



# Standard #: SC.912.N.4.2

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Weigh the merits of alternative strategies for solving a specific societal problem by comparing a number of different costs and benefits, such as human, economic, and environmental.

## General Information

**Subject Area:** Science

**Grade:** 912

**Body of Knowledge:** Nature of Science

**Idea:** Level 3: Strategic Thinking & Complex Reasoning

**Standard:** [Science and Society](#) - As tomorrow's citizens, students should be able to identify issues about which society could provide input, formulate scientifically investigable questions about those issues, construct investigations of their questions, collect and evaluate data from their investigations, and develop scientific recommendations based upon their findings.

**Date Adopted or Revised:** 02/08

**Content Complexity Rating:** [Level 3: Strategic Thinking & Complex Reasoning](#) - [More Information](#)

**Date of Last Rating:** 05/08

**Status:** State Board Approved

## Related Courses

Course Number	Course Title
<a href="#">2020910:</a>	Astronomy Solar/Galactic Honors (Specifically in versions: 2014 - 2015, 2015 - 2022 (current), 2022 and beyond)
<a href="#">2000330:</a>	Biology 2 Honors (Specifically in versions: 2014 - 2015, 2015 - 2018, 2018 - 2022 (current), 2022 and beyond)
<a href="#">2000430:</a>	Biology Technology (Specifically in versions: 2014 - 2015, 2015 - 2022 (current), 2022 and beyond)
<a href="#">3027010:</a>	Biotechnology 1 (Specifically in versions: 2015 and beyond (current))
<a href="#">3027020:</a>	Biotechnology 2 (Specifically in versions: 2015 and beyond (current))
<a href="#">2003350:</a>	Chemistry 1 Honors (Specifically in versions: 2014 - 2015, 2015 - 2022 (current), 2022 and beyond)
<a href="#">2003360:</a>	Chemistry 2 Honors (Specifically in versions: 2014 - 2015, 2015 - 2022 (current), 2022 and beyond)
<a href="#">2001320:</a>	Earth/Space Science Honors (Specifically in versions: 2014 - 2015, 2015 - 2022 (current), 2022 and beyond)
<a href="#">2000380:</a>	Ecology (Specifically in versions: 2014 - 2015, 2015 - 2022 (current), 2022 and beyond)
<a href="#">2002480:</a>	Forensic Science 1 (Specifically in versions: 2014 - 2015, 2015 - 2017, 2017 - 2022 (current), 2022 and beyond)
<a href="#">2002490:</a>	Forensic Sciences 2 (Specifically in versions: 2014 - 2015, 2015 - 2017, 2017 - 2022 (current), 2022 and beyond)
<a href="#">2002410:</a>	Integrated Science 1 Honors (Specifically in versions: 2014 - 2015, 2015 - 2022 (current), 2022 and beyond)
<a href="#">2002440:</a>	Integrated Science 3 (Specifically in versions: 2014 - 2015, 2015 - 2022 (current), 2022 and beyond)
<a href="#">2000390:</a>	Limnology (Specifically in versions: 2014 - 2015, 2015 - 2018 (course terminated))
<a href="#">2002500:</a>	Marine Science 1 (Specifically in versions: 2014 - 2015, 2015 - 2022 (current), 2022 and beyond)
<a href="#">2002510:</a>	Marine Science 1 Honors (Specifically in versions: 2014 - 2015, 2015 - 2022 (current), 2022 and beyond)
<a href="#">2002520:</a>	Marine Science 2 (Specifically in versions: 2014 - 2015, 2015 - 2022 (current), 2022 and beyond)
<a href="#">2002530:</a>	Marine Science 2 Honors (Specifically in versions: 2014 - 2015, 2015 - 2022 (current), 2022 and beyond)
<a href="#">2003400:</a>	Nuclear Radiation (Specifically in versions: 2014 - 2015, 2015 - 2018 (course terminated))
<a href="#">2020710:</a>	Nuclear Radiation Honors (Specifically in versions: 2014 - 2015, 2015 - 2022 (current), 2022 and beyond)
<a href="#">2003310:</a>	Physical Science (Specifically in versions: 2015 - 2022 (current), 2022 and beyond)
<a href="#">2003320:</a>	Physical Science Honors (Specifically in versions: 2014 - 2015, 2015 - 2022 (current), 2022 and beyond)
<a href="#">2003410:</a>	Physics 2 Honors (Specifically in versions: 2014 - 2015, 2015 - 2022 (current), 2022 and beyond)
<a href="#">2003600:</a>	Principles of Technology 1 (Specifically in versions: 2014 - 2015, 2015 - 2022 (current), 2022 and beyond)
<a href="#">2003610:</a>	Principles of Technology 2 (Specifically in versions: 2014 - 2015, 2015 - 2018 (course terminated))
<a href="#">2002540:</a>	Solar Energy Honors (Specifically in versions: 2014 - 2015, 2015 - 2022 (current), 2022 and beyond)
<a href="#">2002550:</a>	Solar Energy 2 Honors (Specifically in versions: 2014 - 2015, 2015 - 2018 (course terminated))
<a href="#">2002330:</a>	Space Technology and Engineering (Specifically in versions: 2014 - 2015, 2015 - 2018 (course terminated))
<a href="#">1800320:</a>	Aerospace Science 3 (Specifically in versions: 2014 - 2015, 2015 - 2022 (current), 2022 and beyond)
<a href="#">1800360:</a>	Aerospace Science 4 (Specifically in versions: 2014 - 2015, 2015 - 2022 (current), 2022 and beyond)
<a href="#">1700360:</a>	Florida's Preinternational Baccalaureate Inquiry Skills (Specifically in versions: 2014 - 2015, 2015 - 2022 (current), 2022 and beyond)
<a href="#">2000500:</a>	Bioscience 1 Honors (Specifically in versions: 2014 - 2015, 2015 - 2022 (current), 2022 and beyond)
<a href="#">2000510:</a>	Bioscience 2 Honors (Specifically in versions: 2014 - 2015, 2015 - 2022 (current), 2022 and beyond)
<a href="#">2000520:</a>	Bioscience 3 Honors (Specifically in versions: 2014 - 2015, 2015 - 2022 (current), 2022 and beyond)

<a href="#">2002445:</a>	Integrated Science 3 for Credit Recovery (Specifically in versions: 2014 - 2015, 2015 - 2020 (course terminated))
<a href="#">2003500:</a>	Renewable Energy 1 Honors (Specifically in versions: 2014 - 2015, 2015 - 2022 (current), 2022 and beyond)
<a href="#">2003838:</a>	Florida's Preinternational Baccalaureate Physics 2 (Specifically in versions: 2015 and beyond (current))
<a href="#">7920022:</a>	Access Physical Science (Specifically in versions: 2016 - 2018, 2018 and beyond (current))
<a href="#">2001341:</a>	Environmental Science Honors (Specifically in versions: 2016 - 2022 (current), 2022 and beyond)
<a href="#">2001330:</a>	Meteorology Honors (Specifically in versions: 2016 - 2019, 2019 - 2022 (current), 2022 and beyond)

## Related Access Points

Access Points Number	Access Points Title
<a href="#">SC.912.N.4.In.2:</a>	Identify that costs and benefits must be considered when choosing a strategy for solving a problem.
<a href="#">SC.912.N.4.Su.2:</a>	Recognize that some strategies may cost more to solve a problem.
<a href="#">SC.912.N.4.Pa.2:</a>	Recognize a local problem that can be solved by science.

## Related Resources

### Educational Game

Name	Description
<a href="#">Stop Disasters Before They Happen:</a>	Students attempt to save towns from damage prior to the arrival of several different natural disasters. Students will learn the importance of early prevention and actions to protect others, themselves and their property when faced with a natural disaster. Certain disasters are more appropriate for particular grade levels. Each scenario takes between 20 and 45 minutes to play, depending on the disaster for which your students are trying to prepare. There are five scenarios available, hurricane, tsunami, flood, earthquake, and wildfire. Each scenario can be played on easy, medium or hard difficulty levels. As with life, there are no "perfect solutions" to each scenario and no "perfect score", so students can play multiple times and the scenarios will still be slightly different. These simulation are part of a larger website that provides multiple links for natural disasters.

### Lesson Plans

Name	Description
<a href="#">Harmful Algal Blooms:</a>	Harmful algal blooms are the result of bacteria and phytoplankton obtaining far too many nutrients from fertilizers, sewage, and other pollutants. This lesson explains the causes and effects of these blooms in depth, and students will consider solutions for reducing blooms around Florida. This lesson involves a classroom discussion of the costs and benefits involved in reducing harmful algal blooms, and how science can be used to inform policy.
<a href="#">Empowering Zanzibar to Defeat Malaria:</a>	In this lesson, students will analyze an informational text describing how one woman, Habiba, earned the title as "Zanzibar's Malaria Hunter." Habiba is one of many surveillance officers working to track, test, treat and educate the public to prevent the spread of malaria. Surveillance officers like Habiba, are helping the PMI (US President's Malaria Initiative) and the Zanzibar Malaria Elimination Program quickly respond to cases of malaria, report the data and eradicate the disease from the archipelago. "The prevalence of malaria in Zanzibar has been reduced from 25 percent in 2005 to less than 1 percent today."  The lesson plan includes a note-taking guide, text-dependent questions, a writing prompt/scoring rubric, and answer keys.
<a href="#">Diabetes: More Than Just Sugar:</a>	This diabetes MEA provides students with the opportunity to investigate finding affordable health coverage, a problem common to many people living with diabetes. Students must rank doctors based on certain costs and the specific services they provide. The main focus of this MEA is to determine the best doctors to go to for diabetic care and treatment, weighing factors such as insurance, cost, doctor visits, location, patient ratings, number of years in business, diet, exercise, weight management, stress management, network participation, and support groups.
<a href="#">Best Types of Grass to Grow in Florida:</a>	Based on various factors, students will decide the best types of grass (sod) to grow in Florida and the advantages and disadvantages of each.
<a href="#">Parker County Public Works Project:</a>	Have you ever considered what sort of discussion is done before deciding to build a water park or hospital in your town or county? What about the roads? The schools? This resource is a valuable tool in teaching students about the importance of developing a thought process and about the value in public works. The students will be conducting an MEA that revolves around the premise of deciding on what is the most important public works project for Parker County, FL.
<a href="#">Acting on Information About Cancer:</a>	Students assume the roles of federal legislators and explore several Cell Biology and Cancer website resources to identify reasons to support or oppose a proposed statute that would require individuals under the age of 18 to wear protective clothing when outdoors.  After completing this activity, students will: <ul style="list-style-type: none"> <li>• understand that science can help us improve personal and public health,</li> <li>• be able to explain that good choices can reduce an individual's risk of developing cancer and can improve an individual's chance of survival if he or she does develop it,</li> <li>• understand that ethics brings to public policy debates two presumptions: that we should protect individual autonomy and that we should protect individual and societal health and well-being,</li> <li>• recognize that ethical values sometimes conflict in public policy debates about strategies for reducing the risk of cancer, and</li> <li>• understand that it is possible for people to hold different positions on a controversial topic and still participate in a</li> </ul>

	reasoned discussion about it.
<a href="#">Florida Panthers and Wildlife Corridors:</a>	Students will learn about the Florida Panther, threats to its survival and the role of wildlife corridors as an attempt to reduce roadway fatalities. Students will participate in a game simulating panther crossings, learn about panthers from a guest speaker or teacher, and participate in a mock town hall meeting evaluating the construction of wildlife corridors.
<a href="#">Preserving Our Marine Ecosystems:</a>	The focus of this MEA is oil spills and their effect on the environment. In this activity, students from a fictitious class are studying about the effects of an oil spill on marine ecosystems and have performed an experiment in which they were asked to try to rid a teaspoon of corn oil from a baking pan filled with two liters of water as thoroughly as possible in a limited timeframe and with limited resources. By examining, analyzing, and evaluating experimental data related to resource usage, disposal, and labor costs, students must face the tradeoffs that are involved in trying to preserve an ecosystem when time, money, and resources are limited.
<a href="#">Cleaning Up Your Act:</a>	Cleaning Up Your Act Model Eliciting Activity (MEA) provides students with a real world engineering problem in which they must work as a team to design a procedure to select the best material for cleaning up an oil spill. The main focus of this MEA is to recognize the consequences of a catastrophic event, and understand the environmental and economical impact based on data analysis. Students will conduct individual and team investigations in order to arrive at a scientifically sound solution to the problem.
<a href="#">Alternative Fuel Systems:</a>	The Alternative Fuel Systems MEA provides students with an engineering problem in which they must develop a procedure to decide the appropriate course for an automobile manufacturer to take given a set of constraints. The main focus of the MEA is to apply the concepts of work and energy to a business model.
<a href="#">Diabetic Dilemma:</a>	Students will evaluate a variety of medications and their potential benefits for a diabetic patient.
<a href="#">Technology vs. Ethics Debate:</a>	Students will debate several controversial issues such as human cloning, use of performance enhancing drugs in sports, and space exploration in order to determine which they deem more important to society: technology or ethics. After brainstorming a list of issues and cutting it down to 8, students will be given 4 to 5 days to research the issues and prepare for the debate. Students will not know which side they are debating until the debate begins. The purpose of this exercise is for students to carefully consider both sides of issues, as well as alternatives, and to understand the importance of maintaining a healthy balance between ethics and technology. After the debate, students will write about what they have learned in terms of the issues themselves, their team's performance in the debate, and whether or not their opinion has changed on any issue due to some important point made during the debate.
<a href="#">Efficient Storage:</a>	The topic of this MEA is work and power. Students will be assigned the task of hiring workers to complete a given task. In order to make a decision as to which workers to hire, the students initially must calculate the required work. The power each worker can exert, the days each worker is available to work each week, the number of sick days each worker has taken over the past 12 months, and the salary each worker commands will then be provided. Full- and/or part-time positions are available. Through data analysis, the students will need to evaluate which factors are most significant in the hiring process. For instance, some groups may select the most efficient workers; other groups may select the group of workers that will cost the company the least amount of money; still other groups may choose the workers that can complete the job in the shortest amount of time. Each group will also be required to provide the rationale that justifies the selection of which workers to hire.
<a href="#">Which Brand of Chocolate Chip Cookie Would You Buy?:</a>	In this activity, students will utilize measurement data provided in a chart to calculate areas, volumes, and densities of cookies. They will then analyze their data and determine how these values can be used to market a fictitious brand of chocolate chip cookie. Finally, they will integrate cost and taste into their analyses and generate a marketing campaign for a cookie brand of their choosing based upon a set sample data which has been provided to them.
<a href="#">Corn Conundrum:</a>	The Corn Conundrum MEA provides students with an agricultural problem in which they must work as a team to develop a procedure to select the best variety of corn to grow under drier conditions predicted by models of global climate change. Students must determine the most important factors that make planting crops sustainable in restricted climate conditions for the client. The main focus of this MEA is manipulating factors relating to plant biology, including transpiration and photosynthesis.
<a href="#">Personal DNA Testing:</a>	A lesson with multi-media components from PBS/NOVA that focuses on DNA testing, including techniques, purposes, and considerations for biotechnology and human decisions regarding health. Students will learn about single nucleotide polymorphisms, how they are used in science, and how they are being used in the medical field. Students will apply this knowledge by looking at a mock data set and probabilities to inform medical recommendations.
<a href="#">Hybrid-Electric Vehicles vs. Gasoline-Powered Vehicles:</a>	Students will be comparing hybrid-electric vehicles (HEV) versus gasoline-powered vehicles. They will research the benefits of owning a HEV while also analyzing the cost effectiveness.
<a href="#">Plants versus Pollutants Model Eliciting Activity:</a>	The Plants versus Pollutants MEA provides students with an open-ended problem in which they must work as a team to design a procedure to select the best plants to clean up certain toxins. This MEA requires students to formulate a phytoremediation-based solution to a problem involving cleaning of a contaminated land site. Students are provided the context of the problem, a request letter from a client asking them to provide a recommendation, and data relevant to the situation. Students utilize the data to create a defensible model solution to present to the client.

#### Original Student Tutorials

Name	Description
<a href="#">Turtles and Towns:</a>	Explore the impacts on sea turtles, humans, and the economy when we live, work, and play at the beach with this interactive tutorial.
<a href="#">Chemistry With a Conscience:</a>	Explore green chemistry and what it means to be benign by design in this interactive tutorial.

#### Perspectives Video: Professional/Enthusiast

Name	Description
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Landfills have come a long way! Explore modern techniques for managing our environmental impact through responsible waste disposal.

[Managing Waste Disposal with Landfills and Recycling:](#) Download the [CPALMS Perspectives video student note taking guide](#).

## Text Resources

Name	Description
<a href="#">Killing a Patient to Save His Life:</a>	This informational text resource is intended to support reading in the content area. This article explores a controversial clinical trial being conducted by the University of Pittsburgh. Scientists are exploring more efficient ways to save lives when patients enter the emergency room in critical condition. The idea involves draining the patient's blood and replacing it with freezing saltwater to induce a hypothermic state that will buy doctors more time to save human lives. This is causing an ethical debate as patients will be essentially clinically dead during this procedure. The technique is known as Emergency Preservation and Resuscitation (EPR).
<a href="#">Better Catalysts for the Petrochemical Industry:</a>	This informational text resource is intended to support reading in the content area. Zeolites are catalysts necessary for the production of gasoline from crude oil. One problem with zeolites is that their pores can be clogged by reaction products. To solve this, scientists have recently created zeolites that have greater pore connectivity, which turns out to be a better, and also cheaper, method of producing catalysts for the petrochemical industry.
<a href="#">Tough Decisions on the Front Line of Nature Conservation:</a>	This informational text resource is intended to support reading in the content area. This article expresses its author's opinion about culling animals in zoos, which is reducing a population by selective slaughter. The argument supports the idea of culling as a way to control inbreeding and to control the breeding of animals that will not help the species stay adaptable and immune to diseases.
<a href="#">Hurricane Sandy was New York's "Self-Inflicted Calamity":</a>	This informational text resource is intended to support reading in the content area. Hurricane Sandy was one of the biggest storms to hit New York City in recent history. Intense wind and rain caused major damage all over the city and surrounding areas. The storm exposed how overdevelopment of reclaimed land and lack of political action to protect the city has led to major flooding—and probably will again unless action is taken.
<a href="#">With Data and Resolve, Tacoma Fights Pollution:</a>	This informational text resource is intended to support reading in the content area. Rain and runoff carry pollutants from human activity to the sea in places like Tacoma, Washington. The city has devised a scientific process for identifying sources and pathways of pollution and is making headway in reducing pollutant buildup and damage. By utilizing forensic methods to find the source of pollution and fining polluters, Tacoma is winning the war.
<a href="#">The Quest for a Clean Drink:</a>	This informational text resource is intended to support reading in the content area. In America, clean water flows with the turn of a knob, but many countries do not have this luxury. This article looks at three different ways scientists have created treatment systems for drinking water in poor countries like India and Bangladesh.
<a href="#">World Cup Raises Epidemic Questions:</a>	This informational text resource is intended to support reading in the content area. Tropical areas such as Brazil can be hotspots for communicable diseases due to warm temperatures and crowded urban spaces. There is a concern that when Brazil hosts the World Cup, mosquito-borne dengue fever may spread to its visitors. The article explores methods of pathogen transfer in a variety of venues (pilgrimages, airplanes, cruise lines) and compares these to conditions at the World Cup.
<a href="#">NASA's Quest for Green Rocket Fuel Passes Big Test:</a>	This informational text resource is intended to support reading in the content area. This text introduces AF-M315E, a "green" or environmentally friendly jet fuel, to potentially be used by NASA instead of hydrazine, which is known to be both toxic to humans and volatile for control of satellites and spacecraft.
<a href="#">Cultured Beef: Do We Really Need a \$380,000 Burger Grown in Petri Dishes?:</a>	This informational text resource is intended to support reading in the content area. The text describes the way scientists have created the first lab-grown meat and the possible implications of this new technology. An infographic and video are included that add significantly to the content.
<a href="#">In a Grain Of Golden Rice, A World of Controversy Over GMO Foods:</a>	This informational text resource is intended to support reading in the content area. This text discusses the origins of, and controversy surrounding, Golden Rice, a genetically modified food that could potentially provide beta-carotene to millions in Africa and Asia.
<a href="#">Fancy a Balloon Ride to the Stratosphere?:</a>	This informational text is intended to support reading in the content area. The article describes a new mini spacecraft that allows individuals to rise peacefully by balloon into the stratosphere.

## Tutorial

Name	Description
<a href="#">Central Idea: Quenching Your Thirst for Literacy Skills:</a>	<b>Click "View Site" to open a full-screen version.</b> This tutorial is designed to help secondary science teachers learn how to integrate literacy skills within their science curriculum. The focus on literacy across content areas is designed to help students independently build knowledge in different disciplines through reading and writing. This tutorial will demonstrate a series of steps that teachers can teach students to help them determine the central ideas of a science text. This tutorial will also explain what an effective summary contains and provide steps teachers can use to help students with paraphrasing.

## Student Resources

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Perspectives Video: Professional/Enthusiast

Name	Description
<a href="#">Managing Waste Disposal with Landfills and Recycling:</a>	Landfills have a come a long way! Explore modern techniques for managing our environmental impact through responsible waste disposal. Download the <a href="#">CPALMS Perspectives video student note taking guide</a> .

## Parent Resources

Perspectives Video: Professional/Enthusiast

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