Earth Day Every Day

A MIDDLE SCHOOL RECYCLING CURRICULUM

BROUGHT TO YOU BY

Green Star of Interior Alaska

Earth Day Every Day

A MIDDLE SCHOOL RECYCLING CURRICULUM

Intended for Grades 6-8

This curriculum is aligned with Alaska State Education Standards as well as Fairbanks North Star Borough School District (FNSBSD) curriculum guidelines. The curriculum was developed for use in the State of Alaska and can be adapted for each unique village, town, or community within the state. The curriculum kits are currently available for check-out from the following locations:

- FNSBSD Library Media Services, 520 Fifth Avenue, Fairbanks, AK 99707
- Green Star of Interior Alaska, 1101 Well Street, Fairbanks, AK 99701

Units Included

- Unit 1 - The Rotten Truth about Garbage
- Unit 2 - Introduction to the 3Rs
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Developed by: Green Star of Interior Alaska

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Sponsors

ALPAR
Alaskans for Litter Prevention & Recycling
Keeping Alaska beautiful

ALPAR (Alaskans for Litter Prevention & Recycling) has been providing recycling and litter prevention programs statewide since 1982. Their mission is to eliminate litter and increase economically viable recycling statewide. ALPAR is supported through contributions from Alaskan businesses and has been providing support for both litter and recycling programs in Fairbanks throughout its history. ALPAR's strategy is to direct resources back into community programs, so their community partnerships are extremely important.

In 2009, ALPAR partnered with the Fairbanks Rescue Mission and WestRock Recycling to provide shipping services for the Mission's community recycling center for Fairbanks. These shipping services were donated to ALPAR to manage for the benefit of community recycling centers, primarily those that are located in the railbelt, accept a wide variety of recyclable materials, and are free to the public at drop off. ALPAR also provides program assistance to many other communities in the state. Without the shipping assistance that ALPAR has historically provided, Alaska's community recycling centers would be prohibitively expensive to operate. ALPAR is tasked to manage the shipping contributions equitably and efficiently to the best effect for ALPAR, the shippers, and all the communities served. The Fairbanks North Star Borough opened the Central Recycling Facility in Fairbanks in September of 2017, centralizing the collection of recycled materials. ALPAR has continued to support recycling in Fairbanks by providing funding for event recycling and recycling education.

In addition to having managed shipping donations for recycling, ALPAR's programs include: free yellow litter bags and marine debris clean up bags for communities, Summer Youth Litter Patrol grants throughout the state, the Flying Cans and Flying Bottles programs serving rural Alaska, and numerous Anchorage programs, such as Adopt-a-Pathway, Guide to Recycling, and annual Christmas Tree, Nursery Pot, and Glass Recycling events and programs.

Fred Meyer fund

Fred G. Meyer (originally Frederick Grubmeyer) came to Portland, Oregon in 1908 when he was 22 years old. Drawing on his experience working for his family's grocery business, Mr. Meyer began selling coffee from a horse-drawn cart to workers at farms and lumber camps. As he watched and listened to his Customers (always a proper noun to Mr. Meyer), he began planning a completely new kind of store.

How One-Stop Shopping began

In 1922, Mr. Meyer opened the first Fred Meyer store in Portland at the corner of SW 5th & Yamhill. Mr. Meyer's vision was to give Customers more reasons to shop in his store than in any other. Before he opened his new store, Customers went to separate shops for meat, produce, cheese and other goods. Mr. Meyer placed these all under one roof and put an expert in charge of each area, setting the stage for the Fred Meyer stores we know today – stores that average 150,000 square feet and carry more than 225,000 items.

The Fred Meyer Fund awards grants to nonprofit organizations in Alaska, Idaho, Oregon and Washington with focus areas in: youth development/K-12 education, hunger reduction, cancer research and awareness, military family support, and environmental education and stewardship. The generosity of Fred Meyer customers, along with the generosity of Fred Meyer Associates, has helped the Fred Meyer Fund award more than $15 million in grants since 1997. In 2013, the fund awarded nearly $2.1 million in grants.

Sponsors

KINROSS Fort Knox

Kinross Fort Knox is a gold mine located 25 miles northeast of Fairbanks. Project construction began in 1995, with the first gold pour occurring a year later. The mine operates 24 hours a day, 365 days a year. Currently it employs 670 local Alaskans, and produces approximately 350,000 Troy ounces of gold every year making it the largest operating gold mine in Alaska.

The mine was first recognized for its reclamation efforts before it actually became a mine. In 2009, Fort Knox, in partnership with Alaska Department of Fish and Game, received the prestigious Tileston Award for the reclamation work done at Fish Creek Valley. In 1995, we began reclamation on Fish Creek Valley—a placer mine developed long before Fort Knox opened. After years of voluntary work, the habitat has greatly improved and is now home to moose, wolves, birds and other small mammals. Just this past year, Fort Knox was also the recipient of a reclamation award from the International Mining Compact Commission.

People, safety, environment. These are the values that Kinross Fort Knox treasures most. In addition to being a good steward of the environment, we take our responsibility to invest in the community seriously. As the largest single property taxpayer in the borough, we also give substantially to local organizations. This includes an investment of 2 million dollars to the University of Alaska and financial investments in over 100 other non-profits each year!

Green Star of Interior Alaska

What is Green Star's mission?

Organized as a 501(c)(3) in 1998, Green Star encourages the reuse of materials, reduction of unnecessary waste, and increased recycling efforts in Interior Alaska. Green Star accomplishes its mission by managing electronics collected by the borough for recycling from businesses and households, coordinating recycling for community events large and small, and providing educational outreach to the Fairbanks area.

Who comprises the organization?

Five employees: The Executive Director, Program Director, Electronics Resale Coordinator/Warehouse Assistant, Warehouse Manager, and a Disassembly Specialist

There are currently four people serving on the Board of Directors, with five vacant seats.

A dedicated team of over 80 community volunteers

What does Green Star do?

Electronic Recycling for the Fairbanks North Star Borough (FNSB):

- Green Star receives 10 tons of electronics per month from the borough, collected from residents and businesses of FNSB at their Central Recycling Facility.
- Green Star organizes weekly work days for a dedicated team of volunteers to sort the electronics for shipment.
- Green Star recycled more than 120 tons of electronic waste (e-waste) in 2018.
- Green Star partners with both local and national companies to reuse any electronics collected at the Central Recycling Facility that are still in good working order. Green Star works with electronics recyclers with environmentally-sound recycling practices to process any non-usable electronics.
- Green Star works as the regional hub for Interior Villages in the Backhaul Alaska Program. We collect and recycle back-hauled electronics from 11 different Interior villages at little to no cost.

Event Recycling Services

- Green Star partners with a variety of community organizations to provide recycling bins at community events and coordinate volunteers who collect and sort recyclable materials. In the past, you may have seen Green Star volunteers at the Tanana Valley State Fair, Midnight Sun Festival, Golden Days, and the Golden Wheel Amusement's Summer Spectacular.

Educational Outreach

- In 2018, Green Star published and distributed 40,000+ Fairbanks Recycling Guides, which provide valuable information about how and where to recycle various materials in our community.
- Green Star also developed this recycling curriculum kit for use in FNSB's middle schools. This curriculum will help educate the next generation of Fairbanks residents on the importance of recycling and environmental stewardship.

Contributors

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Photos by Sarah States unless otherwise credited.

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Acknowledgements

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Project Learning Tree - GreenSchools! Waste & Recycling Investigation
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Note to Educators

Dear Teacher,

Welcome to Earth Day Every Day: A Middle School Curriculum on Reducing, Reusing, and Recycling. A printable version can be found at: http://www.iagreenstar.org/curriculum.

The goals of the Earth Day Every Day Curriculum are:

- to increase Alaska's participation in the 3Rs - Reducing, Reusing, and Recycling
- to help students understand how recycling is an alternative to landfilling
- to provide engaging activities that meet Alaska Department of Education standards
- to instill an environmental ethic in students

How to get the most out of the Earth Day Every Day Curriculum:

- Review the Introduction and the Teacher Background Information found at the beginning of each unit.
- Each unit includes a list of associated vocabulary words; it is recommended that you review these words with your class before beginning the unit lessons and post a copy in the front of the class for easy reference.
- It is recommended that you cover Units 1-3 in the suggested order; however, you may also choose to cover only selected portions of the curriculum as they best fit into your existing classroom curriculum.
- Use the "Extension Ideas" listed at the end of each unit to further explore ways to make waste reduction and recycling an ongoing part of your classroom.
- In an effort to reduce waste, we encourage two-sided copying for all class printouts.

About the Curriculum

While this curriculum could be adapted into many standard content areas, the class activities fit best with the Alaska content for science standards.

A student who meets the content standards should:

1. develop an understanding of the processes of science used to investigate problems, design and conduct repeatable scientific investigations, and defend scientific arguments;
2. develop an understanding that the processes of science require integrity, logical reasoning, skepticism, openness, communication, and peer review; and
3. develop an understanding that culture, local knowledge, history, and interaction with the environment contribute to the development of scientific knowledge, and local applications provide opportunity for understanding scientific concepts and global issues.

The English/Language Arts, Writing, Mathematics, Science, and Social Studies Standards found in this curriculum were adopted from Alaska's Department of Education & Early Development June 2012 Standards. In addition, the Next Generation Science Standards (NGSS) were also used for all Science Standards. More information can be found at the Fairbanks North Star Borough (FNSB) School District Curriculum website (https://education.alaska.gov/akstandards) and at www.nsta.org/ngss.

How to read and understand the Standards section

Organization of English/Language Arts Standards

The standards can be identified in the first row by their content, strand, grade, then standard number (or number and letter, where applicable). For example, RI.CS.6,7,8.6 denotes "Reading Standards for Informational Text (content), Craft and Structure (strand), Grades 6, 7, & 8, standard number 6." The Content Area Key & Strand Key can be found at the Alaska Department of Education website (https://education.alaska.gov/akstandards).

Organization of Alaska's Core Science Standards

The standards can be identified in the first row by their [grade], then content letter abbreviation and standard number. For example, [6,7,8] SA1.1 denotes "Grade 6, 7, & 8, Science as Inquiry and Process (content), standard number 1.1."

Organization of the Next Generation Science Standards (NGSS)

The NGSS include three topics: Life Science, Earth & Space Science, and Physical Science. The standards page includes the topic, the Disciplinary Core Idea (the "big ideas" through each of the main disciplines of science), the Performance Expectation (what each student that demonstrates an understanding should be able to do), and a Clarifying Statement. To see further Foundation details and to see how the NGSS relates to the Common Core Standards for Education, refer to the NGSS website (www.nsta.org/ngss).

Organization of Math Standards

Unit One of the Earth Day Every Day Curriculum covers three of the eleven Mathematical Content Standard Domains, including Geometry, Expressions and Equations, and the Number System. For specific Domain details, including the Clusters and Standards, refer to the Alaska Department of Education website (https://education.alaska.gov/akstandards).

Thank You

Thank you for teaching the Earth Day Every Day Curriculum. This program provides practical knowledge and skills that will help your students make intelligent decisions now and in the future!

Happy Reducing, Reusing, and Recycling!

Outreach and Education Staff
Green Star of Interior Alaska
www.iagreenstar.org

UNIT 1 STANDARDS

ENGLISH/LANGUAGE ARTS STANDARDS

Standards	Grade 6	Grade 7	Grade 8
RI.CS.6,7,8.6	Determine an author's purpose (to inform, persuade, entertain, critique, etc.) and point of view in a text and explain how it is conveyed in the text.	Determine an author's purpose (to inform, persuade, entertain, critique, etc.) and point of view in a text and analyze how the author distinguishes his or her point of view from that of others.	Determine an author's purpose (to inform, persuade, entertain, critique, etc.) and point of view in a text and analyze how the author acknowledges and responds to conflicting evidence or viewpoints.
RI.KI.6,7,8.1	Cite textual evidence to support analysis of what the text says explicitly as well as inferences drawn from text.	Cite several pieces of textual evidence to support analysis of what the text says explicitly as well as inferences drawn from text.	Cite textual evidence that most strongly supports an analysis of what the text says explicitly as well as inferences drawn from the text.
RL.KI.6,7,8.2	Determine a theme or central idea of a text and how it is conveyed through particular details; restate and summarize main ideas or events, in correct sequence, after reading a text.	Determine a theme or central idea of a text and analyze its development over the course of the text; restate and summarize main ideas or events, in correct sequence, after reading a text.	Determine a theme or central idea of a text and analyze its development over the course of the text, including its relationship to the characters, setting, and plot; restate and summarize main ideas or events, in correct sequence, after reading a text.
RI.IK.6,7,8.8	Trace and evaluate the argument and specific claims in a text, distinguishing claims that are supported by reasons and evidence from claims that are not.	Trace and evaluate the argument and specific claims in a text, assessing whether the reasoning is sound and the evidence is relevant and sufficient to support the claims.	Delineate and evaluate the argument and specific claims in a text (e.g., identify bias and propaganda techniques, well-supported logical arguments), assessing whether the reasoning is sound and the evidence is relevant and sufficient; recognize when irrelevant evidence is introduced.
LA.6,7,8.2a-c	Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing.	Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing.	Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing.
LA.6,7,8.6	Acquire and accurately use grade-appropriate general academic and domain-specific words and phrases; gather vocabulary knowledge when considering a word or phrase important to comprehension or expression.	Acquire and accurately use grade-appropriate general academic and domain-specific words and phrases; gather vocabulary knowledge when considering a word or phrase important to comprehension or expression.	Acquire and accurately use grade-appropriate general academic and domain-specific words and phrases; gather vocabulary knowledge when considering a word or phrase important to comprehension or expression.

LITERACY IN HISTORY/SOCIAL STUDIES, SCIENCE, AND TECHNICAL SUBJECTS

	Grade 6	Grade 7	Grade 8
His/SS.6,7.4	Determine the meaning of words and phrases as they are used in a text, including vocabulary specific to domains related to history/ social studies.	Determine the meaning of words and phrases as they are used in a text, including vocabulary describing political, social, or economic aspects of history/social studies.	N/A
Science and Tech.6,7,8.2	Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions.	Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions.	Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions.

ALASKA'S CORE SCIENCE STANDARDS

	Grade 6	Grade 7	Grade 8
[6,7,8] SE1.1	The student demonstrates an understanding of how to integrate scientific knowledge and technology to address problems by recognizing that technology cannot always provide successful solutions for problems or fulfill every human need.	The student demonstrates an understanding of how to integrate scientific knowledge and technology to address problems by describing how public policy affects the student's life (e.g. public waste disposal).	The student demonstrates an understanding of how to integrate scientific knowledge and technology to address problems by describing how public policy affects the student's life and participating diplomatically in evidence-based discussions relating to the student's community.
[6,7,8] SE2.1	The student demonstrates an understanding that solving problems involves different ways of thinking by identifying and designing a solution to a problem.	The student demonstrates an understanding that solving problems involves different ways of thinking by identifying, designing, testing, and revising solutions to a local problem.	The student demonstrates an understanding that solving problems involves different ways of thinking by identifying, designing, testing, and revising solutions to a local problem.

NGSS STANDARDS FOR SCIENCE

TOPIC	Disciplinary Core Idea	Performance Expectations - Students who demonstrate understanding can:	CLARIFICATION STATEMENT
Life Science	MS-LS1 From Molecules to Organisms: Structures and Processes	MS-LS1-5: Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.	Examples of local environmental conditions could include availability of food, light, space, and water. Examples of genetic factors could include large breed cattle and species of grass affecting growth of organisms. Examples of evidence could include drought decreasing plant growth, fertilizer increasing plant growth, different varieties of plant seeds growing at different rates in different conditions, and fish growing larger in large ponds than they do in small ponds.
Life Science	MS-LS2 Ecosystems: Interactions, Energy, and Dynamics	MS-LS2-4: Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.	Emphasis is on recognizing patterns in data and making warranted inferences about changes in populations, and on evaluating empirical evidence supporting arguments about changes to ecosystems.
Life Science	MS-LS4 Biological Evolution: Unity and Diversity	MS-LS4-6: Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time.	Emphasis is on using mathematical models, probability statements, and proportional reasoning to support explanations of trends in changes to populations over time. [Assessment Boundary: Assessment does not include Hardy Weinberg calculations]
Earth and Space Sciences	MS-ESS3 Earth and Human Activity	MS-ESS3-4: Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems.	Examples of evidence include grade-appropriate databases on human populations and the rates of consumption of food and natural resources (such as freshwater, mineral, and energy). Examples of impacts can include changes to the appearance, composition, and structure of Earth's systems as well as the rates at which they change. The consequences of increases in human populations and consumption of natural resources are described by science, but science does not make the decisions for the actions society takes.

NGSS STANDARDS FOR SCIENCE

TOPIC	Disciplinary Core Idea	Performance Expectations - Students who demonstrate understanding can:	CLARIFICATION STATEMENT
Earth and Space Sciences	MS-ESS3 Earth and Human Activity	MS-ESS3-5: Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.	Examples of factors include human activities (such as fossil fuel combustion, cement production, and agricultural activity) and natural processes (such as changes in incoming solar radiation or volcanic activity). Examples of evidence can include tables, graphs, and maps of global and regional temperatures, atmospheric levels of gases such as carbon dioxide and methane, and the rates of human activities. Emphasis is on the major role that human activities play in causing the rise in global temperatures.

MATH

	Grade 6	Grade 7	Grade 8
Expressions and Equations - 6,7.EE	Apply and extend previous understandings of arithmetic to algebraic expressions. Reason about and solve one-variable equations and inequalities. Represent and analyze quantitative relationships between dependent and independent variables.	Use properties of operations to generate equivalent expressions. Solve real-life and mathematical problems using numerical and algebraic expressions and equations.	N/A
Geometry - 6,7.G	Solve real-world and mathematical problems involving area, surface area, and volume.	Solve real-life and mathematical problems involving angle measure, area, surface area, and volume.	N/A
The Number System - 7,8.NS	N/A	Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers.	Know that there are numbers that are not rational, and approximate them by rational numbers.

UNIT 2 STANDARDS

ENGLISH/LANGUAGE ARTS STANDARDS

Standards	Grade 6	Grade 7	Grade 8
RL.IK.6.7	Compare and contrast the experience of reading a story, drama, or poem to listening to or viewing an audio, video, or live version of the text, including contrasting what they "see" and "hear" when reading the text to what they perceive when they listen or watch.	N/A	N/A
RI.KI.6,7,8.2	Determine a central idea and subtopics of a text and how they are conveyed through particular details; restate and summarize the central idea or events, in correct sequence when necessary, after reading a text.	Determine a central idea and subtopics in a text and analyze their development over the course of the text; restate and summarize the central idea or events, in correct sequence when necessary, after reading a text.	Determine a central idea and subtopics of a text and analyze their development over the course of the text, including their relationship to supporting ideas; restate and summarize the central idea or ideas, in correct sequence when necessary, after reading a text.
RL.CS.6,7,8.4	Determine the meaning of words and phrases as they are used in a text, including figurative and connotative meaning. Analyze the impact of a specific word choice on meaning and tone.	Determine the meaning of words and phrases as they are used in a text, including figurative and connotative meaning; analyze the impact of a specific word choice on meaning and tone.	Determine the meaning of words and phrases as they are used in a text, including figurative and connotative meaning; analyze the impact of a specific word choice on meaning and tone, including analogies or allusions to other texts.

LITERACY IN HISTORY/SOCIAL STUDIES, SCIENCE, AND TECHNICAL SUBJECTS

	Grade 6	Grade 7	Grade 8
His/SS.6,7,8.7	Integrate visual information (e.g., in charts, graphs, photographs, videos, or maps) with other information in print and digital texts.	Integrate quantitative or technical analysis (e.g., charts, research data) with qualitative analysis in print or digital text.	Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, as well as in words) in order to address a question or solve a problem.
Science and Tech.6,7,8.4	Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 6-8 texts and topics.	Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 6-8 texts and topics.	Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 6-8 texts and topics.
Science and Tech.6,7,8.7	Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).	Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.	Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia)) in order to address a question or solve a problem.

ALASKA'S CORE SCIENCE STANDARDS

	Grade 6	Grade 7	Grade 8
[6,7,8] SA3.1	The student demonstrates an understanding that interactions with the environment provide an opportunity for understanding scientific concepts by gathering data to build a knowledge base that contributes to the development of questions about the local environment (e.g., moose browsing, trail usage, river erosion).	The student demonstrates an understanding that interactions with the environment provide an opportunity for understanding scientific concepts by designing and conducting a simple investigation about the local environment.	The student demonstrates an understanding that interactions with the environment provide an opportunity for understanding scientific concepts by conducting research to learn how the local environment is used by a variety of competing interests (e.g. competition for habitat/ resources, tourism, oil and mining companies, hunting groups).

NGSS STANDARDS FOR SCIENCE

TOPIC	Disciplinary Core Idea	Performance Expectations - Students who demonstrate understanding can:	CLARIFICATION STATEMENT
Physical Science	MS-PS1 Matter and its Interactions	MS-PS1-3: Gather and make sense of information to describe that synthetic materials come from natural resources and impact society.	Emphasis is on natural resources that undergo a chemical process to form the synthetic material. Examples of new materials could include new medicine, foods, and alternative fuels.

NGSS STANDARDS FOR SCIENCE

TOPIC	Disciplinary Core Idea	Performance Expectations - Students who demonstrate understanding can:	CLARIFICATION STATEMENT
Physical Science	MS-PS1 Matter and its Interactions	MS-PS1-2: Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.	Examples of reactions could include burning sugar or steel wool, fat reacting with sodium hydroxide, and mixing zinc with hydrogen chloride. [Assessment boundary: Assessment is limited to analysis of the following properties: density, melting point, boiling point, solubility, flammability, and odor.]
Earth and Space Sciences	MS-ESS3 Earth and Human Activity	MS-ESS3-1: Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes.	Emphasis is on how these resources are limited and typically non-renewable, and how their distributions are significantly changing as a result of removal by humans. Examples of uneven distributions of resources as a result of past processes include but are not limited to petroleum (locations of the burial of organic marine sediments and subsequent geologic traps), metal ores (locations of past volcanic and hydrothermal activity associated with subduction zones), and soil (locations of active weathering and/or deposition of rock).
Earth and Space Sciences	MS-ESS3 Earth and Human Activity	MS-ESS3-3: Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.	Examples of the design process include examining human environmental impacts, assessing the kinds of solutions that are feasible, and designing and evaluating solutions that could reduce that impact. Examples of human impacts can include water usage (such as the withdrawal of water from streams and aquifers or the construction of dams and levees), land usage (such as urban development, agriculture, or the removal of wetlands), and pollution (such as of the air, water, or land).

UNIT 3 STANDARDS

ENGLISH/LANGUAGE ARTS STANDARDS

Standards	Grade 6	Grade 7	Grade 8
W.6,7,8.7	Conduct short research projects to answer a question, drawing on several sources and refocusing the inquiry when appropriate.	Conduct short research projects to answer a question, drawing on several sources and generating additional related, focused questions for further research and investigation.	Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration.
W.6,7,8.10	Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.	Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.	Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.
S&L.6,7,8.1a-d	Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 6 topics, texts, and issues, building on others' ideas and expressing their own clearly.	Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 7 topics, texts, and issues, building on others' ideas and expressing their own clearly.	Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 8 topics, texts, and issues, building on others' ideas and expressing their own clearly.
S&L.6,7,8.4	Present claims and findings, sequencing ideas logically and using pertinent descriptions, facts, and details to accentuate main ideas or themes; use appropriate eye contact, adequate volume, and clear pronunciation.	Present claims and findings, emphasize salient points in a focused, coherent manner with pertinent descriptions, facts, details, and examples; use appropriate eye contact, adequate volume, and clear pronunciation.	Present claims and findings, emphasize salient points in a focused, coherent manner with relevant evidence, sound valid reasoning, and well-chosen detail; use appropriate eye contact, adequate volume, and clear pronunciation.

ALASKA'S CORE SCIENCE STANDARDS

	Grade 6	Grade 7	Grade 8
[6,7,8] SA1.1	The student will demonstrate an understanding of the process of science by asking questions, predicting, observing, describing, measuring, classifying, making generalizations, inferring, and communicating.	The student will demonstrate an understanding of the process of science by asking questions, predicting, observing, describing, measuring, classifying, making generalizations, inferring, and communicating.	The student will demonstrate an understanding of the process of science by asking questions, predicting, observing, describing, measuring, classifying, making generalizations, inferring, and communicating.
[6,7,8] SA1.2	The student will demonstrate an understanding of the process of science by collaborating to design and conduct simple repeatable investigations.	The student will demonstrate an understanding of the process of science by collaborating to design and conduct simple repeatable investigations, in order to record, analyze, interpret data, and present findings.	The student will demonstrate an understanding of the process of science by collaborating to design and conduct simple repeatable investigations, in order to record, analyze, interpret data, and present findings.
[6] SB3.1	The student demonstrates an understanding of the interactions between matter and energy and the effects of these interactions on systems by recognizing that most substances can exist as a solid, liquid, or gas depending on temperature.	N/A	N/A
[6,7,8] SE3.1	The student demonstrates an understanding of how science discoveries and technological innovations affect our lives and society by describing the various effects of an innovation on a global level.	The student demonstrates an understanding of how science discoveries and technological innovations affect our lives and society by recognizing the effects of a past scientific discovery, invention, or scientific breakthrough (e.g., DDT, recycling).	The student demonstrates an understanding of how science discoveries and technological innovations affect our lives and society by predicting the possible effects of a recent scientific discovery, invention, or scientific breakthrough.

NGSS STANDARDS FOR SCIENCE

TOPIC	Disciplinary Core Idea	Performance Expectations - Students who demonstrate understanding can:	CLARIFICATION STATEMENT
Life Science	MS-LS2 Ecosystems: Interactions, Energy, and Dynamics	MS-LS2-1: Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.	Emphasis is on cause and effect relationships between resources and growth of individual organisms and the numbers of organisms in ecosystems during periods of abundant and scarce resources.
Life Science	MS-LS2 Ecosystems: Interactions, Energy, and Dynamics	MS-LS2-2: Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.	Emphasis is on predicting consistent patterns of interactions in different ecosystems in terms of the relationships among and between organisms and abiotic components of ecosystems. Examples of types of interactions could include competitive, predatory, and mutually beneficial.
Life Science	MS-LS2 Ecosystems: Interactions, Energy, and Dynamics	MS-LS2-5: Evaluate competing design solutions for maintaining biodiversity and ecosystem services.	Emphasis is on the processes of melting, crystallization, weathering, deformation, and sedimentation, which act together to form minerals and rocks through the cycling of Earth's materials.
Earth and Space Sciences	MS-ESS2 Earth's Systems	MS-ESS2-1: Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process.	Emphasis is on the processes of melting, crystallization, weathering, deformation, and sedimentation, which act together to form minerals and rocks through the cycling of Earth's materials.
Engineering, Technology, and Applications of Science	MS-ETS1 Engineering Design	MS-ETS1-1: Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.	N/A

UNIT 1

The Rotten Truth about Garbage

At a Glance:

This unit begins and ends with students testing their knowledge of America's garbage crisis. **The Rotten Truth about Garbage Pre-test** is followed by watching The Story of Stuff. Next, students complete a **worksheet** while participating in a **class discussion** about the history of garbage. In the **activities section**, students will understand that as the population continues to grow, so does our production of solid waste. After reviewing the **The Rotten Truth about Garbage Pre-test** and considering the alternatives to current garbage disposal methods like reducing, reusing, and recycling, students describe their concluding thoughts about waste management practices in their community. Finally, the unit includes several optional **extension exercises** that can be added for extra credit or additional activities if desired.

Objectives:

Students will be able to:

- learn about how the content and volume of garbage has changed over time and develop opinions about solid waste management
- understand that there is no "away" when garbage is "thrown away"
- draw conclusions that will direct personal choices about consumption and garbage disposal
- use math to gain an understanding that, as our population continues to grow, so does our production of solid waste

Time:

Two 55 minute class periods

Materials provided:

- History of Garbage PowerPoint
  - Located on flash drive included in binder
  - Also located online at: www.iagreenstar.org/curriculum
- History of Garbage Script (pg. 6)
- For Population Increase Class Activity (pg. 10):
  - A metronome

Materials needed:

- Computer, projector and display screen for PowerPoint and vocabulary words
- Internet access to YouTube video
- A calculator for each student
- A photocopy of the following worksheets for each student:
  - The Rotten Truth about Garbage Pre-test (pg. 5)
  - History of Garbage Worksheet (pg. 8)
  - Math Path to 7 Billion Student Worksheet (pgs. 11-12 OR pgs. 13-14)
  - HOMEWORK: All About Garbage (pg. 16)
  - HOMEWORK: Story of Stuff Reflection (pg. 19)

TEACHER SUPPORTING BACKGROUND INFORMATION

You probably throw away garbage every day. With over 329 million people in the United States, that adds up to a lot of garbage![1] When garbage, also known as solid waste or trash, is taken to landfills, it sits for many years—contributing to issues such as greenhouse gas buildup (methane gas, for example, is naturally produced during the decay process of organic matter), and groundwater pollution.[2] That's why it is important for all of us to think of creative ways at home and school to produce less waste. The less garbage we produce, the less garbage ends up in landfills, and that means our planet stays cleaner and healthier. Unit 1 is meant to educate and inspire your students to make a difference by creating less trash in their daily activities.

Fun Facts

- The nutrients lost due to food waste each year in the U.S. are equal to feeding 190 million people for a full year![3]
- We are drowning in plastic waste because 40% of the over 448 million tons of plastic produced every year is disposable - and much of is discarded within minutes after purchase.[4]
- The Great Pacific Garbage Patch is a collection of marine debris in the North Pacific Ocean. The problem with is that it is a huge watery slush of tiny bits of plastic, called microplastic. It is difficult for humans to pick up the microplastic in order to clean it up. However, it is easy for seabirds, fish, and other marine animals to swallow the plastic.[5]

PROCEDURE:

Class One

1. This lesson begins with students testing their knowledge of America's garbage crisis. Hand out copies of The Rotten Truth about Garbage Pre-test (pg. 5) to the class. Have students take the pre-test at the beginning of the lesson, guessing at any answers they don't know. This is for fun, not a grade. After they have filled in their answers, have them keep the pre-test for later. They will review their answers at the end of the unit to see if their answers were correct. Note: Students will need a calculator to answer the math questions. (Estimated time to complete: 10 minutes)

2. Talk through the History of Garbage script (pg. 6) with the PowerPoint and have the students complete the History of Garbage worksheet (pg. 8). The PowerPoint slides are numbered to correspond with the script. The answer key is located on pg. 9. (Estimated time to complete: 20 minutes)

3. Class Activity: Population Increase (see pg. 10 for details). (Estimated time to complete: 30 minutes)

4. Assign Homework: All About Garbage (pg. 16).

Class Two

5. Visual Aid: Watch The Story of Stuff *(see link below)*. This 20-minute video presents a critical vision of consumerist society, primarily in America. After the film, use the Discussion Starters (pg. 17) to begin a class conversation about the film. (Estimated time to complete: 35 minutes)

   - The Story of Stuff: www.youtube.com/watch?v=9GorqroigqM
   - Refer to the following link for additional discussion questions from The Story of Stuff: https://www.scribd.com/document/47591394/Annie-Leonard-Discussion-Guide

6. Assessment: At the end Unit 1, have students review The Rotten Truth about Garbage Pre-test using the answer key (pg. 18). (Estimated time to complete: 10 minutes)

7. Assign Homework: Story of Stuff Reflection (pg. 19). Distribute Student Worksheet to each student. Students will reflect on what they learned from the Story of Stuff video.

8. Optional Extensions (pgs. 20-24).

9. Sources for the material (pgs. 25-26).

Vocabulary Words

GARBAGE/TRASH/SOLID WASTE
Objects that are considered worthless or meaningless.

MODERN LANDFILL
Environmental engineers design landfills to prevent toxins in the garbage from contaminating local soil, water or air. Modern landfills, which include a liner to keep contaminants from leaking into the groundwater, are covered daily to prevent garbage from blowing away and often have methane gas collectors.

OPEN PIT LANDFILL
A disposal site where garbage is discarded in a manner that does not protect the environment, is a source of toxic runoff, and is exposed to the elements and to scavengers.

MUNICIPAL SOLID WASTE
Everyday items that are discarded by a community. The garbage produced by a specific area, such as Fairbanks.

BIODEGRADABLE
Matter that decays and becomes absorbed by the surrounding environment.

DECOMPOSE
To break down or be broken down into simpler parts or substances by sunlight, chemicals, or the action of living things (such as bacteria and fungi). For example, leaves decompose on the forest floor.

GREENHOUSE GAS
Any gas (e.g. methane, carbon dioxide, water vapors) that traps heat in the atmosphere and contributes to global climate change, making the Earth warmer.

INDUSTRIAL REVOLUTION
A period in American (and world) history when factories and machines began to mass produce items, allowing cheaper goods onto the market.

THE "THROWAWAY" SOCIETY
People that 'Take, Make and Waste'. A society that ignores the environmental consequences of mass production of short-lived items.

INDUSTRIALIZED COUNTRIES
Countries characterized by industry on an extensive scale. Industry boosts the economy; thus, industrialized countries are wealthier and larger consumers than non-industrial countries.

Name_____ **Date:**_____

THE ROTTEN TRUTH ABOUT GARBAGE PRE-TEST

Directions: These are questions you may not know. Try your best! You will review your answers to the pre-test at the end of this lesson to see if your answers were correct. You will need a calculator for the math questions.

1. What is garbage?

2. Which country makes the most garbage per person, per day?
   a. Germany b. China
   c. United States d. Mexico

3. Early humans didn't have the garbage problem we face today because:
   a. there were few people b. they were nomadic hunters and gatherers
   c. all their garbage was biodegradable d. all of the above

4. What was introduced during the Industrial Revolution - the era of factories - that increased our garbage load?
   a. cheap, factory-made goods, meaning more stuff to buy and throw away
   b. nomadic lifestyle
   c. biodegradable garbage
   d. modern landfills

5. What features have been added to make modern landfills safer for the environment? You may select more than one answer.
   a. the runoff water is tested for toxins
   b. they are left uncovered so the wind can blow trash around
   c. they are built with a thick lining to keep toxins away from our soils
   d. they are covered or fenced to prevent wildlife from scavenging garbage

6. In the United States, where does most of our garbage end up?
   a. landfills b. rivers
   c. burned d. recycled

7. Which kind of garbage do we make more of than any other?
   a. plastic b. glass
   c. metal d. paper

8. How many plastic bottles do Americans throw away each hour?
   a. 150 b. 3,000
   c. 250,000 d. 2.5 million

9. _____ humans are added to the planet every minute.

10. Each person in the United States generates 4.4 pounds of waste per day. If the population of the US is 329 million (as of September, 2019), how much waste is produced per day? (Show your work)

HISTORY OF GARBAGE SCRIPT

1. Q: What is Garbage?
A: Anything that people no longer have a use for or no longer want. People have always made garbage, also known as waste or trash, but the amounts and types of things thrown away have changed over time.[6]

2. Early humans never had the garbage problem we face today because:
- they lived in small family groups of 30-60 people (representing a lower density of humans than that of our school)
- they were nomadic hunters and gatherers, meaning they had few belongings because they were always moving, and making things was difficult
- their stuff was made from plants and animals, which means their garbage was biodegradable, it quickly rotted away (decomposed), or was eaten by scavengers

3. Garbage did not start to become a widespread problem until people started to live in villages and towns. What happened that allowed humans to stop moving from place to place in search of food? Farming! There now was enough food for people to settle down - and also more time to make stuff. Families could start accumulating stuff – items like toys, dishes, and furniture.

4. As villages grew into cities, garbage built up around homes, but there was no system for dealing with it so garbage was simply thrown into the streets and rivers. Even though there was no consistent system for garbage disposal, people didn't want to live among their garbage. People with wealth and resources could move their trash out of sight. This often resulted in trash accumulating in communities of people with less wealth and power to resist trash being dumped where they lived.[7]

5. Advancements in technology lead to the Industrial Revolution - the era of factories. In America, the Industrial Revolution introduced cheap, factory-made goods as early as the 1850s. People had more stuff to buy. Now that there was too much garbage for it to be left in the streets, it was hauled away for burning or dumped into large pits.[8]

8. As early as the 1950s, Americans became known as a "throwaway society." What invention started this? Plastic! Disposable plastic items such as Ziploc bags, silverware, and bottles became very popular. We were (and still are!) in love with the convenience of single-use items, and manufacturers liked the fact that we used disposable stuff, because they could keep selling us the same stuff over and over again. Today, our waste problem is that we throw away more stuff than we have space for in landfills, and the new stuff is not biodegradable.[9]

6. Advances in technology in the 20th century also led to the production of large quantities of hazardous waste. We discovered some common items in our homes were toxic, such as paint (lead), thermometers (mercury), and household pesticides (DDT). Therefore, when we threw those things away, our garbage was also toxic. In the late 1970s, the negative health impacts of toxic garbage rocked the United States during the Love Canal Disaster. Love Canal, a former chemical dump-turned-suburb in upstate New York, was found to have contaminated groundwater and soil that was linked to illnesses in the local residents. This event woke America up to the fact that toxins can leech from garbage into our drinking water.[10] Around the same time, studies in Houston, Texas found that toxic waste dumps were more likely to be located in communities of people with less wealth and fewer resources to keep industries from depositing toxic waste in their neighborhoods.[11]

7. America started to invest in modern landfills, which were created to protect soil, water, and wildlife. Modern landfills include a thick lining to prevent leakage of toxins into our soils. Runoff water is tested for toxins, and the landfill is covered nightly to keep wildlife from scavenging garbage.[12] Although modern landfills are more effective in keeping the surrounding environment free from toxins, we are still studying the effects of landfills on people. Modern landfills are also expensive to build and many communities cannot afford to do so.

9. We have a garbage crisis. We make twice as much garbage (per person, per day) as most other industrialized countries.[13]

10. Garbage has become a crisis because we don't know how we will safely dispose of it all. Most of our garbage (seven bags out of ten) is buried in landfills. Modern landfills are designed to protect soil and groundwater, but they are still not the best use of land because they store garbage without allowing it to decompose. Some garbage processing facilities incinerate, or burn, trash. Incinerating trash can reduce the volume of stuff to be tossed in a landfill by up to 95%,[14] but this process can also lead to air pollution and health problems. And despite technology advances in waste management, illegal trash dumping is a frequent occurrence.[15]

11. Throwing out garbage, putting it by the curb, taking it to the dump -- try as we might, we can never really make garbage disappear. When we throw garbage "away," it just goes somewhere else, often affecting people or wildlife who do not have the resources or ability to escape it. The important thing to remember is that there is no "away."[16]

12. Luckily, an important part of the solution is something everyone can do. Now, more and more people are using the 3Rs - Reducing, Reusing, and Recycling - to make less garbage and take better care of our planet and our fellow human beings.

13. Using games, experiments, and activities, we will be finding out more about the garbage crisis and how we can all become part of the solution, but first let's talk about Fairbanks' history in regards to its garbage.

14. The city of Fairbanks was founded in 1903. One of their first tasks as a city government when they started to collect tax money was to build infrastructure. The city council decided to designate the Chena River as the city dump site for all residents.

15. Here's a picture of where the first city dump was located. At that time, Fairbanks residents would eagerly await spring temperatures so the rivers would carry away the winter's garbage accumulation.

16. Problems quickly arose without a proper solid waste management system in place. The garbage was starting to slow down boat mobility on the river. In 1904, the city council suggested creating a garbage dumping site "500 yards beyond the city limits and 100 yards back from the river."

17. Despite the law saying residents couldn't throw garbage in the river, they still dumped other things into it. In this picture from the 1940s, you see a pile of coal ash. The other thing being dumped in the river was the city's sewage. This did not cease until the late 1960s.

Name_____ **Date:**_____

HISTORY OF GARBAGE WORKSHEET

1. Write your own definition of garbage: _____

_____.

2. Early humans never had the garbage problem we face today, because _____

_____.

3. Garbage was not a problem until people began to live in _____ and _____.

4. For a long time, garbage was thrown into the _____ and _____.

5. During the Industrial Revolution, Americans were introduced to _____ and could afford to buy more stuff.

6. Rainwater can wash the _____ found in our dumps out into our drinking water.

7. Modern landfills include a thick _____ to prevent the leakage of toxins into our soils.

8. With the invention of _____, America became a "throwaway society."

9. We make _____ as much garbage as most other industrialized countries.

10. Garbage has become a _____ because we don't know how we will safely dispose of it all.

11. Try as we might, we can never really make garbage _____.

12. Name one solution to our garbage crisis: _____

13, Using games, experiments, and activities, we will be finding out more about the garbage crisis, but first let's talk about _____ history in regards to its garbage.

14. The city of Fairbanks was founded in _____.

15. Early Fairbanksans waited for _____ so the river would take away the garbage.

16. In 1904, the city council created a garbage dumping site _____ yards beyond the city limit and _____ yards away from the river.

17. Name two things we still dumped into the Chena River from the 1940s to the 1960s:
_____ and _____.

Name_____ **Date:**_____

HISTORY OF GARBAGE ANSWER KEY

1. Write your own definition of garbage: **Anything that people no longer have a use for or no longer want (or any variation)**

2. Early humans never had the garbage problem we face today, because **they lived in small groups, they were nomadic, and their garbage was biodegradable**. (Any or all of these answers are correct.)

3. Garbage was not a problem until people began to live in **villages** and **towns**.

4. For a long time, garbage was thrown into the **streets** and **rivers**.

5. During the Industrial Revolution, Americans were introduced to **cheap, factory-made goods** and could afford to buy more stuff.

6. Rainwater can wash the **toxins** found in our dumps out into our drinking water.

7. Modern landfills include a thick **lining** to prevent the leakage of toxins into our soils.

8. With the invention of **plastic**, America became a "throwaway society."

9. We make **twice** as much garbage as most other industrialized countries.

10. Garbage has become a **crisis** because we don't know how we will safely dispose of it all.

11. Try as we might, we can never really make garbage **disappear**.

12. Name one solution to our garbage crisis: **reduce, reuse, or recycle**

13. Using games, experiments, and activities, we will be finding out more about the garbage crisis, but first let's talk about **Fairbanks'** history in regards to its garbage.

14. The city of Fairbanks was founded in **1903**.

15. Early Fairbanksans waited for **Spring** so the river would take away the garbage.

16. In 1904, the city council created a garbage dumping site **500** yards beyond the city limit and **100** yards away from the river.

17. Name two things we still dumped into the Chena river from the 1940s to the 1960s: **coal ash** and **the city's sewage**.

Class Activity - Population Increase
Math Path to 7 Billion

OVERVIEW:
In this activity, students will understand that as the population continues to grow, so does our production of solid waste. The need for reduction of waste (through reducing, reusing, and recycling) has never been greater.

OBJECTIVE:
Students will understand math concepts and make the population connection using a metronome.

MATERIALS NEEDED:
- Metronome (provided in kit)
- Student Worksheet - Math Path to 7 Billion (pgs. 11-12 or pgs. 13-14)
- Calculator for each student

PROCEDURE:
1. Distribute the Math Path to 7 Billion Student Worksheet to each student. Depending on the level of experience with conversion, you can provide either **Version A** (pgs. 11-12), which walks students through the process step by step, or **Version B** (pgs. 13-14), which allows them to do conversions without guidance. Give the students time to complete the worksheet.

2. Go over the answers as a class. (Answer Key located on pg. 15).

3. Once they understand the math concepts, make the population connection using a metronome (available in kit) and the script below:

   "This metronome shows how many people are added to the planet each minute. One tick of the metronome indicates one person being added to our world. (*Set the metronome to 148 ticks per minute.*) Currently, we are adding about 148 people per minute, like you calculated on your worksheet. (*Turn off the metronome.*) When Columbus arrived in the Americas in 1492, the world population was relatively stable, growing by about one million people per year, or 2 ticks per minute. As death rates dropped dramatically after the Industrial Revolution, human populations began to grow. By 1940, we were adding 40 people per minute (*Set the metronome to 40, or the slowest setting.*); 88 per minute by 1950 (*Set the metronome to 88 ticks per minute.*); 138 per minute by 1970 (*Set the metronome to 138 ticks per minute.*); and 148 per minute today (*Set the metronome to 148 ticks per minute.*). This seems really fast, but our rate of growth has actually slowed: just 15 years ago, it stood at 176 per minute (*Set the metronome to 176 ticks per minute*). As the population continues to grow so does our production of solid waste. The need for reduction of waste - through reducing, reusing and recycling - has never been greater."[17]

4. To further illustrate the population growth trend, visit the U.S. and World Population Clock: http://www.census.gov/popclock/

Name_____ **Date:**_____

Math Path to 7 Billion
Student Worksheet - Version A

DIRECTIONS

Read through the questions and solve each problem using division.

Question 1.
If the population was growing by 1 million (1,000,000) people per year, as it was in 1492 when Columbus arrived in the Americas, how many people would be added to the planet each minute?

Process (round to the nearest whole number):

a. First, change the number of people/year into the number of people/day by dividing by 365.

$$\frac{\text{1,000,000 people}}{\text{365 days}} = \_\_\_\_\_ \text{ people/day (answer a)}$$

b. Change the number of people added/day into the number of people/hour by dividing by 24 hours.

$$\frac{\text{Answer to (a)}}{\text{24 hours}} = \_\_\_\_\_ \text{ people/hour (answer b)}$$

c. Change the number of people/hour into the number of people/minute by dividing by 60 minutes.

$$\frac{\text{Answer to (b)}}{\text{60 minutes}} = \_\_\_\_\_ \text{ people/minute}$$

ANSWER: _____ people would have been added to the planet each minute.

Question 2.
Using the same process as you used in question 1, answer the following question. If the population is growing by 82 million (82,000,000) people per year, as it is currently, how many people are being added to the planet each minute?

a. First, change the number of people/year into the number of people/day by dividing by 365.

$$\frac{82{,}000{,}000 \text{ people}}{365 \text{ days}} = \_\_\_\_\_ \text{ people/day (answer a)}$$

b. Change the number of people added/day into the number of people/hour by dividing by 24 hours.

$$\frac{\text{Answer to (a)}}{24 \text{ hours}} = \_\_\_\_\_ \text{ people/hour (answer b)}$$

c. Change the number of people/hour into the number of people/minute by dividing by 60 minutes.

$$\frac{\text{Answer to (b)}}{60 \text{ minutes}} = \_\_\_\_\_ \text{ people/minute}$$

ANSWER: _____ people are being added to the planet each minute.

Name_____ **Date:**_____

Math Path to 7 Billion
Student Worksheet - Version B

DIRECTIONS

Read through the questions and solve each problem using division.

Question 1.
If the population was growing by 1 million (1,000,000) people per year, as it was in 1492 when Columbus arrived in the Americas, how many people would be added to the planet each minute?

Procedure: Do the calculations. Show your work.

ANSWER: _____ people would have been added to the planet each minute.

Question 2.
Using the same process as you used in question 1, answer the following question. If the population is growing by 82 million 82,000,000) people per year, as it is currently, how many people are being added to the planet each minute?

Procedure: Do the calculations, rounding to the nearest whole number. Show your work.

ANSWER: _____ people are being added to the planet each minute.

Math Path to 7 Billion
Answer Key

Question 1.

a. First, change the number of people/year into the number of people/day by dividing by 365.

$$\frac{\text{1,000,000 people}}{\text{365 days}} = \text{2,738.72603 people/day (answer a)}$$

b. Change the number of people added/day into the number of people/hour by dividing by 24 hours.

$$\frac{\text{Answer to (a)}}{\text{24 hours}} = \text{114.155251 people/hour (answer b)}$$

c. Change the number of people/hour into the number of people/minute by dividing by 60 minutes.

$$\frac{\text{Answer to (b)}}{\text{60 minutes}} = \text{1.90259 people/minute}$$

Question 2.

a. First, change the number of people/year into the number of people/day by dividing by 365.

$$\frac{\text{82,000,000 people}}{\text{365 days}} = \text{224,657.534 people/day (answer a)}$$

b. Change the number of people added/day into the number of people/hour by dividing by 24 hours.

$$\frac{\text{Answer to (a)}}{\text{24 hours}} = \text{9,360.73059 people/hour (answer b)}$$

c. Change the number of people/hour into the number of people/minute by dividing by 60 minutes.

$$\frac{\text{Answer to (b)}}{\text{60 minutes}} = \text{156.012177 people/minute}$$

Name_____ **Date:**_____

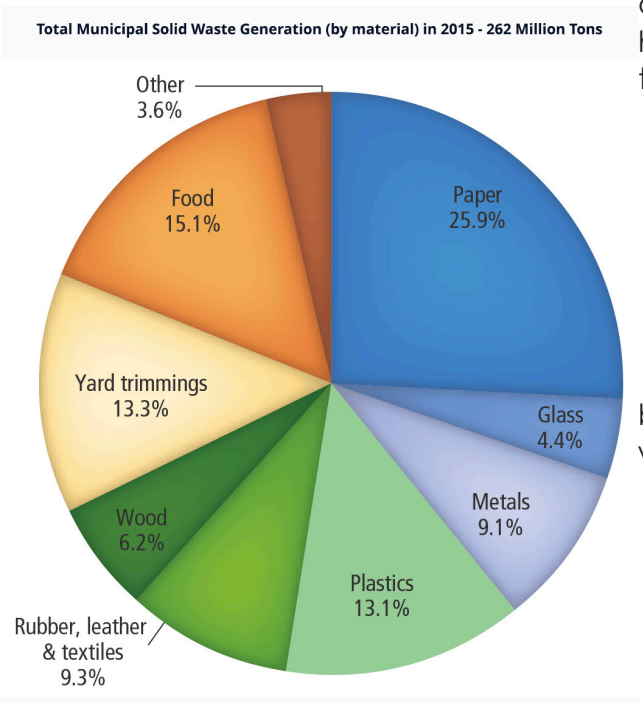
HOMEWORK: All About Garbage!

What do you put in the garbage can every day? Once you toss it, chances are you never want to think about it (or smell it) again. But take a closer look. It's not all gross.

1. The average American generates 4.5 pounds of waste per day. Calculate how many pounds of waste your family would generate in a week.
Formula:
(4.5 pounds x number of people in your family) x 7 = pounds of waste your family would generate in a week
Show your work below:

2. Use your answer to figure out how much waste your family would generate in a year (365 days).
Show your work below:

3. The the following chart is a general overview of what's in America's trash, according to the Environmental Protection Agency (EPA).[18]



a. Does it surprise you to know that most of your school and household waste is likely paper (one of the easiest materials to recycle)?

b. What can your class and/or family do to produce less waste?

VISUAL AID: STORY OF STUFF WITH CLASS DISCUSSION STARTERS

PROCEDURE:

1. The class will watch the following YouTube video
   The Story of Stuff: www.youtube.com/watch?v=9GorqroigqM

2. As students are watching the video, ask them to take notes paying close attention to shocking facts and stats that Annie uses.

3. After watching The Story of Stuff, use one or more of these discussion starters to begin a recycling conversation between your students:

   - Annie says the U.S. has 5% of the world's population but uses 30% of the resources and makes 30% of the waste.[19]
     - Do you agree that this is a problem? (Not everybody does.)
     - How did it come to be this way, and what are some of the steps that we in the U.S. can take to reduce the quantity and impact of our nation's consumption?

   - Annie says "recycling doesn't get to the core of the problem." Why not?

   - Annie says that an important thing missing from the conventional textbook story of the materials economy is people.
     - Who are the people that have the most say in how this system runs?
     - Who are the people that are most affected by the loss of natural resources and pollution?
     - Who are the people that work in the different parts of this system?
     - Where are you in this system?
     - What options do you have, from where you sit, to change the system to support sustainability and justice?

   - Annie says that, in the U.S., most of our leisure time is spent watching TV and shopping.
     - How much of your time per week do you spend watching TV?
     - How much do you spend shopping?
     - How much time (per week) do you spend on a cell phone or other device?
     - When you think about the leisure time activities that bring you the most joy, what are they?
     - Does your leisure time schedule match your priorities?

4. Assign homework found on pg. 19

REVIEW THE ROTTEN TRUTH ABOUT GARBAGE PRE-TEST

Have students review the Rotten Truth about Garbage Pre-test and correct their answers.
Lead a discussion using the following questions:

- What answers on the pre-test did you correct?
- What answers surprised you?
- Why is the garbage crisis important?
- How does it affect our daily lives?
- How do our throw away habits affect the future?

THE ROTTEN TRUTH ABOUT GARBAGE PRE-TEST - ANSWER KEY

1. What is Garbage?
Garbage can be defined as anything that people no longer have a use for or no longer want. People have always made garbage, but the amounts and kinds of things thrown away have changed over time. Garbage is also known as "municipal solid waste" or trash.[20]

2. Which country makes the most garbage per person, per day?
C. United States [21]
(Note: Americans generate about 4.5 pounds per person per day!)[22]

3. Early humans didn't have the garbage problem we face today because:
d. all of the above[23]

4. What was introduced during the Industrial Revolution - the era of factories - that increased our garbage load?
a. Cheap, factory-made goods[24]

5. What features have been added to make modern landfills safer for the environment?
a. the runoff water is tested for toxins
c. they are built with a thick lining to keep toxins away from our soils
d. they are covered or fenced to prevent wildlife from scavenging garbage[25]

6. In the United States, where does most of our garbage end up?
a. landfills[26]

7. Which kind of garbage do we make more of than any other?
d. paper
(Note: Paper makes up 27 percent of municipal solid waste (MSW), more than any other material Americans throw away. Because of this, recycling paper can greatly reduce the overall amount of MSW produced. A good amount of this paper comes from packaging.)[27]

8. How many plastic bottles do Americans throw away each hour?
d. 2.5 million[28]

9. **148** humans are added to the planet every minute.[29]

10. Each person in the United States generates about 4.5 pounds of waste per day. If the population of the US is 329 million (as of September, 2019), how much waste is produced per day? (Show your work)
329 million x 4.5 pounds = 1,480,500,000 pounds of waste produced per day

Name_____ **Date:**_____

HOMEWORK: Story of Stuff Reflection

Many facts in the film The Story of Stuff may have surprised you. Select one (or more) of the facts below. Reflect on the fact(s) you selected and write a half page on the subject. Be sure to include why you selected the fact(s) and what you found interesting about them. Be sure to use correct punctuation and grammar.

Assignment due: _____

- We see more advertisements in **one year** than a person 50 years ago saw in a **lifetime**.
- Each person in the United States creates an average of **4 1/2 pounds of garbage a day**. That is twice what we made thirty years ago.
- Even if we could recycle 100% of the waste coming out of our homes, it doesn't get to the core of the problem.
- **70 garbage cans' worth of junk** were created to make just one can of garbage you throw out.
- Human happiness **peaked in the 1950s** at the same time consumption mania exploded and **has been dropping ever since**.

EXTENSIONS FOR UNIT 1

Extension 1

Week-long Garbage Audit

How Much Garbage Do You Make In a Week?

BACKGROUND INFORMATION:

Over a one week period, each student will monitor the garbage their family produces. At the end of one week, the student will write a report about the week's garbage audit and determine garbage reduction strategies. This activity could also be adapted for classrooms.

KEY CONCEPT:

Over-packaging, disposable products, uneaten food, and reusing or recycling can all contribute to a family's weekly garbage generation. Little things such as using durable goods like cloth dish towels rather than paper towels, recycling aluminum cans, or composting food scraps can greatly reduce the amount of garbage that is landfill bound and can become part of a daily routine. All family members will take responsibility by saving their garbage, analyzing it, and developing ideas on how they can make less waste and become more environmentally conscious consumers..

OBJECTIVES:

After completing the garbage audit, families will be able to:

- identify components of their weekly "garbage"
- recognize that everyone makes garbage and that it adds up over time
- determine alternatives to sending waste to the landfill
- recognize that a little effort adds up to a big reduction in the amount of garbage made
- implement waste reduction techniques in their homes and/or classrooms

MATERIALS NEEDED:

- bathroom scale
- one large plastic garbage can with a tight fitting lid for collecting food, contaminated paper, and garbage
- one large garbage can for all the dry garbage
- one small plastic bag for each student or family member
- gloves for one adult

PROCEDURE:

1. Have all family members make a prediction about how much garbage they make in a week.
2. All family members need to be briefed on the rules of the week-long garbage collection. Everything that would normally be thrown away is saved and taken home. This includes any food that may normally be put in sink garbage disposals.
   ** *Kleenex and toilet paper should not be collected because of sanitary reasons.*
3. Each family member will carry a small plastic bag to save his or her garbage when away from home.
4. At the end of each day, family members will empty their individual bags into either the dry garbage can or food garbage (wet) garbage can.
5. After one week, have one family member stand on the bathroom scale and record his or her weight. Next have the same person stand on the scale holding the dry garbage can. Record the weight. Subtract the person's initial weight from their weight while holding the can to get the amount of dry garbage your family or classroom made in one week.
6. Repeat the process with the wet garbage can. Record the weight of the wet garbage for one week.

Extension 1 (continued)

Week-long Garbage Audit

How Much Garbage Do You Make In a Week?

7. Add the dry garbage and the wet garbage weights together. This is the total amount of garbage made in one week by your family.
8. Smell the two cans. How do they smell? Is one particularly smelly? Which one? Why?
9. Have an adult family member use gloves to sort through the dry garbage. Are there things that should not have been bought in the first place (for example, items with excess packaging or disposable items)? What alternatives are there to using these products? How much of a difference would it have made to the amount of garbage your family generated if these products had not been used?
10. Are there things that could be reused? Remove those things and decide how you will reuse them. Re-weigh the dry garbage can. What's the difference?
11. Following the rules of your community's recycling program, have the adult take out all the recyclables (for example, glass, aluminum and steel cans, plastic bottles #1 & #2, paper, cardboard). Now re-weigh the dry garbage can. What is the difference in weight?
12. Compare the original weight of the dry garbage can with the weight after removing items to be reused or recycled. How much of a difference did this make?
13. Take a look at the wet garbage. How much of it is vegetable or fruit garbage? How much garbage could be prevented if you composted?

To learn more about composting, visit www.iagreenstar.org/recycling-food-waste

Extension 2

Tour your community's Municipal Solid Waste Facility

BACKGROUND INFORMATION:

This activity helps students to develop an understanding of municipal solid waste management, its importance, and the role it plays in their community.

OBJECTIVES:

The student will do the following:

- define waste and leachate
- describe a sanitary landfill in terms of its construction and function
- perform math problems to visualize distance

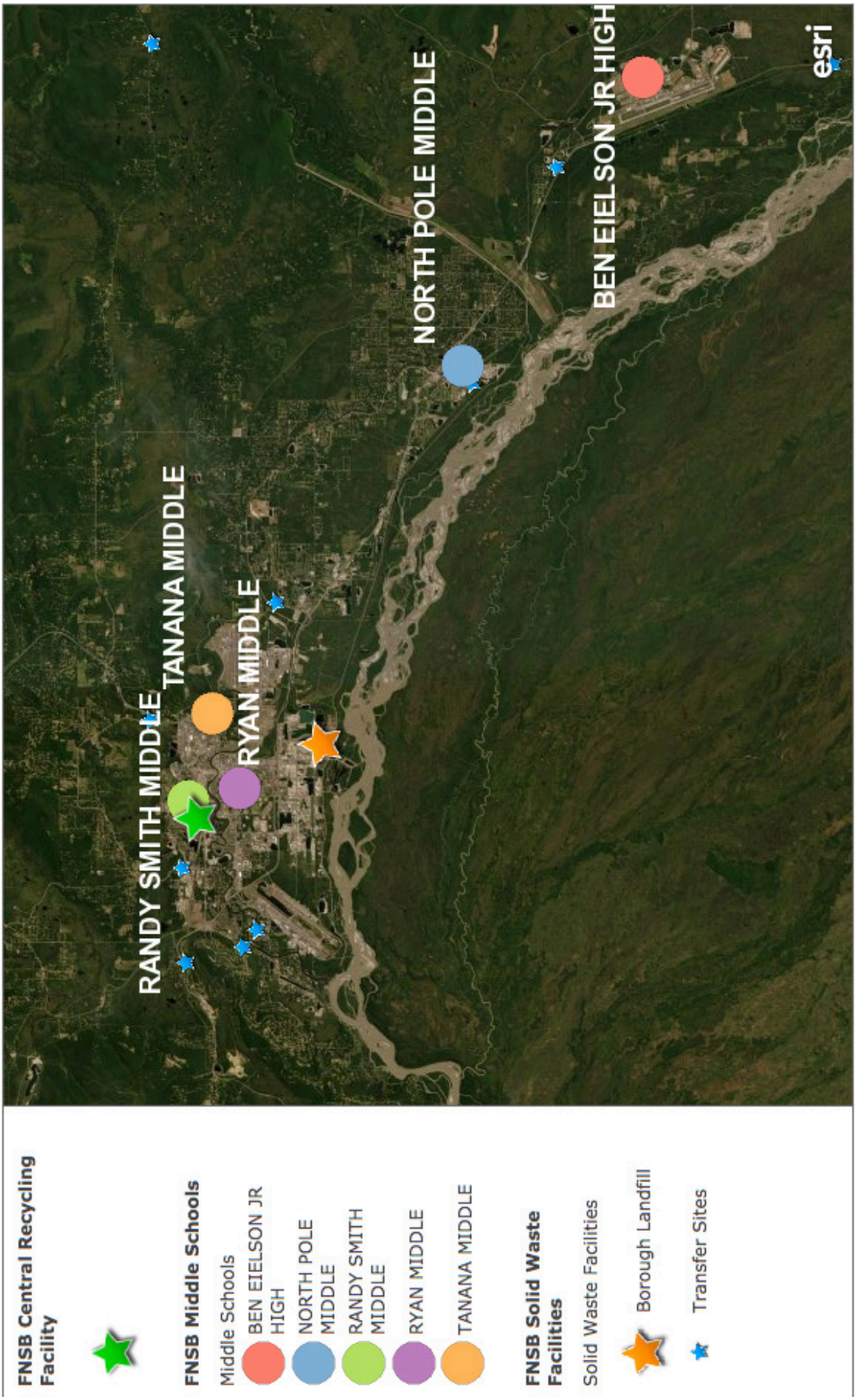
MATERIALS NEEDED:

- internet access to research the location of your community's Municipal Solid Waste Facility
- map of your community (a physical printout or projected image)
- school bus for class trip

PROCEDURE:

1. Find out where the Municipal Solid Waste Facility (or Landfill) is in your community.
2. Have students find the facility on a map, and then map the distance between the school and the facility. What is the route that the school garbage would take to get to the landfill?
3. Time permitting, visit the waste processing facility on a class trip. Ask students to take notes about what they find out.

Fairbanks' modern covered landfill. Photo Credit: Pam Seiser.


FNSB Central Recycling Facility
FNSB Middle Schools
Middle Schools
BEN EIELSON JR HIGH
NORTH POLE MIDDLE
RANDY SMITH MIDDLE
RYAN MIDDLE
TANANA MIDDLE
FNSB Solid Waste Facilities
Solid Waste Facilities
Borough Landfill
Transfer Sites
RANDY SMITH MIDDLE
TANANA MIDDLE
RYAN MIDDLE
NORTH POLE MIDDLE
BEN EIELSON JR HIGH
esri

Extension 3

Interview an adult in your household

BACKGROUND INFORMATION:

Students talk to older family members about garbage and recycling memories to discover how our attitudes and actions regarding garbage, recycling, and waste reduction have changed across generations.

OBJECTIVES:

Students will:

- understand that lifestyles change over time
- practice communication skills by interviewing family members about garbage
- analyze how our cultural attitude about garbage has changed over time

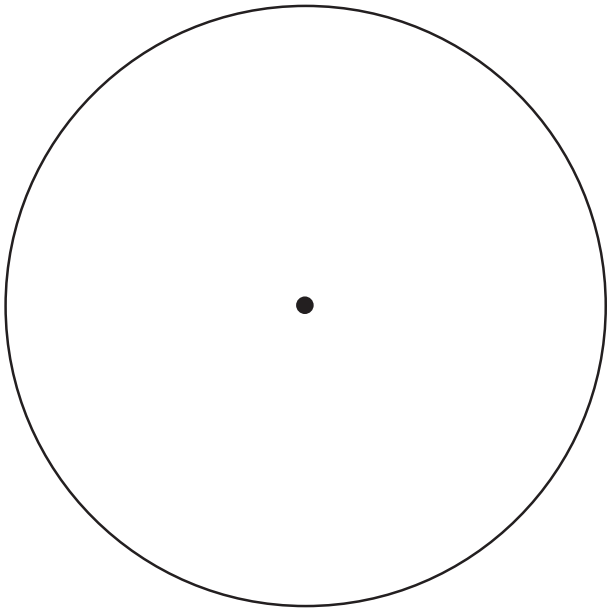
MATERIALS NEEDED:

- paper and pencil

PROCEDURE:

1. Student will ask the interviewee the following question:
   Approximately what percent of our household garbage today is:
   paper?
   yard trimmings?
   metals?
   plastic?
   glass?
   food waste?
   other (please list)?

   The total should add up to 100 percent. Once complete, create a pie graph using the estimated percentages your interviewee came up with. Include a key that lists the waste type and the color or pattern that is shaded in the chart.



2. Show interviewee the chart below depicting a general overview of what's in America's trash, according to the EPA.

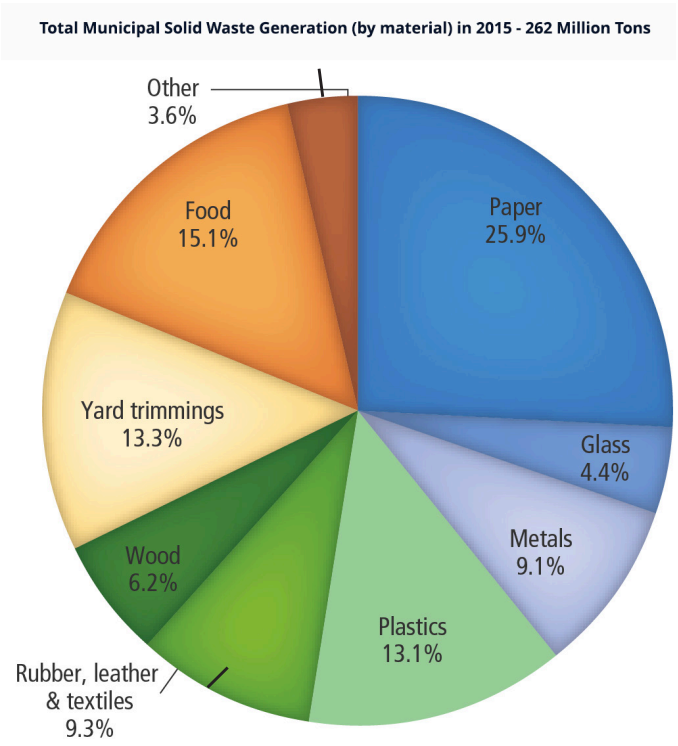
   Compare the pie graph you created with the percentages in the chart below.

3. Ask your interviewee the following questions:

   Does it surprise you to know that most of your household garbage is likely paper (one of the easiest materials to recycle)?

   What can your family do to make less garbage?

4. Looking Back…
   Ask the interviewee to remember what they considered trash during their youth (i.e., what was thrown out), how that trash was disposed of, where it was disposed of, and how all of these characteristics compare with today's ideas about trash and methods for handling trash.



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ROTTEN TRUTH ABOUT GARBAGE PRE-TEST

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UNIT 2

Introduction to the 3Rs

At a Glance:

This unit begins and ends with students testing their knowledge of the 3Rs (reduce, reuse, and recycle). The **Introduction to the 3Rs Pre-test** is followed by watching a short video that emphasizes the importance of Reduce, Reuse, and Recycle. Next, students complete a **worksheet** while participating in a **class discussion** about the 3Rs. In the **activities section**, students rotate through stations representing a shopping trip, allowing them to practice buying products that use fewer of the earth's resources and create less trash or pollution. After reviewing the **Introduction to the 3Rs Pre-test**, students will see that each of us can make a lasting impact by taking simple steps in our community.

Objectives:

Students will be able to:

- understand how reducing and reusing are more effective methods of garbage reduction than recycling
- understand how recycling is more environmentally-friendly than landfilling
- know what a natural resource is and categorize renewable vs. non-renewable resources
- conclude that when we reduce, reuse, and recycle, we save resources

Time:

Two 55 minute class periods

Materials provided:

- Introduction to the 3Rs PowerPoint
  - Located on flash drive included in binder
  - Also located online at: www.iagreenstar.org/curriculum
- Introduction to the 3Rs Script (pg. 33)
- For 3Rs Shopping Trip Class Activity:

- Station 1: tin lunch box, plastic grocery bag
- Station 2: recycled paper, non-recycled paper
- Station 3: new shirt with tags, used hand-me-down shirt
- Station 4: Capri Sun juice pouch (non-recyclable), plastic juice bottle
- Station 5: Styrofoam cup, compostable cup, dictionary
- Station 6: cup of soup, soup can
- Station 7: large sugar bag, individual sugar packets

Materials needed:

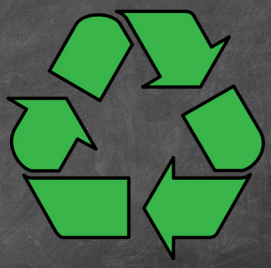
- Computer, projector and display screen for PowerPoint, vocabulary words, and seven principles of reducing waste (3Rs Shopping Trip Class Activity)
- Internet access to YouTube video
- A calculator for each student
- A photocopy of the following worksheets for each student:
  - Introduction to the 3Rs Pre-test (pg. 31)
  - Introduction to the 3Rs Worksheet (pg. 34)
  - HOMEWORK: Resource Matching (pg. 36)
  - 3Rs Shopping Trip Worksheet (pgs. 39-40)

TEACHER SUPPORTING BACKGROUND INFORMATION

Reducing, reusing, and recycling products is the key to sustainability. By introducing the 3Rs to your class, this unit will empower your students to take action. Many items present in household waste are recyclable provided that residents take the initiative to recycle and have a convenient location to take the recycled materials. The state of Alaska has historically been starved for recycling options, but many new recycling programs are springing up across the state. To ensure the sustainability of such programs, it is crucial to introduce your community's recycling scene to your classroom!

The symbol for recycling!

There are three arrows that show a loop is occurring, the first arrow represents the collection of materials that can be recycled. The second arrow represents the stage of recycling where collected materials are remanufactured into new products. The final arrow that closes the loop represents buying products that are recycled.[1]



Fun Facts

- Plastic is not one material but a family of related materials with varying properties based on the type of polymer that was used to make it. Some example of these properties include: flexibility, heat resistance, and whether or not it is gas permeable. The number on the bottom of a plastic container indicates the polymer (resin) type. We take care to separate plastic based on these numbers so manufacturers can ensure they have the right material for the right applications. For example, #5 plastic is heat resistant and can be used in a microwave, while #1 plastic would melt.[2]

- Recycling paper reduces greenhouse gas production. In 2015, the U.S. recycled 14 million tons of paper, which is equal to taking 31 million cars off the road for a year![3]

- Infinitely recyclable and highly durable, nearly 75 percent of all aluminum ever produced is still in use today. Aluminum is 100 percent recyclable and retains its properties indefinitely. Despite all this, Americans throw away nearly $1 billion of aluminum cans every year.[4]

- Recycling and composting kept almost 35% of the waste out of the landfill in 2015.[3]

PROCEDURE:

Class One

1. This lesson begins with students testing their knowledge of the 3Rs. Hand out copies of the Introduction to the 3Rs Pre-test (pg. 31) to the class. Have students take the pre-test at the beginning of the lesson, guessing at any answers they don't know. This is for fun, not a grade. After they have filled in their answers, have them keep the pre-test for later. They will review their answers at the end of the unit to see if their answers were correct. (Estimated time to complete: 10 minutes)

2. Visual Aid: Watch The Three Rs video *(link found below)*. This four-minute video emphasizes the importance of Reducing, Reusing, and Recycling using Jack Johnson's lyrics. After the video, use the Discussion Starters (pg. 32) to begin a class conversation about the film. (Estimated time to complete: 10 minutes)
   - The Three Rs: https://www.youtube.com/watch?v=wtoeZ9Nkeqk

3. Talk through the Introduction to the 3Rs script (pg. 33), with the PowerPoint and have the students complete the Introduction to the 3Rs Worksheet (pg. 34). The PowerPoint slides are numbered to correspond with the script. The answer key is located on page 35. (Estimated time to complete: 25 minutes)

4. Assign Homework: Resource Matching (pg. 36). Distribute Student Worksheet to each student. Prepare to discuss the homework at the beginning of Class Two. Students will learn the importance of saving resources by matching some common items to the resource from which each is made. They will also classify resources as renewable or non-renewable.

Class Two

5. Review the answers to the Resource Matching homework assignment from Class One. The answer key is found on page 37. (Estimated time to complete: 10 minutes)

6. Class Activity: 3Rs Shopping Trip (see pg. 38 for details). (Estimated time to complete: 35 minutes)

7. Assessment: At the end of Unit 2, have students review the Introduction to the 3Rs Pre-test, using the answer key (pg. 43). Lead a discussion using the questions. (Estimated time to complete: 15 minutes)

8. Optional Extensions (pgs. 44-50).

9. Sources for the material (pgs. 51-52).

Vocabulary Words

REDUCE
Decreasing the use of something.

REUSE
To use again or more than once.

RECYCLE
To make something new from something that has been used before.

ECONOMY
The process or system by which goods and services are produced, sold, and bought in a country or region.

ECONOMICS
The science that deals with the production, allocation, and use of goods and services.

SUPPLY AND DEMAND
Supply is how much of something is available. *Demand* is how much of something people want. The relationship between supply and demand results in many decisions such as the price of an item and how much of the item will be produced.

REMANUFACTURE
To manufacture material a second time into a new product.

CONSUMPTION
The utilization of economic goods in the satisfaction of wants.

NATURAL RESOURCE
Something that is taken from the earth and is often manufactured into the things we use.

RENEWABLE RESOURCES
Natural resources which can replenish to overcome usage and consumption (like wood).

NON-RENEWABLE RESOURCES
Natural resources that once they are used up, they cannot be replenished—at least not in our lifetime. These include fossil fuels, such as oil, natural gas, and coal.

HAZARDOUS MATERIALS
Any item or agent (biological, chemical, radiological, and/or physical), which has the potential to cause harm to humans, animals, or the environment.

SUSTAINABILITY
The idea that we must maintain the world we live in. We must act responsibly so that the resources on the planet will be able to support many generations to come. Reducing, reusing, and recycling our natural resources are the keys to sustainability.

Name_____ **Date:**_____

INTRODUCTION TO THE 3RS PRE-TEST

Directions: These are questions you may not know. Try your best! You will review your answers to the pre-test at the end of the lesson to see if your answers were correct.

1. Reducing, reusing, and recycling products made from natural resources is the key to sustainability.
   Define natural resource:

2. Define and give examples of renewable and non-renewable resources.
   Renewable Resources:

   Non-renewable Resources:

3. List three ways you can reduce waste:

4. Where can you take your unwanted or used items (clean and in good condition) — such as clothing, household items, books, and more — to be reused in your community?

5. Define recycle:

6. What does this symbol  stand for?

7. Which of these does recycling do?
   a. helps to conserve energy and natural resources
   b. contributes to the economy
   c. reduces the amount of waste requiring disposal
   d. all of the above

8. True or False: Recycling is always the first step you should take to reduce waste.

VISUAL AID: THE 3RS MUSIC VIDEO WITH CLASS DISCUSSION STARTERS

PROCEDURE:

1. The class will watch the following YouTube video:
   The Three Rs: Reduce, Reuse, Recycle: www.youtube.com/watch?v=wtoeZ9Nkeqk
2. As students are watching the video, ask them to take notes, paying close attention to the examples Mr. Johnson uses for each "R": reduce, reuse, and recycle.
3. The class will watch the video a second time, this time paying close attention to what it means to reduce, reuse, and recycle. Pause the video after each section and ask the students to review their notes and add or edit if necessary.
4. Once your class has finished watching the video, write the words "Reduce," "Reuse," and "Recycle" across the board. Then ask the students what they think it means to do each and write their answer under the appropriate section.
5. Once the students have shared all their ideas, the class will work together to come up with a working definition for reduce, reuse, and recycle and give examples of each.

"The 3 R's"

Three it's a magic number
Yes it is, it's a magic number
Because two times three is six
And three times six is eighteen
And the eighteenth letter in the alphabet is R
We've got three R's we're going to talk about today
We've got to learn to
Reduce, Reuse, Recycle
Reduce, Reuse, Recycle
Reduce, Reuse, Recycle
Reduce, Reuse, Recycle
If you're going to the market to buy some juice
You've got to bring your own bags and you learn to reduce your waste
And if your brother or your sister's got some cool clothes
You could try them on before you buy some more of those
Reuse, we've got to learn to reuse
And if the first two R's don't work out
And if you've got to make some trash
Don't throw it out
Recycle, we've got to learn to recycle,
We've got to learn to
Reduce, Reuse, Recycle
Reduce, Reuse, Recycle
Reduce, Reuse, Recycle
Reduce, Reuse, Recycle
Because three it's a magic number
Yes it is, it's a magic number
3, 3, 3
3, 6, 9, 12, 15, 18, 21, 24, 27, 30, 33, 36
33, 30, 27, 24, 21, 18, 15, 12, 9, 6, and
3, it's a magic number

INTRODUCTION TO THE 3RS SCRIPT

1. The 3Rs that we are going to cover are Reduce, Reuse and Recycle. Do you know the meaning of the term "recycle"?
Recycle: to make something new from something that has been used before.[5]

2. Is recycling the first or last thing we should do to reduce waste?
Recycling is not the first step we should take, it should be the last. Step one is to reduce your consumption. Step two is to reuse as much as possible. Step three is to recycle anything that is left.[6]

3. Reducing, reusing, and recycling products made from natural resources is the key to sustainability. What is a natural resource?
A natural resource is something that is taken from the earth and turned into the things we use.[7]

4. What is the difference between a renewable resource and a non-renewable resource? List examples of each.
Renewable resource: A natural resource which can replenish to overcome usage and consumption, if it is managed wisely.
- Examples of renewable resources: Trees and Fish
Non-renewable resource: Natural resources that once they are used up, cannot be replenished—at least not in our lifetime.
- Examples of non-renewable resources: Most fossil fuels, such as oil, natural gas, and coal[8]
Hold up various items around the classroom and challenge students to identify what resource was used to make that item (i.e. paper was made from a tree = renewable resource, plastic bottle was made from oil = non-renewable resource, etc.)

5. What are the benefits of reducing our consumption and reusing what we have?
- Saves money! You don't spend your money on a bunch of new stuff you probably don't need.
- Helps preserve potentially fragile ecosystems by reducing the need to extract raw materials from them.
- Saves both nonrenewable and renewable resources, like water! Lots of water goes into making almost everything we consume.
- Reducing the amount of stuff we buy and reusing what we already own means we throw away less! This means we don't use as much energy and resources to recycle and we don't fill up our landfills as quickly.[9]

Ask your class to come up with ways they can reuse in their daily lives. Example: A lunch meat container reused to store leftovers in the refrigerator.

6. Where are some places in your community that take used items to be reused?
The following are some examples for Fairbanks:
- Value Village and Fairbanks Resource Agency Closet Collections accept used clothing, accessories, and some household goods.
- The Literacy Council of Alaska accepts used books.
- Play It Again Sports accepts sport equipment.
- Fairbanks Community Food Bank, Fairbanks Rescue Mission and Stone Soup Cafe accept food donations.[10]

Ask your class if they have ever donated used items before. If so, where?

7. What are some benefits of recycling?
- Saves water, energy, and natural resources
- Reduces the need for more landfills
- Creates jobs in the recycling and manufacturing industries
- Promotes an awareness of the finiteness of our natural resources and offers an environmentally acceptable method of waste management[11]

Name_____ **Date:**_____

INTRODUCTION TO THE 3RS WORKSHEET

1. The three Rs that we are going to cover are _____, _____ and _____.

2. Is recycling the first or last step we should take to reduce waste?

3. Reducing, reusing, and recycling products made from natural resources is the key to sustainability. **What is a natural resource?**

4. What is the difference between a renewable resource and a non-renewable resource? **List examples of each.**

   Renewable resource:

   Non-renewable resource:

5. List two benefits of reducing our consumption and reusing what we have.

   1.

   2.

6. Where are some places in your community that accept used items for reuse?

7. List two benefits of recycling.

   1.

   2.

INTRODUCTION TO THE 3RS WORKSHEET ANSWER KEY

1. The three Rs that we are going to cover are **Reduce**, **Reuse,** and **Recycle**.

2. Is recycling the first or last step we should take to reduce waste? **Last**

3. Reducing, reusing and recycling products made from natural resources is the key to sustainability. What are natural resources? **Natural resources come from the environment around us. A Natural Resource is taken from the earth and is often turned into the different things we use.**

4. What is the difference between a renewable resource and a non-renewable resource? List examples of each.
   Renewable resource: **A natural resource which can replenish to overcome usage and consumption. Example: Trees and Fish**
   Non-renewable resource: **A natural resource that cannot be readily replaced by natural means on a level equal to its consumption.**
   Example: Most fossil fuels, such as oil, natural gas, and coal

5. List two benefits of reducing our consumption and reusing what we have. Answers will vary, see examples below:
   - Saves money! You don't spend your money on a bunch of new stuff you probably don't need.
   - Helps preserve potentially fragile ecosystems by reducing the need to extract raw materials from them.
   - Saves both nonrenewable and renewable resources, like water! Lots of water goes into making almost everything we consume.
   - Reducing the amount of stuff we buy and reusing what we already own means we throw away less! This means we don't use as much energy and resources to recycle and we don't fill up our landfills as quickly.

6. Where are some places in your community that accept used items for reuse?
   - Used clothing, accessories and household goods: **Value Village and Fairbanks Resource Agency Closet Collections**
   - Used books: **The Literacy Council of Alaska**
   - Food donations: **Fairbanks Community Food Bank, Fairbanks Rescue Mission and Stone Soup Cafe**
   - Sports equipment: **Play It Again Sports**

7. List two benefits of recycling. Answers will vary, see examples below:
   - Saves water, energy, and natural resources
   - Reduces the need for more landfills
   - Creates jobs in the recycling and manufacturing industries
   - Promotes an awareness of the finiteness of our natural resources and offers an environmentally acceptable method of waste management

Name_____ **Date:**_____

HOMEWORK: Resource Matching

Each of the items below are made from a natural resource – something that is taken from the earth and turned into the things we use. Each of these items can also be recycled. When we recycle, not only do we make less trash, we also save our natural resources. If we recycle, fewer trees will need to be cut down, less land will need to be mined, and less oil will need to be extracted.

Directions:
Draw lines to match which resource the materials are made from.

eggs/milk	sand
glass jar	trees
plastic	animals
cardboard/paper	oil
aluminum can	bauxite ore

Now, of the resources listed, which ones are renewable and which resources are non-renewable?

Remember, a renewable resource is a natural resource which can replenish to overcome usage and consumption. A non-renewable resource is a natural resource that cannot be readily replaced by natural means on a level equal to its consumption.

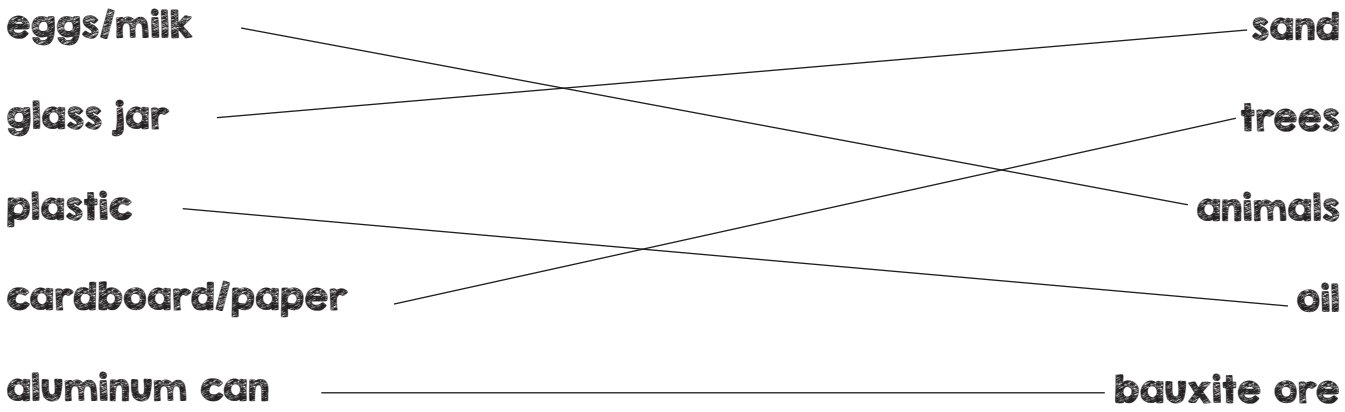
Renewable **Non-renewable**

Name_____ **Date:**_____

HOMEWORK ANSWER KEY: Resource Matching

Each of the items below are made from a natural resource – something that is taken from the earth and turned into the things we use. Each of these items can also be recycled. When we recycle, not only do we make less trash, we also save our natural resources. If we recycle, fewer trees will need to be cut down, less land will need to be mined, and less oil will need to be extracted.

Directions
Draw lines to match which resource the materials are made from.



Now, of the resources listed, which ones are renewable and which resources are non-renewable?

Remember, a renewable resource is a natural resource which can replenish to overcome usage and consumption. A non-renewable resource is a natural resource that cannot be readily replaced by natural means on a level equal to its consumption.

Renewable

animals

trees

Non-renewable

sand

oil

bauxite ore

Class Activity - 3Rs Shopping Trip

OVERVIEW:

Students rotate through stations representing a shopping trip, allowing them to practice buying products that use fewer of the earth's resources and create less waste.

OBJECTIVE:

As students rotate through stations in small groups answering questions relating to principles of reducing waste, they will begin to identify how their consumer choices affect the environment.

MATERIALS:

- Station 1: tin lunch box, plastic grocery bag
- Station 2: recycled paper, non-recycled paper
- Station 3: new shirt with tags, used "hand-me-down" shirt
- Station 4: Capri Sun juice pouch, plastic juice bottle
- Station 5: Styrofoam cup, compostable cup, dictionary
- Station 6: cup of soup, soup can
- Station 7: large sugar bag, individual sugar packets

SEVEN PRINCIPLES OF REDUCING WASTE

1. Avoid disposables. Buy and use things that last and are reusable.
2. Buy products made from recycled materials.
3. Reuse items instead of throwing them away.
4. Look for products in containers that can be recycled in your community.
5. Look for products that use the least amount of hazardous materials.
6. Avoid products with unnecessary packaging.
7. Buy in bulk, or large quantities, to reduce packaging.

PROCEDURE:

1. Set up 7 stations using the materials listed above.

2. Review the following Seven Principles of Reducing Waste with the students (see flash drive for image file).

3. Pass out the 3Rs Shopping Worksheets and have students rotate through the stations in teams. Each station focuses on one of the seven principles of reducing waste. Encourage group discussion. Allow four minutes per station.

4. After students have visited all of the stations, discuss their choices as a class. Are there any changes that they would be willing or able to make in the things they personally buy or use?

Name_____ **Date:**_____

3Rs Shopping Trip Worksheet

DIRECTIONS

We have discussed the Seven Principles of Reducing Waste. Now, with the seven principles in mind, go to each station and answer the questions for that station.

STATION 1 – Durable versus disposable items

If you brought your lunch to school every day in a new plastic grocery bag, how many bags would you use in a school year (Hint: there are typically 36 weeks in a school year)? Show your work.

The tin lunch box is reusable. Why is this a good choice?

STATION 2 – Products made from recycled materials

Which product is made from recycled materials? How do you know?

Which product would you encourage your school to buy?

STATION 3 – Items that are reusable

What is the advantage of wearing used clothes instead of buying brand new clothes?

List some of the earth's resources you save by donating your clean, gently used clothes to a second-hand store for reuse.

STATION 4 – Products that are sold in recyclable containers

Do opportunities for plastic recycling exist in your community? Yes _____ No _____ I don't know _____

Do you save plastic for recycling? Yes _____ No _____

The Capri Sun juice pouch is hard to recycle. With this in mind, which juice container would you encourage your school to buy and why?

STATION 5 – Products that are less toxic

What characteristics of Styrofoam make it dangerous to wildlife?

What does "compostable" mean (you can use a dictionary)?

How can your school avoid using plastic and Styrofoam?

STATION 6 – Products with minimal packaging

Which product would you choose and why? Consider your health, the environment, ease of use, convenience of product, etc.

STATION 7 – Products that are sold in bulk

Which type of package shows buying in bulk?

How does this type of package reduce waste?

What natural resource is saved?

Answer Key: 3Rs Shopping Trip

Station 1 – Durable versus disposable items

If you brought your lunch to school every day in a new plastic grocery bag, how many bags would you use in a school year (Hint: there are typically 36 weeks in a school year)? Show your work.
Equation: 36 weeks x 5 days per week = 180 days
Answer: **180 plastic bags would be used just for lunch by the end of the year.**

The tin lunch box is reusable. Why is this a good choice?
Answers will vary. Possible answers include:
- Using the tin lunch box reduces waste by avoiding disposable containers.
- Durable items are easier to use (they do not break down as fast as single use disposable items).
- Tin lunch boxes are customizable (meaning students can pick a design they like that represents them).

Station 2 – Products made from recycled material

Which product is made from recycled material? How do you know?
Answer: **Choice A - recycled paper**
Note: The plastic packaging holding together the two different reams of paper have information printed on them. Students will read the packaging to see which product is made from recycled material.

Which product would you encourage your school to buy?
Answers will vary.

Note: Students should understand that buying recycled material products reduces waste and saves energy compared to buying new products, but recycled products can be more expensive than new products because it's often cheaper for companies to harvest new material than it is to pay for the recycling process. However, recycled materials might become cheaper if more people choose to buy recycled materials instead of new ones.

Station 3 – Items that are reusable

What is the advantage of buying and wearing used clothes instead of buying brand new clothes?
Answers will vary. Buying and wearing used clothes:
- Saves money; thrift stores are usually cheaper than department stores, and clothing swaps are free!
- Provides an opportunity to find unique clothing and styles
- Extends the life of clothes that might otherwise go to the landfill
- Uses fewer resources - clothing takes an intensive amount of water and energy to manufacture

List some of the earth's resources you save by buying or donating used clothes in good condition.
Answers will vary. Possible answers include:
- Oil, natural gas, and other nonrenewable resources - if clothing is made from plastic (i.e. Polar Fleece, polyester, Spandex).[20]
- Water - clothing production uses huge amounts of water (i.e. one pair of jeans takes 2,000 gallons to make!)[21]
- People - garment workers are among the most underpaid and exploited workers in the world[22]
- Animals - if clothing is made from leather, wool, or fur
- Plants - if clothing is made from cotton or rayon

Note: As an extension, your class can discover what their clothes are made of. Ask each student to choose a partner, and taking turns, read the labels in one another's clothing. They may find plastics such as Polyester, Acrylic, and Nylon are materials that are used in clothes. Other examples include Kevlar, Spandex, and Gore-Tex.

Station 4 – Products that are sold in recyclable containers

Do opportunities for plastic recycling exist in your community? **Answers will vary.**

Do you save plastic for recycling? **Answers will vary.**

The Capri Sun juice pouch is hard-to-recycle. With this in mind, which juice container would you encourage your school to buy and why?
Answers will vary. Possible answers include:
- The plastic juice bottle because it is easier to recycle; our class could start a recycling collection program to reduce waste.
- The plastic juice bottle because the Capri Sun container is designed to be used one and thrown away, requiring a constant input of new resources to make new pouches.
- We could not buy individual juices and invest in filtered water fountains for the school instead.

Note: Explain to your students that Capri Sun pouches are made by putting layers of aluminum and plastic together, making them very difficult to recycle. It is estimated that 1.4 billion Capri Sun pouches are disposed of each year in the United States. Stacked end to end, that's enough pouches to wrap around the Earth almost five times (121,527 miles) – or reach nearly halfway to the moon.[23]

Station 5 – Products that are less toxic

What characteristics of Styrofoam make it dangerous to marine wildlife?
Answer: **Styrofoam finds it way to the marine wildlife because it is lightweight. It floats and is easily blown or washed into waterways, where it is carried to the ocean. Styrofoam crumbles into smaller and swallowable sized pieces and is therefore easily mistaken for food by surface feeding animals such as fish and seabirds. If swallowed, Styrofoam can block intestines and/or release toxins. Styrofoam does not decompose with exposure to sunlight or seawater, so the danger of Styrofoam litter does not disappear over time.**[24]

What does "compostable" mean (you can use a dictionary)?
Answer: **Compostable means an item can be broken down by microorganisms in the presence of oxygen and moisture to a point where it can be safely added to our soils.**[25]

How can your school avoid using plastic and Styrofoam?
Answers will vary. Possible answers include:
- **Switch to products that are packaged in compostable packaging. Even if the compostable packaging ends up in the landfill, if it ever breaks down it will become natural plant fibers, while plastic and Styrofoam are likely to never degrade in a landfill.**
- **Serve food buffet-style or family-style on reusable lunch trays.**
- **Encourage students to bring lunches from home in reusable containers.**

Station 6 – Products with minimal packaging

Which product would you choose and why? Consider your health, the environment, ease of use, convenience of product, etc.
Answers will vary. Possible answers include.
- **The can of soup because it has the least packaging, it's healthier, and/or it can be recycled in my community.**
- **The cup of soup because it tastes better and/or it is more convenient.**
- **Neither! Learn to make your own soup using products that you can buy in bulk or unpackaged (vegetables, beans, rice, etc).**

Note: $1 out of every $11 is spent on packaging.[26] *While we need to protect the contents of the products we are purchasing, the amount of packaging can be excessive. Buying reasonably packaged products would decrease the amount of waste we throw out.*

Station 7 – Products that are sold in bulk

Which type of package shows buying in bulk?
Answer: **Large sugar bag**

How does this type of package reduce waste?
Answers will vary. Possible answers include:
If you can buy in bulk, you eliminate some need for additional or excess packaging, which has a positive impact on the environment and may save you money.
Many of the products we buy contain packaging that costs money and uses natural resources to make. Plus, it's often immediately thrown away, creating waste for landfills.

What natural resource is saved?
Answer: **Trees**

REVIEW THE INTRODUCTION TO THE 3RS PRE-TEST

Have students review the introduction to the 3Rs Pre-test and correct their answers. Lead a discussion using the following questions:

- What answers on the pre-test did you change?
- What things surprised you?
- Why is it important to reduce, reuse and recycle?
- How do you practice the 3Rs?

INTRODUCTION TO THE 3RS PRE-TEST - ANSWER KEY

1. Reducing, reusing, and recycling products made from natural resources is the key to sustainability. Define natural resource: **A natural resource is something that is taken from the earth or atmosphere that has value to humans. Humans use natural resources for many things like food, energy production, and manufacturing. Examples of natural resources include fish, solar energy, and gold.**[12]

2. Define and give examples of renewable and non-renewable resources.
Renewable Resources: **A *renewable resource* is a natural resource that can be replenished in the same or shorter amount of time than it takes to draw the supply down. Renewable resources can be inexhaustible (like wind or sun), or living resources that, if managed correctly, can be regrown to keep pace with harvest levels (like fish or timber).**[13]
Non-renewable Resources: ***Non-renewable resources* cannot be readily replaced on a level equal to their consumption. For example, fossil fuels (oil, natural gas, and coal) are considered non-renewable resources because they take thousands of years to form.**

3. List three ways you can reduce waste:
Answers may vary. Possible answers include:

- **Ask yourself if you really need to buy that item. What do you have at home that might do the job just as well?**
- **Learn how to cook one or two meals using foods that can be purchased with minimal or no packaging (i.e. veggie stir fry, pasta with marinara sauce made from fresh tomatoes, etc).**
- **Research how to start a compost bin in your home to reduce food waste in your trash.**
- **When you want to buy a new item, buy a high-quality item that will last a long time. Reuse it as much as possible, and try finding it second-hand before buying it new!**
- **Use reusable bags and containers to shop, travel, and pack food on-the-go.**
- **Avoid single-use and single-serve items. Buy in bulk where possible!**
- **For more ideas, see the article listed in the source citation.**[14]

4. Where can you take your unwanted or used items, — such as clothing, household items, books, and more — to be reused in your community?
Answers will vary depending on your community. All used or unwanted items you donate or give away should be clean and in good, working condition. For Fairbanks, used clothing, accessories and household goods are accepted at Value Village and Fairbanks Resource Agency Closet Collections. The Literacy Council of Alaska accepts used books. Play It Again Sports accepts sport equipment. Fairbanks Community Food Bank, Fairbanks Rescue Mission and Stone Soup Cafe all accept food donations.[15]

5. Define recycle:
Recycling is the process of recovering material from waste and turning it into new products.[16]

6. What does this symbol  stand for?
Recycling. If there is a number within the symbol, the symbol is designating the plastic resin type, which aids in sorting recyclable materials.[17]

7. Which of these does recycling do?
d. all of the above[18]
Note: Recycling is good for the economy because it creates more jobs.

8. True or False: Recycling is always the first step you should take to reduce your waste.
False[19]

EXTENSIONS FOR UNIT 2

Extension 1 - Paper

Make Paper (Classroom Activity)

BACKGROUND INFORMATION:

When we think of paper, we usually think of trees. But it is only very recently in the history of paper that trees have become the main source of fiber. Paper can be made from many types of plants because cellulose is the major building block of all plant cell walls. To make paper, cellulose is broken down into separate fibers through beating and mixing with water. When the water is drained away, a sheet of interwoven fibers is left.

OBJECTIVE:

Students will:

- learn about the paper recycling process by making their own sheets of paper.

MATERIALS NEEDED:

- scrap paper (provided by instructor)
- framed screen
- cloth towel
- sponge
- tub of water (provided by instructor)
- blender (provided by instructor)
- measuring cup
- paper towels (provided by instructor)

PROCEDURE:

Before the demonstration, fill a tub with water deep enough to submerge the screen and have students tear scrap paper into one inch square pieces. Demonstrate steps 2-7, then have students work in small groups to make their own recycled paper.

1. BLEND PAPER INTO A PULP. Drop a handful of paper scraps into a blender about 2/3 full of water. Blend at medium speed until scraps are thoroughly mixed with water. Add more paper in small amounts and continue blending until pulp looks like watery oatmeal. *It's recommended that only the teacher does this.*
2. POUR THE PULP INTO THE SCREEN. Submerge the screen in the tub of water. Pour a cup of paper pulp into the center of the screen, swirling the pulp gently so that the entire surface is covered.
3. DRAIN THE WATER OFF. Lift the screen out of the tub and let the water drain off. Place the screen flat on a table, unhook and open the top of the frame.
4. PRESS WATER OUT OF THE PAPER PULP. Carefully place a cloth towel on top of the pulp. Using a sponge, press on top of the towel to remove water from the paper pulp. (Hint: do not rub with sponge – lift and press evenly on all portions of the paper.)
5. REMOVE THE SHEET OF PAPER FROM THE SCREEN. Starting at one corner, carefully peel back the towel – the sheet of paper should come off the screen and adhere to the towel. (Hint: if the paper sticks to the screen, lay the towel back over the paper and continue to press water out with the sponge. Then try peeling the towel off again.)
6. REMOVE THE SHEET OF PAPER FROM THE TOWEL TO DRY. Lay the towel on the table with the new sheet of paper facing up. Place a paper towel on top of the paper and press through the paper towel with a wrung out sponge to remove more water. Peel back the paper towel carefully – the recycled paper should come off the cloth towel and stick to the paper towel. (Hint: if paper sticks to the cloth towel, use your fingers to gently loosen the paper.) The recycled paper should air dry on the paper towel before being removed.
7. After demonstrating to the students, have small groups come up to the papermaking station and work together to make their own sheets of paper using steps 2-7 above.

Extension 2 - Metal

Mapping the World's Bauxite Mines

BACKGROUND INFORMATION:

Bauxite is the rock mined to create aluminum. It is created through the chemical weathering of clays typically found between the tropics of Cancer and Capricorn and composed of clay, iron oxides and titanium dioxides.

It takes four tons of bauxite ore to make one ton of aluminum. The first step in this process is for the bauxite to be refined into alumina, a white powder. In the second step, alumina is transformed into aluminum using carbon large amounts of electricity. The third step is pouring the melted aluminum into molds. The first two steps are skipped when manufacturing aluminum from recycled cans, which saves 95% of the energy cost in producing aluminum.[27]

Australia is the top exporter of bauxite, followed by India, China, Guinea, and Brazil. According to estimations of undiscovered bauxite reserves and current mining activities, it is predicted that the bauxite supply will last another 250-340 years.

OBJECTIVES:

Students will:

- appreciate humanity's role in producing and sharing natural resources
- discover that worldwide cooperation is necessary to make aluminum products

MATERIALS NEEDED:

- map of the world (pg. 46)
- colored pencils
- table of bauxite production (right)

Country	Thousands of Metric Tons of Bauxite Mined
Australia	68,414
China	44,000
Brazil	28,100
India	18,000
Guinea	17,400
Jamaica	8,540
Russia	5,475
Kazakhstan	5,310
Surinam	4,000
Greece	2,500

PROCEDURE:

1. After reviewing the data, have students create a table for their map that will tell the reader the different amounts of bauxite mined from each country (lightest color for the least bauxite mined and darkest color for the most mined.)

2. Have students color the map according to their table. Students should also identify and label the tropics of Cancer and Capricorn on their map.

3. Lead the students in a discussion.
   - Where does most bauxite come from?
   - What are the environmental costs of mining bauxite? Discuss change in landscape, removal of vegetation, air pollution from extraction, transportation and processing and so on.
   - What are the economic costs of using bauxite in a Washington aluminum plant versus using recycled cans from Alaska (extraction, transportation, processing raw ore, etc.)?

Extension 2 - Metal

Mapping the World's Bauxite Mines

Country	Thousands of Metric Tons of Bauxite Mined
Australia	68,414
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Kazakhstan	5,310
Surinam	4,000
Greece	2,500

Extension 3 - Plastic

All About Plastic

BACKGROUND INFORMATION:

Every piece of plastic ever made still exists today, and much of this plastic has traveled from our hands to our oceans. This activity will empower students to use less plastic.

Even though plastic has been around for at least 50 years, we have not discovered a way for it to decompose. Our plastic waste keeps piling up. What makes plastic so attractive to manufacturers is that it is lightweight and durable. These same traits make plastic dangerous to wildlife, because lightweight plastic floats where sea birds feed, and durable means that if swallowed, the plastic cannot be digested and instead blocks the guts of sea birds.[28]

OBJECTIVES:

Students will:

- gain a greater understanding of the need to carefully use all resources in ways that are not wasteful and damaging to the environment — both now and in the future
- understand that they can personally play an important role in reducing plastic pollution and increasing recycling rates for a healthier environment
- identify new practices which would generate less plastic waste

MATERIALS NEEDED:

- calculator
- internet with access to YouTube

PROCEDURE:

1. Watch the YouTube video **Use Less Plastic** by Good.Is. - www.youtube.com/watch?v=LZ71svh1RVo
2. Discuss ways to reduce the amount of plastic waste generated at home, school, and in your community.
3. To better understand the impacts, let's take a look at the numbers:

   - In 2013, 33 million tons of plastic waste was produced, of that, 9% was retrieved for recycling. How many tons of waste was recycled? **2.97 million; that also means that over 30 million tons of plastic was thrown away**
   - 14 percent of the 2.97 million tons of recycled plastics consisted of plastic bags and wrappers that are one time use items. How many tons is that? **420 thousand tons**
   - In 2013, 14% of all solid waste was from plastics. In 1960, it was only 1%. We now produce 33 million tons per year. How many more millions of tons of waste are produced now from plastics than in 1960? **32.67 million tons**
   - If each family uses an average of 60 plastic bags for every 4 shopping trips, and they make 6 shopping trips a month how many plastic bags will they have used in one year? **4,320 bags a year**

Extension 4 - Plastic

What's that Number?

BACKGROUND INFORMATION:

There are many types of plastic. Some plastics are very stiff and some are flexible; some plastics are shatterproof and some are heat resistant (microwaveable). These characteristics are based on plastic's chemical makeup (resin type). Mixing one type of plastic with another when remanufacturing them into new products can lead to problems with melting or breakage. Therefore, manufacturers print a code on the bottom of items so recycled plastic can be sorted by resin type. These codes are called resin identification codes.[29]

OBJECTIVES:

Students will:

- define and explain the purpose of plastic resin identification codes
- discover new uses for a recycled plastic item

MATERIALS NEEDED:

- plastic cards, numbered one through seven (provided)
- presentation materials such as poster board, paper, and markers
- computer with internet access

PROCEDURE:

1. Break the students into seven groups and give each group a card, numbered one through seven. Each card represents a resin identification code.

2. Introduce resin identification codes to your students. Explanation and definitions can be found in the Background Information section above.

3. Assign a researcher, presenter, and finder for each group. If you have more than 3 students in each group, you may assign multiple researchers, presenters, or finders to the group.
   - Finder: Find 2-3 items in the classroom that are made with their type of plastic. If they can not find anything, it is their responsibility to either draw pictures or find pictures from the internet. They will stand with the presenter to show the class.
   - Researcher: Research what this type of plastic can be remanufactured into. For example, plastic bottles can be made into polar fleece, which can be made into jackets.
   - Presenters: Present their resin identification code, what type of plastic it is, and what it can be recycled into.

4. Follow up with a class discussion
   Class discussion example:
   - It is important to recycle only the plastics that can be recycled in your community. Use the resin identification codes to make sure you are recycling properly. Help lower labor costs of recycling programs by correctly sorting your plastics before dropping them off.
   - Because plastics are made from non-renewable resources, it is very important to use them wisely. If we can buy a product in an alternate recyclable or reusable material, we should. Reuse plastic containers if we can. Finally, make sure plastic is either recycled or thrown away properly because plastic litter is a major source of ocean pollution.

Extension 5 - Glass

Making Rock Candy

BACKGROUND INFORMATION:

Glass is made from melting sand, soda ash, and limestone together at temperatures as high as 2,600°F. However, after the phase change, the sands do not return to their granulated structure—they remain in the sheet that we know as glass. Making glass requires temperatures too high to emulate in class. However, making rock candy is a great way to model the glass making process!

OBJECTIVE:

Students will:

- model the glass making process

MATERIALS NEEDED:

- 4 cups white sugar
- 2 cups water
- aluminum foil
- butter
- cookie sheet
- candy thermometer
- hammer (clean)
- stove or microwave
- pot or microwave-safe dish

PROCEDURE:

1. Boil 2 cups of water on the stove top or microwave
2. Completely dissolve 4 cups of white sugar in the water
3. Line a cookie sheet with aluminum foil and butter it
4. Continue boiling the sugar mixture until it reaches 300°F
5. Pour syrup out on prepared baking sheet and let rest until completely cool (about 45 minutes)
6. Break the candy into pieces and enjoy!

Want more?
Take a chunk of the rock candy, grind it up, and use it to make rock candy again, mimicking the glass recycling process.

Extension 6

Can to Can Game

BACKGROUND INFORMATION:

Recycling is the process of collecting and processing materials that would otherwise be thrown away as trash and turning them into new products. Recycling can benefit your community and the environment. The activity will inform students of the many **benefits of recycling**, including:

- Reduces the amount of waste sent to landfills and incinerators
- Conserves natural resources such as timber, water, and minerals
- Prevents pollution by reducing the need to collect new raw materials
- Saves energy

OBJECTIVE:

Students will:

- learn that recycling reduces the impact on the environment by saving energy and resources

MATERIALS NEEDED (CONTACT GREEN STAR TO BORROW THESE ITEMS):

- 4-6 bauxite rocks
- 4-6 aluminum cans
- 16 laminated role signs
- container marked "bauxite"
- empty bin marked "landfill"
- empty bin marked "recycling"

PROCEDURE:

1. Choose 13 students to represent the life of an aluminum can.
2. Assign each student a role. Have students each choose a movement to go with their part.
    1. Bauxite says: "ore from the tropics"
    2. Miner says: "dig it up"
    3. Ship says: "over the seas"
    4. Smelter says: "melt it down"
    5. Factory says: "roll it, punch it, cut it"
    6. Bottler says: "fill 'er up"
    7. Trucker says: "off to the store"
    8. Store says: "drinks for sale"
    9. Refrigerator says: "cool 'em down"
    10. Consumer says: "I'm thirsty"
    11. Trash can says: "throw it in here"
    12. Trash truck says: "to the landfill"
    13. Landfill says: "more garbage"
3. Bauxite starts the game and passes one rock down the line of students, each student says their part and makes their motion in turn. After the smelter says "melt it down," the factory says "roll it, punch it, cut it out" and the teacher takes the bauxite and hands the factory an aluminum can to pass on to the bottler. When the first can reaches the landfill, bauxite can begin again with a new rock. Have students go through the motions until the bauxite is depleted and the "landfill" bin is full of cans.
4. Ask students if they have been using energy to show the life cycle of the can. It takes energy to mine the bauxite, to run the factories, to cool the drinks and for all the forms of transportation needed in the production, selling and disposal of the can. Using energy depletes another valuable non-renewable resource, fossil fuels, and results in air and water pollution.
5. What is another route the can might take? Replace the can Factory (role #5) with a Recycling Center, replace the Trash Can (role #11) with a Recycling Bin, replace the Trash Truck (role #12) with a Recycling Truck and remove the Landfill. Now take out the Bauxite (role #1), the Miner (role #2) and the Ship (role #3) and make the circle smaller. Return the cans from the Landfill and start over with the Smelter handing a can to the bottler. NOTE: You may want to choose different students for this new exercise to allow more students to participate.
6. Repeat the game, but this time one can is passed continuously around the circle, there is no need for the bauxite or more cans. Who uses energy this time? Who gets to rest? Why is this good for the environment? The circle represents a cycle. What are cycles and how does that relate to recycling?

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UNIT 3

Recycling in Alaska

At a Glance:

In this unit, we take a deeper look at some natural resources (oil, sand, wood, and minerals) found in Alaska that make up everyday items (plastic, glass, paper, and metal). This unit begins and ends with students testing their knowledge of why recycling matters in Alaska with the **Recycling in Alaska Pre-test**. In the **activities section**, students investigate what materials are recyclable in their hometown. Next, students complete a **worksheet** while participating in a class discussion about Alaska's natural resources and our state's recycling scene. After reviewing the **Recycling in Alaska Pre-test**, students consider ways to increase recycling in their home, school, and community.

Objectives:

Students will be able to:

- discuss the importance of natural resources (such as oil, sand, wood, and minerals)
- explain why is it important to recycle everyday items made from our natural resources
- understand the challenges of recycling in Alaska
- investigate what materials are recyclable in their hometown

Time:

Two 55 minute class periods

Materials provided:

- Recycling in Alaska PowerPoint
  - Located on flash drive included in binder
  - Also located online at: www.iagreenstar.org/curriculum
- Recycling in Alaska Script (pgs. 61-62)
- Map of Alaska

Materials needed:

- Computer, projector and display screen for PowerPoint and vocabulary words
- Internet access to YouTube video
- A calculator for each student
- A photocopy of the following worksheets for each student:
  - Recycling in Alaska Pre-test (pg. 57)
  - HOMEWORK: Sorting Trash (pg. 59)
  - Recycling in Alaska Worksheet (pgs. 63-64)

TEACHER SUPPORTING BACKGROUND INFORMATION

It is important to conserve our state's natural resources by recycling. Alaska produces many natural resources including oil, natural gas, sand, minerals, and wood. Here are some reasons to recycle Alaska's natural resources:

WOOD

Wood is a unique resource because it is renewable, biodegradable, and the products made from wood fibers are easy to recycle.[1] Paper products make up 40% of the logging industry,[2] which means almost half of the trees cut down are used to make paper. We thought electronics would reduce paper waste, but the ease of desktop printers has increased demand for printer paper. 45% of office printouts end up in the trash by the end of the day they are printed![3] That being said, it is more important than ever before to commit to recycling paper.

OIL

Since the discovery of the Prudhoe Bay oil field in 1967, oil production has been the engine of economic growth in Alaska.[4] Crude oil is valuable because it can be refined into several products included gasoline and hydrocarbon gas liquids (that is used to manufacture plastic). Roughly 50% of the plastic in our lives is used once and thrown away, like straws and lids on drinks.[5] 185 pounds of plastic is thrown away by the average American each year.[6] Plastic is popular because it is lightweight and waterproof, which is also the reason plastic litter travels so wide and far. The Great Pacific Garbage Patch, located in the Pacific Ocean, is twice the size of Texas and 90% of it is from plastic waste.[7] Plastic builds up in our oceans because it does not biodegrade. Plastic pieces resemble aquatic organisms and are ingested by wildlife with serious, sometimes deadly, consequences.[8]

MINERALS

Alaska's lands are abundant in mineral resources from gold to zinc. It was gold that first focused the world's attention on Alaska, beginning with the Klondike Gold Rush in 1897.[9] One exciting thing about mineral resources like metal is that it can be recycled over and over, since it does not lose its important properties in the process.[10]

SAND

Sand and gravel may be dull compared to gold, but they are still import resources; we need them to build the roads to access gold mines and oilfields. Sand is also used to produce glass.

Fun Facts

- Federal, state, and tribal agencies are all involved in managing Alaska's natural resources because only 1% of Alaska's lands are privately owned. Of the remaining land, 59% is managed by the federal government, 28% by the state government, and 12% by native corporations.[11]
- Most commercial logging takes place in the coastal zone of south-east and south-central Alaska. The primary reason trees are cut in the Interior is to obtain firewood.[12]
- In 1975, the Trans-Alaska Pipeline was built to carry oil from Prudhoe Bay, and 1.8 million barrels a day travel through the 800-mile pipeline to Valdez.[13]
- Annual sand and gravel production is often a reflection of trends within the construction market. A major spike in gravel production occurred during the the building of Dalton Highway to Prudhoe Bay, a 414-mile long road.[14]

Fairbanks Recycles!

- The Fairbanks North Star Borough Used Oil Recovery Program began in 2002. Used oil is now the primary heat source for the main Solid Waste Facility Building. This program has resulted in significant savings of used oil disposal costs and reduced the need to purchase heating fuel.[15]
- Recycling is popular! 86% of residents in the FNSB would recycle at transfer sites, if available, according to the results of a 2012 survey sponsored by the FNSB Recycling Commission.[16]
- Did you know that the FNSB has a Sustainability Commission that works with the community to identify sustainability goals for the borough? Their purpose is to "provide leadership to ensure a secure and sustainable community development that maximizes public health, safety, self-reliance and welfare within the powers of the borough."[17]

PROCEDURE:

Class One

1. This lesson begins with students testing their knowledge of why recycling matters in Alaska. Hand out copies of the Recycling in Alaska Pre-test (pg. 57) to the class. Have students take the pre-test at the beginning of the lesson, guessing at any answers they don't know. This is for fun, not a grade. After they have filled in their answers, have them keep the pre-test for later. They will review their answers at the end of the unit to see if their answers were correct. (Estimated time to complete: 10 minutes)

2. Class Activity: Recycling in your Community (see pg. 58 for details). (Estimated time to complete: 45 minutes)

3. Assign Homework: Sorting Trash (pg. 59). Distribute student worksheet to each student. Students will learn that many household items thrown away everyday can be recycled in their community! Have students come prepared to discuss during the next class.

Class Two

4. Visual Aid: Join SciShow as they explore what happens to your stuff after you toss it into the little green bin with the arrows on it *link found below)*. Discussion starters can be found on page 60. (Estimated time to complete: 15 minutes)
   - How Recycling Works: https://www.youtube.com/watch?v=b7GMpjx2jDQ

5. Talk through the Recycling in Alaska script (pg. 61) with the PowerPoint and have the students complete the Recycling in Alaska worksheet (pgs. 63-64). The PowerPoint slides are numbered to correspond with the script. The answer key is located on page 65. (Estimated time to complete: 20 minutes)

6. Assessment: At the end of Unit 3, have students review the Recycling in Alaska Pre-test using the answer key (pg. 67). Estimated time to complete: 20 minutes)

7. Assign Homework: Putting It All Together: Recycling Investigation (pg. 68). Students will be asked to go home and review their family's recycling plan.

8. Optional Extensions (pgs. 69-75).

9. Sources for the material (pgs. 76-77).

Vocabulary Words

NATURAL RESOURCE
Something of value that is taken from the earth and turned into the different things we use.

RENEWABLE RESOURCES
A natural resource which can replenish to overcome usage and consumption.

NON-RENEWABLE RESOURCES
Natural resources that cannot be readily replaced by natural means on a level equal to their consumption.

CRUDE OIL
A liquid substance created from decayed plants and animals held under pressure for thousands of years. Processing crude oil creates petroleum products used to make plastic and gasoline.

SAND
A loose granular material used to make glass.

METAL
A solid material that is typically hard, shiny, malleable (meaning it can be hammered into a new shape), and strong.

FERROUS METALS
Metals containing iron - such as nickel, steel, and iron - that are magnetic.

NON FERROUS METALS
Non-ferrous metals do not contain iron and therefore are not magnetic. Gold, silver, tin, copper, lead, and aluminum are non-ferrous metals.

ORE
A type of rock that contains minerals with important elements including metals.

COMMODITY
A physical item rather than a service, with economical value, such as copper or trees.

BACKHAUL SHIPPING
The return trip a truck or cargo ship makes after making a delivery. A load of goods (e.g. recyclable materials) that are transported after the primary load was delivered is an example of a backhaul.

CARBON DIOXIDE
A greenhouse gas, meaning that if it is in the atmosphere, it holds heat close to the earth, which makes our planet warm. Carbon dioxide is produced by our respiration and the burning of fossil fuels. CO_2 is captured when plants use photosynthesis to grow new tissue.[18]

Name_____ **Date:**_____

RECYCLING IN ALASKA PRE-TEST

Directions: These are questions you may not know. Try your best! You will review your answers to the pre-test at the end of the lesson to see if your answers are correct. You will need a calculator for the math questions.

1. Which country has become the largest consumer of paper and paper products per person in the world?
   a. Spain b. Mexico
   c. China d. United States

2. Why are forests important to Alaska?
   a. Trees provide habitat for wildlife
   b. Trees slow down climate change by storing carbon dioxide
   c. Trees sustain our logging industry, bringing money into the state
   d. All of the above

3. Sand is used to make which of these items?
   a. Plastic b. Glass
   c. Paper d. Gold

4. Can you recycle glass in your community?
   a. Yes
   b. No

5. Metal:
   a. is strong and useful for making tools
   b. is a natural resource found in Alaska
   c. can be recycled multiple times because it does not lose its important properties in the process
   d. all of the above

6. Metals such as aluminum and steel can be recycled over and over again because they do not lose any strength or quality in the recycling process. Below is a list of the six simple steps to recycling metal. Draw a line to match the steps with the recycling process:

First step	The metal is made into a new product
Second step	The consumer places used metal in recycling bin
Third step	The melted metal is hardened into a block called an ingot
Fourth Step	The ingot is rolled into a thin sheet
Fifth Step	A recycling company melts the metal with similar metals
Sixth Step	The consumer buys a metal product

7. Plastic is:
   a. made from sand b. found naturally in Alaska's forests
   c. made from by-products of oil d. made from gold

8. How many millions of tons of plastic are thrown away each year?
   a. 12 million tons b. 30 million tons
   c. 6 million tons d. 122 million tons

9. What percentage of plastic waste is recovered for recycling?
   a. 2% b. 36%
   c. 9% d. 40%

10. What types of plastic can you recycle in your community?

Class Activity: Recycling in your Community

OBJECTIVE:

Teach students the specifics of recycling in their community and help them understand why Alaska does not recycle everything. Do your homework before conducting this class activity. What online resources does your community have to learn about solid waste management and recycling opportunities? List them out before taking your class to the computer lab.

MATERIALS:

A computer with Internet access for each student

PROCEDURE:

1. Explain to students that local governments and private companies usually manage solid waste (garbage) and recycling. It is important that they understand what can be recycled to ensure proper recycling processes.

2. Visit the computer lab. Ask each student to use your community's online resources that you have provided them with - Solid Waste Management websites, recycling organization websites, and your community's recycling guide - to find out where to drop off recyclables locally. As a group, find out what items can be recycled and how to prepare those items for recycling - for example, rinsing plastic bottles and removing lids. You can also discover how, when, and where to recycle non-standard items (e.g. paint, electronics, motor oil, batteries, scrap tires, old clothes, food scraps, or yard waste).

3. Discuss your students' findings from the class activity. Hold up various recyclable items (examples include: plastic 1 & 2, aluminum cans, a picture of a junk car, paper, cardboard, cell phone, etc.), as well as things that are not recyclable in your community (examples may include: plastic bags, plastic 3-7). Ask students to identify the materials that are recyclable in your community.

   * TIP: This is a good time to discuss ferrous and non-ferrous metals. Remember, non-ferrous metals do not contain iron and are not magnetic. Aluminum is a non-ferrous metal. When recycling, use a magnet to find out if your metal is aluminum or tin (if it is not magnetic, chances are you're dealing with aluminum or tin).

4. If time permits, do some poster art. After students have researched local recycling options, including where to recycle, what can be recycled, and how to prepare recyclables, they will create a poster detailing what's recyclable in their community.

Name_____ **Date:**_____

HOMEWORK: Sorting Trash

DIRECTIONS

Go through your trash. With an adult supervising, list what is recyclable in your community and what is definitely trash. Draw a picture of at least four of your items in each category. If there are items you are unsure about, put them below.

Recycle	Garbage
	
Undecided	

VISUAL AID: HOW RECYCLING WORKS WITH CLASS DISCUSSION STARTERS

PROCEDURE:

1. Join SciShow as they explore what happens to your stuff after you toss it into the little green bin with the arrows on it. Link found below:
   How Recycling Works: https://www.youtube.com/watch?v=b7GMpjx2jDQ

2. After watching How Recycling Works, use the Teacher's Script and Discussion Starters to begin a recycling conversation between your students.

TEACHER'S SCRIPT:

Almost everything we recycle in Alaska must be shipped to the Lower 48 and sent to a recycling facility similar to what was shown in the video. However, newspaper recycled in the state may be sold to Thermo-Kool of Alaska, a Wasilla company that turns the paper into cellulose insulation.

DISCUSSION STARTERS:

1) Why do some communities have recycling programs (and high-tech sorting machines) and other communities do not?

Answer: Recycling becomes more attractive when the alternative becomes more costly. When burying garbage becomes more costly than sorting recyclable material, local governments will switch to mandatory recycling programs. Communities with high densities of people and land shortages (no room for landfills) are more likely to have recycling laws than other communities. People also tend to recycle more when they have to pay to toss their garbage.

2) Many people think it doesn't make sense to recycle in Alaska when we have to ship recycled material back to Washington, some 2,000 miles away. Can you explain how we save energy and reduce wear and tear on the earth by recycling?

Answer: Yes, it is worth it. Here's why: Shipping trucks are constantly driving materials north to Alaska and up until recently, 80% of them drove back empty.[18] Many recycling programs in the state are set up so that trucking companies donate the use of these previously empty trucks to transport recyclables to Anchorage, where they are then barged to Seattle's recycling facilities. These donated backhaul shipments make use of energy that is already being used to return the trucks to Anchorage, and also help to make recycling more affordable in the state of Alaska. Also, using recycled material reduces energy usage, water usage, and production of greenhouse gases in manufacturing, compared to using raw natural resources.

RECYCLING IN ALASKA SCRIPT

This discussion is meant to take a deeper look at each natural resource (oil, sand, wood, and minerals) found in Alaska that make up common recyclable items (plastic, glass, paper, and metal).

1. Alaska provides many natural resources. We will be talking about four in particular - oil, sand, wood, and minerals. List some common everyday products that are made from:

- Oil
- Sand
- Wood
- Metallic Minerals

Oil is used to make plastic.
Sand is used to make glass.
Wood fiber is used to make paper and paper products.
Minerals are extracted from the earth's crust to make metals.[19]

2. Let's start by discussing metals. Do you know the meaning of the term "metal"?
Metal is a substance (such as gold, tin, or copper) that usually has a shiny appearance, is a good conductor of electricity and heat, can be melted, and is usually capable of being shaped. Metals are strong and are useful for making tools, buildings, bridges, and other structures where strength is important.[20]

3. Does anyone know what types of metal might be found here in Alaska?
You may know that gold is very abundant in the state, but many other metals are also mined in Alaska, such as zinc, lead, and silver. The Red Dog Mine is currently the world's largest producer of zinc, making it a valuable export for Alaska. Copper is the third most valuable metal in Alaska and was very economically important during World Wars I and II.[21]

4. One exciting thing about metal is it can be recycled over and over again because it does not lose its important properties in the process. Can you brainstorm other reasons for recycling metals?
Metal recycling:
- Saves energy, reducing greenhouse gas emissions
- Reduces the need to extract metals from the earth, reducing the impact on the environment
- Reduces waste
- Conserves non-renewable resources[22]

5. In the US, we mainly recycle aluminum and steel. Why not other metals, like gold, silver, brass, and copper?
Some other metals are so valuable that we rarely throw them away. Therefore, they generally do not create a waste problem.[23]

6. This (above statement) is not true in the case of electronics. The electronics we often discard contain valuable metals like gold. How many electronic devices can you count in this classroom?
Answers will vary. Common answers include: computer, calculators, printer, and anything with a cord or a battery.

7. Electronics recycling programs and opportunities exist around the state of Alaska. What (if any) electronic recycling opportunities exist in your community?
Answers will vary.
Note to teacher: The answer should have been discussed in the "Recycling in your community" activity earlier in this unit.

8. Computers are everywhere. Do you think using computers reduces paper waste?
We thought electronics would reduce paper waste, but the ease of desktop printers has increased demand for printer paper. 45% of office printouts end up in the trash by the end of the day they are printed![24]

9. Now let's talk about Alaska's forests. Hundreds of everyday items have their roots in Alaska's forests. Can you name two items?
Think beyond paper and lumber. Cellulose within the wood fiber has many uses. Cellulose can be modified into thin strong material ideal for ping pong balls, or transformed into cloth for baby wipes, or safely used as a thickener for toothpaste.[25]

10. Why are the forests important to Alaska?
Forests provide firewood and lumber. Logging brings jobs into rural areas. But forests are more than just trees. Forests provide habitat for wildlife, keep the soil from eroding, and help slow down climate change by storing carbon dioxide.[26] We call these ecological services. Forests have recreational and aesthetic values, too. Who doesn't love the color show a forest provides in the fall?

11. Before logging or mining an area, what minerals are required?
Sand and gravel. These industrial minerals are used to make roads and concrete.

12. Now let's talk about Alaska's sand resource. What important everyday item started out as sand?
Glass[27]

13. What (if any) glass recycling opportunities exist in your community?
Answers will vary. We have the technology to recycle glass, but the process is not profitable in the U.S., meaning people and businesses can't make a lot of money from recycling glass. Therefore, even though we have the technology, the incentive to recycle glass is hard to find.[28]
(Note to teacher: If no glass recycling opportunities exist in your community, challenge your students to practice the first two Rs - Reduce and Reuse - as much as possible.)

14. While it is true that Alaska's forests, mineral deposits, and sand bring in money to the state, 85% of Alaska's state government revenue comes from oil production.[29] Brainstorm everyday items that started life as oil.
Answers will vary. Some examples include:

- Cosmetics: petroleum-based products can make up to 80% of a cosmetic's ingredients
- Cleaning products: The average cleaning solution contains oil
- Plastic: If you look around, you'll find that a great deal of your things are made, at least partially, of plastic. From your iPod to that bottle of Mountain Dew you're drinking, roughly 4-5% of the total U.S. oil consumption is dedicated to the manufacture of plastic products.
- Fuel: The combined sources of gasoline, diesel, and jet fuel account for around 72% of oil consumption.[30]

15. Now let's talk about plastic. In Alaska, scientists are finding that sea birds are ingesting plastic.[31] The more plastic we consume, the greater the potential for plastic to end up killing sea birds and other animals. Brainstorm ways to reduce or reuse plastic bags and other one-time use plastics.
Answers will vary. Possible answers include:

- bring your lunch in a paper or reusable bag
- don't use plastic in the first place
- carry a reusable bag wherever you go

Optional: Have students try to live for a period of time without using plastic. Have them keep a journal of what they do to avoid plastic and when they were forced to use plastic. What was difficult? What was easy? Where is plastic unavoidable?

16. What (if any) plastic recycling opportunities exist in your community?
Answers will vary.
Teacher's Note: The answer should have been discovered during the "Recycling in your community" activity earlier in this unit.

17. Recycling would not have its strength in Alaska if it weren't for the many partners, organizations, community members, and businesses working together to make a change. ALPAR is just one organization dedicated to supporting recycling in Alaska. What/who is ALPAR?
ALPAR is the acronym for "Alaskans for Litter Prevention and Recycling." ALPAR is dedicated to eliminating litter and increasing economically viable recycling in Alaska. ALPAR provides the yellow and green bags we use on Clean Up Day. They also have many other programs, including Flying Cans, which helps remote villages fly out aluminum cans for recycling. [32]

18. Alaska is a very unique state, which has historically been starved for recycling options. The good news is that many new recycling programs are becoming available and expanding around the state. Did anything about our discussion today surprise you?
Answers will vary.

Name_____ **Date:**_____

RECYCLING IN ALASKA WORKSHEET

1: Alaska provides many natural resources. We will be talking about four in particular - oil, sand, wood, and minerals. List some common every-day products that are made from:

Oil:

Sand:

Wood:

Minerals:

2: Do you know the meaning of the term metal?

3: Can you list some of the metals that might be found in here in Alaska?

4: Brainstorm reasons for recycling metals.

5: In the US, metal recycling programs mainly target aluminum and steel. Why not other metals, like gold, silver, brass, and copper?

6: How many electronic devices can you count in your classroom?

7: What (if any) electronic recycling opportunities exist in your community?

8: Computers are everywhere. Do you think this reduces paper waste?

9: Hundreds of everyday items have their roots in Alaska's forests. Can you name two common items?

1)

2)

10: Why are the forests important to Alaska?

11: To log or mine we first have to build roads out of _____ and _____

12: What important everyday item started out as sand?

13: What (if any) glass recycling opportunities exist in your community?

14: Brainstorm everyday items that started life as oil.

15: Brainstorm ways to reduce or reuse plastic bags and other one-time use plastics.

16: What (if any) plastic recycling opportunities exist in your community?

17: Name an organization that is dedicated to eliminating litter and increasing economically viable recycling in Alaska.

18: Did anything about our discussion today surprise you?

RECYCLING IN ALASKA WORKSHEET ANSWER KEY

1. Alaska provides many natural resources. We will be talking about four in particular - oil, sand, wood, and minerals. List some common every-day products that are made from:
Oil: **Plastic is made from by-products of refining oil.**

Sand: **Sand is melted to make glass.**

Wood: **Wood fiber is used to make paper and paper products.**

Minerals: **Minerals are extracted from the earth's crust to make metals.**

2. Let's start by discussing metals. Do you know the meaning of the term "metal"?
Metal is a substance (such as gold, tin, or copper) that usually has a shiny appearance, is a good conductor of electricity and heat, can be melted, and is usually capable of being shaped. Metals are strong and are useful for making tools, buildings, bridges and other structures where strength is important.

3. Can you list some of the metals that might be found in here in Alaska?
Gold, zinc, lead, silver, and copper

4. Can you brainstorm other reasons for recycling metals?
Saves energy
Reduces the need to extract metals from the earth, reducing the impact on the environment
Reduces waste
Saves non-renewable resources

5. In the US, metal recycling programs mainly target aluminum and steel. Why not other metals - like gold, silver, brass, and copper?
Some other metals are so valuable that we rarely throw them away. Therefore, they generally do not create a waste problem.

6. How many electrical devices can you count in this classroom?
Answers will vary. Correct responses could include: computer, calculators, printer, and anything with a cord or a battery.

7. What (if any) electronic recycling opportunities exist in your community?
Answers will vary.

8. Computers are everywhere. Do you think this reduces paper waste?
No

9. Hundreds of everyday items have their roots in Alaska's forests. Can you name two common items?
Paper and lumber

10. Why are the forests important to Alaska?
Trees provide habitat for wildlife, keep the soil from eroding and help to slow down climate change by storing carbon dioxide. Trees also sustain our logging industry, bringing money into our state.

11. To log or mine we first have to build roads out of (fill in the blank)
Sand and gravel

12. What important everyday item started out as sand?
Glass

13. What glass recycling opportunities exist in your community?
Answers will vary. (Note: If no glass recycling opportunities exist in your community, challenge your students to practice the first two Rs - Reduce and Reuse - as much as possible.)

14. Brainstorm everyday things that started life as oil.
Answers will vary. Some examples include:
Cosmetics
Cleaning products
Food additives
Plastic
Fuel

15. Brainstorm ways to reduce or reuse plastic bags and other one-time use plastics.
Answers will vary.

16. What (if any) plastic recycling opportunities exist in your community?
Answers will vary.

17. Name an organization that is dedicated to eliminating litter and increasing economically viable recycling in Alaska.
ALPAR or "Alaskans for Litter Prevention and Recycling"

18. Did anything about our discussion today surprise you?
Answers will vary.

REVIEW THE RECYCLING IN ALASKA PRE-TEST

Have students review the Recycling in Alaska Pre-test and correct their answers.
Lead a discussion using the following questions:

- What answers on the pre-test did you change?
- What things surprised you?
- Why is the production of paper important to Alaska?
- What are ways you can reduce and reuse glass?
- What surprised you about the complexities of recycling in Alaska?
- In what ways can you increase recycling in your home, school, and community?

RECYCLING IN ALASKA PRE-TEST - ANSWER KEY

1. Which country has become the largest consumer of paper and paper products per person in the world?

d. United States[33]

2. Why are the forests important to Alaska?

d. All of the above[34]

3. Sand is used to make which of these items?

b. Glass[35]

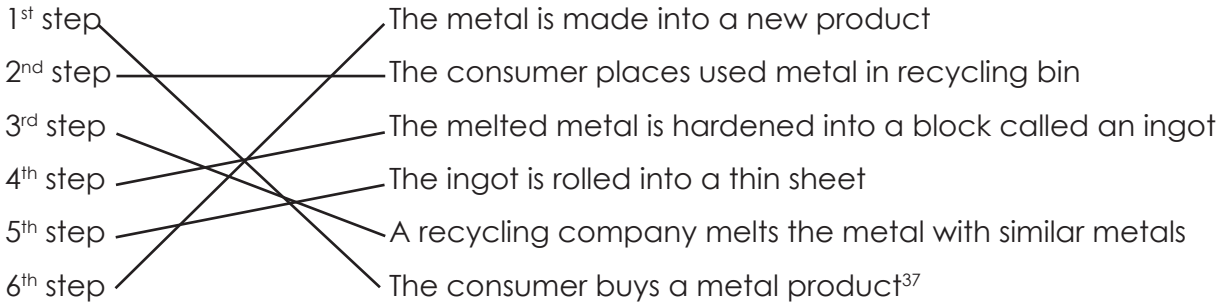
4. Can you recycle glass in your community?

Answers will vary depending on your community

5. Metal:

d. All of the above[36]

6. Metals such as aluminum and steel can be recycled over and over again because they do not lose any strength or quality in the recycling process. Below is a list of the six simple steps to recycling metal. Draw a line to match the steps with the recycling process:



7. Plastic is:

c. Made from byproducts of oil[38]

8. How many millions of tons of plastic are thrown away each year?

b. 30 Million tons[39]

9. What percentage of plastic waste is recovered for recycling?

c. 9%[39]

10. What types of plastic can you recycle in your community?

Answers will vary depending on your community

Name_____ **Date:**_____

HOMEWORK
Putting It All Together: Recycling Investigation

DIRECTIONS

Go home and review your family's current recycling plan. Interview at least one adult family member as to why your family does or does not recycle. If your family does not recycle, explain why your household does not, and how your family could recycle in the future. If your household does indeed recycle, explain your family's recycling process, and how your family might improve the process to recycle more. Take photos and/or devise a chart to document the process.

This worksheet will help guide you through the interviewing process.

Part 1: The Question

Does your family have a recycling plan in place? Yes or No? Why or why not?

Part 2: Create a Recycling Plan

If your family does not recycle create a plan for how your family could recycle in the future. If your household does indeed recycle, explain your family's recycling process, and how your family might improve the process to recycle more.

EXTENSIONS FOR UNIT 3

Extension 1

Recycling in Various Parts of Alaska

BACKGROUND INFORMATION:

This activity focuses on Alaskan geography as well as Alaska's recycling opportunities that currently exist. Recycling occurs in several areas of the state, primarily in urban areas close to the coast. This includes:

- Borough of Sitka
- City of Gustavus
- Fairbanks North Star Borough (unique in that it's not a coastal town)
- Haines Borough
- Juneau Borough
- Kenai Peninsula Borough
- Kodiak Island Borough
- Matanuska-Susitna Borough
- Municipality of Anchorage

OBJECTIVES:

Students will:

- learn about which items can be recycled in Alaska
- gain a sense of responsibility toward the way they dispose of their resources
- increase their understanding about the process that materials go through during the recycling process in Alaska

MATERIALS NEEDED:

- map of Alaska (see next page)
- access to the internet to look up recycling centers
- access to a phone for calling recycling center directors

PROCEDURE:

1. As a class, map each recycling center's location (listed above in Background Information).

2. Divide your class into research teams. Each team will be responsible for gathering information from a different recycle center in Alaska.

3. Their research should answer questions about what happens to the recyclables once received at the recycling center, types of recyclable material accepted, monthly amount of material shipped out, etc.

4. Encourage each team to call and interview the director or a representative to learn about the history of each recycling center and the challenges they face. Gather success stories as well.

5. Have students pick a presenter to present findings from research. After presentations, conduct a class discussion, answering the following questions:
   - What does each recycling center have in common? (Hint: most are near a coast, making it easy for shipping recyclables out).
   - Hypothesize the reasons why some communities have set up elaborate recycling programs while others have no recycling programs at all.


ARCTIC OCEAN
BEAUFORT SEA
CHUKCHI SEA
BERING SEA
PACIFIC OCEAN
GULF OF ALASKA
CANADA
NORTHWEST TERRITORIES
YUKON TERRITORY
BRITISH COLUMBIA
ARCTIC CIRCLE
RUSSIA
BROOKS RANGE
ALASKA RANGE
ALEUTIAN ISLANDS
SEWARD PENINSULA
KODIAK I
ALASKA PENINSULA
Barrow
Wainwright
Prudhoe Bay
Kotzebue
Selawik
Bettles
Circle
Tok
Fairbanks
Nenana
Galena
Nome
Unalakleet
Holy Cross
Bethel
Hooper Bay
Gambell
St Lawrence Island
St Matthew I
Nunivak I
Dillingham
Mt McKinley 20320+
Anchorage
Glennallen
Palmer
Valdez
Mt St Elias 18008
Mt Fairweather 15300
Seward
Kenai
Homer
King Salmon
Kodiak
Chignik
Shishaldin Vol 9387
Unimak I
Unalaska
Adak
St Paul I
St George I
Attu
Juneau
Skagway
Sitka
Wrangell
Ketchikan

Extension 2

Tour de Trash

BACKGROUND INFORMATION:

This lesson offers an excellent lesson in ecology. Landfills and recycling centers are the most common forms of waste disposal and are important components of an integrated waste management system. In this lesson students will see first hand what happens to trash and recyclables by taking a field trip to the local landfill and recycling centers.

OBJECTIVES:

Students will:

- understand how recycling may offset the overall trash production in their household, community, island, and the world
- comprehend the process of trash disposal, from your house to the landfill
- find out the economic and environmental cost of throwing our resources into the landfill

MATERIALS NEEDED:

- paper and pens for note taking

PROCEDURE:

1. Visit the local landfill and recycling center(s) in your community. If you live in Fairbanks, you can contact Green Star to help plan your class' Tour de Trash.

2. Ask students to take notes about what they learn. How will what they learn affect their recycling behavior?

Note: Want to learn about your community's waste management system, but don't have the time or bus funds for a field trip? Invite a waste management representative, recycling center representative, and/or Green Star of Interior Alaska employee to visit your school for educational presentations.

Extension 3

Start a School Recycling Club!

BACKGROUND INFORMATION:

For this extension, students are encouraged to start a school recycling club to learn about recycling and to serve as the recycling leaders at school and within the community. By implementing a recycling program, students can help their school or school district reduce waste, improve resource management, and foster student achievement.

OBJECTIVES:

Students will:

- apply their math, science, social studies, and communication skills
- build teamwork and problem-solving capabilities

MATERIALS NEEDED:

To become a Resourceful School you'll need:
- leadership
- a convenient system
- some equipment
- partnership with a hauler who will serve your recycling collection needs

PROCEDURE:

Part 1: Do your homework

1. Assemble a team: Planning for your school recycling program must include the custodial staff, students, teachers, parents, school administrators, and a representative of a local community recycling program. Student organizations, such as the National Honor Society, Beta Club, Builders Club, 4-H Club, or environmental/ecology clubs are often successful at maintaining school recycling efforts.
2. Analyze the trash: Conducting an assessment of your school's waste stream can identify the type, quantity, and/or origin of the potential recyclable materials. This information can assist your team with formulating school recycling goals and procurement of recycling containers and/or other needed materials. Students should complete the assessment with guidance from a teacher(s). An assessment can be done simply by recording the contents of an individual classroom, or a sampling of classrooms can participate in an assessment by sorting and weighing discarded trash. Once the trash is sorted and weighed, it can be multiplied by the number of classrooms for an estimate of the amount of trash and recyclable materials being discarded. Adding the waste from the library, computer labs, offices, cafeteria and other parts of your school will lead to a more accurate estimate of the total amount and type of waste in your school.
3. Identify a hauler for your recyclable material: IT IS CRITICAL to determine how the recyclable material will be removed from your school.
4. Establish a recycling goal: Make sure the material or materials you identify for recycling can be managed and processed locally.
5. Develop a budget for your program. Potential start-up costs of your school recycling program may include: recycling bins, signage, staff and teacher training, awards or incentives, and other miscellaneous materials, such as posters, bulletin board decorations, books, activity materials, etc.
6. Getting Approval: The success of a strong recycling program depends on the support of your administration. Strong administrative support can provide credibility to your program and designated staff time and/or money for the program. Student achievement and economics heavily influence administrative decisions. Make sure your team creates a program proposal that connects the recycling program to the Alaska state teaching standards and showcases potential economic benefits (money saved and/or earned by your program).

Extension 3 (continued)

Start a School Recycling Club!

Part 2: Organize the recycling collection and storage system

1. Map the School: The custodial staff will know where trash is being discarded. The recycling team should shadow the custodian and map the trash collection route or location of the trash cans in classrooms, offices, library, and cafeteria. Determine the space needed (inside the classrooms and for outside storage) to implement the recycling program. This will help the team determine how many bins to make and/or purchase and the ideal placement of the recycling containers in your school. Share the map of the proposed recycling container locations with parents, students, teachers, and school administration for feedback.
2. Questions to ponder about storage and collection systems for recyclable materials:
   - What type of collection containers will be needed for the classrooms, halls, storage areas, etc.?
   - Will the recyclable materials be picked up by a hauler? As an alternative, will a designated person (school staff member, parent, and/or high school student) from the school deliver the recyclable materials to the processor?
   - Does the school have indoor space to use as a collection and storage center? If not, is there space for a large outdoor container?
   - How will the recyclable materials be moved from the classrooms to the collection and storage areas? How will the collection and storage bins be moved outside for pickup?
   - How will the custodian be involved?
   - If an outdoor recycling bin is needed, will there be room for the truck to maneuver and empty the container?
   - How will contamination of the recyclable materials be prevented?

Part 3: Educate and Promote

This is the most important step for the success of an enduring school recycling program.
The entire school will need information on how and what to recycle. Presentations, made at a school assembly or in individual classrooms, should include the following: the locations of the collection and storage bins, the materials that can be recycled, how the system will work and the benefits of recycling. Remember that each school year students, teachers, school staff, and parents will need information about the program. Most importantly, recycling programs should be based on Alaska's teaching standards to ensure sustainability and to ensure support from the school district and parents.

Part 4: Begin Recycling!

If the above steps have been followed, your well-designed and supported recycling program is off to a GREAT start! Don't forget to keep the goal(s) with all the milestones surpassed in a prominent spot in your school to motivate the students, teachers, parents, and staff to achieve the goal. The goal(s), along with the results, is a powerful tool to include in a grant or award application.

Note: If there are no local recycling services in your school district in which your school is located then traditional recycling at your school may not be practical. Students, parents, and school staff should contact local government officials to discover if recycling can become a reality in your community – educate your local leaders about the benefits of recycling.

Extension 4

Alaska's Forest and Logging Industry Research

BACKGROUND INFORMATION:

Alaska's forest products industry provides hundreds of jobs and contributes millions of dollars to the state's economy. It was once a larger industry, when harvesting of the Tongass National Forest (TNF), the largest national forest in the U.S., was unrestricted. Within the last two decades, cutting of old growth in the TNF was limited to conserve the forest for other uses. Many trees within the TNF are currently not old enough to harvest. Logging has contracted in Southeastern Alaska, but not elsewhere in the state. Explore where logging is taking place, and who is managing the lands other than Tongass National Forest.

OBJECTIVES:

Students will:

- use appropriate tools and techniques to gather, analyze, and interpret data

MATERIALS NEEDED:

- internet access for research

PROCEDURE:

1. Have students research where forests exist in Alaska, how far north trees grow, who the landlords of the forest are, and where the logging industry is most concentrated.

2. Describe how large the logging industry is:
   - How much wood is harvested each year?
   - How much wood is made into pulp, lumber or energy?
   - Is the logging industry growing or declining in Alaska?

See http://www.akrdc.org/forestry for information.

Extension 5

Public Awareness Campaign

BACKGROUND INFORMATION:

Students will produce a public awareness campaign (brochure, poster, and/or presentation) to inform their community about how to recycle locally and to motivate the public to recycle.

OBJECTIVES:

Students will:

- understand that publicity is crucial for promoting recycling-associated policies and the success of recycling programs
- recognize that in order to raise environmental awareness and increase recycling efforts there needs to be quality and easily understandable information available in order for people to get involved
- foster a sense of responsibility and "proactive citizenship," so that when students become adults they will make choices that help the environment rather than harm it

MATERIALS NEEDED:

- brochure, poster, and/or presentation materials for campaign
- access to internet for research

PROCEDURE:

1. Explain to students that raising public awareness is a function of public relations that focuses on providing information about a particular subject (in this case, recycling) so your target audience can make their own educated decisions and (hopefully) back your cause.

2. Creating a plan is the second step in conducting a public awareness campaign. The plan should determine the target audiences, create the objectives, and define the strategies. Establishing target audiences are essential to the success of your campaign. Keep in mind, "the general public" is not a reasonable target audience. Think through what group of people will make the biggest impact, both positively and negatively, on your cause, then prioritize those audiences.
   The Public Awareness Campaign should:
   - Use facts and information from the local community
   - Give compelling reasons for recycling
   - Give accurate and complete information about how and where to recycle
   - Be visually pleasing
   - Be well organized
   - Communicate effectively

3. The next part of the planning process is creating objectives that focus on what attitudes or opinions you want to achieve from your target audiences. Make sure your objectives are specific, measurable, attainable, relevant, results-orientated and time specific so you can effectively evaluate the success of your campaign. Then create strategies that describe how you want to reach your objectives.

4. Once the plan is in place, begin to execute. This is where the exciting things happen like events, speaking engagements, videos, branding, brochure/poster/presentation creation, etc. During this step is when you are accomplishing tactics based off your objectives and strategies.

5. The last step is evaluation. What worked? What didn't? Were you successful?

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