systems must have a source of energy, a process, and loads.						3			4	4		4

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STL-17	**Understanding of and abilities to select and use information and communication technologies**	12	16	13	4	8	16	8	8	7	0	24	7
A	Information is data that has been organized.	4											
B	Technology enables people to communicate by sending and receiving information over a distance.	4											
C	People use symbols when they communicate by technology.	4											
D	The processing of information through the use of technology can be used to help humans make decisions and solve problems.		4										
E	Information can be acquired and sent through a variety of technological sources, including print and electronic media.		4										
F	Communication technology is the transfer of messages among people and/or machines over distances through the use of technology.		4										
G	Letters, characters, icons, and signs are symbols that represent ideas, quantities, elements, and operations.		4										
H	Information and communication systems allow information to be transferred from human to human, human to machine, and machine to human.			3		4							
I	Communication systems are made up of a source, encoder, transmitter, receiver, decoder, and destination.			3		4							
J	The design of a message is influenced by such factors as the intended audience, medium, purpose, and nature of the message.			4									
K	The use of symbols, measurements, and drawings promotes clear communication by providing a common language to express ideas.			3	4								
L	Information and communication technologies include the inputs, processes, and outputs associated with sending and receiving information.						4					4	
M	Information and communication systems allow information to be transferred from human to human, human to machine, machine to human, and machine to machine.						4					4	
N	Information and communication systems can be used to inform, persuade, entertain, control, manage, and educate.						1	4	4			4	
O	Communication systems are made up of source, encoder, transmitter, receiver, decoder, storage, retrieval, and destination.						4					4	
P	There are many ways to communicate information, such as graphic and electronic means.							4	4	4		4	3
Q	Technological knowledge and processes are communicated using symbols, measurement, conventions, icons, graphic images, and languages that incorporate a variety of visual, auditory, and tactile stimuli.						3			4		4	4

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	STL-18 Understanding of and abilities to select and use transportation technologies	12	8	4	4	11	4	8	0	4	16	0	4
A	A transportation system has many parts that work together to help people travel.	4											
B	Vehicles move people or goods from one place to another in water, air, or space and on land.	4											
C	Transportation vehicles need to be cared for to prolong their use.	4											
D	The use of transportation allows people and goods to be moved from place to place.		4										
E	A transportation system may lose efficiency or fail if one part is missing or malfunctioning or if a subsystem is not working.		4										
F	Transporting people and goods involves a combination of individuals and vehicles.			4		3							
G	Transportation vehicles are made up of subsystems, such as structural, propulsion, suspension, guidance, control, and support, that must function together for a system to work effectively.					4							
H	Governmental regulations often influence the design and operation of transportation systems.				4								
I	Processes, such as receiving, holding, storing, loading, moving, unloading, delivering, evaluating, marketing, managing, communicating, and using conventions are necessary for the entire transportation system to operate efficiently.					4							
J	Transportation plays a vital role in the operation of other technologies, such as manufacturing, construction, communication, health and safety, and agriculture.						4				4		
K	Intermodalism is the use of different modes of transportation, such as highways, railways, and waterways as part of an interconnected system that can move people and goods easily from one mode to another.							4			4		
L	Transportation services and methods have led to a population that is regularly on the move.							4			4		
M	The design of intelligent and non-intelligent transportation systems depends on many processes and innovative techniques									4	4		4

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	STL-19 Understanding of and abilities to select and use manufacturing technologies	8	12	12	8	4	10	15	3	14	24	0	15
A	Manufacturing systems produce products in quantity.	4											
B	Manufactured products are designed.	4											
C	Processing systems convert natural materials into products.		4										
D	Manufacturing processes include designing products, gathering resources, and using tools to separate, form, and combine materials in order to produce products.		4										
E	Manufacturing enterprises exist because of a consumption of goods.		4										
F	Manufacturing systems use mechanical processes that change the form of materials through the processes of separating, forming, combining, and conditioning them.			4									
G	Manufactured goods may be classified as durable and non-durable.			4									
H	The manufacturing process includes the designing, development, making, and servicing of products and systems.					4							
I	Chemical technologies are used to modify or alter chemical substances.				4								
J	Materials must first be located before they can be extracted from the earth through such processes as harvesting, drilling, and mining.			4									
K	Marketing a product involves informing the public about it well as assisting in selling and distributing it.				4								
L	Servicing keeps products in good operating condition.							4					
M	Materials have different qualities and may be classified as natural, synthetic, or mixed.						4	3		3	4		3
N	Durable goods are designed to operate for a long period of time, while non-durable goods are designed to operate for a short period of time.									4	4		4
O	Manufacturing systems may be classified into types, such as customized production, batch production, and continuous production.						3			3	4		4
P	The interchangeability of parts increases the effectiveness of manufacturing processes.						3			4	4		4
Q	Chemical technologies provide a means for humans to alter or modify materials and to produce chemical products.							4			4		
R	Marketing involves establishing a product's identity, conducting research on its potential, advertising it, distributing it, and selling it.							4	3		4		

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1 = Topics and lessons refer to previous knowledge

		K-2	3-5	Exploring Technology	Invention & Innovation	Systems	Foundations	Impacts	Issues	Technological Design	Advanced Design Applications	Advanced Technological Applications	Engineering Design
	Course Total	172	232	212	147	166	202	154	97	182	236	209	187
	STL-20 Understanding of and abilities to select and use construction technologies	8	12	7	0	12	8	4	0	11	20	0	11
A	People live, work, and go to school in buildings, which are of different types: houses, apartments, office buildings, and schools.	4											
B	The type of structure determines how the parts are put together.	4											
C	Modern communities are usually planned according to guidelines.		4										
D	Structures need to be maintained.		4										
E	Many systems are used in buildings.		4										
F	The selection of designs for structures is based on factors such as building laws and codes, style, convenience, cost, climate, and function.			4									
G	Structures rest on a foundation.			3		4							
H	Some structures are temporary, while others are permanent.					4							
I	Buildings generally contain a variety of subsystems.					4							
J	Infrastructure is the underlying base or basic framework of a system.						4				4		
K	Structures are constructed using a variety of processes and procedures.						4				4		
L	The design of structures includes a number of requirements.									4	4		4
M	Structures require maintenance, alteration, or renovation periodically to improve them or to alter their intended use.									3	4		3
N	Structures can include prefabricated materials									4	4		4