



MIND MAPPERS

MAKING DIFFICULT SUBJECTS **EASY TO UNDERSTAND**

How Do We Stop Climate Change?

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Ages 8 & up | Grades 3 & up

Teacher's Guide

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OVERVIEW

This teacher's guide addresses the Next Gen Science Standards and Common Core State Standards outlined, for reference, at the beginning of each lesson. Some lessons and activities are whole class, others are designed for small group instruction, and a few are individual or team tasks. They do not have to be taught sequentially; however, they do coincide with the order of the themes covered in the *How Do We Stop Climate Change?: Mind Mappers: Making Difficult Subjects Easy to Understand*.



LESSON 1: K/W/H/L Anchor Chart-Activating Prior Knowledge, Formulating Scientific Questions, Researching, and Gathering Information (before reading the book)

Goal	Create a whole-class generated anchor chart of what students know, wonder, how they will find out, and what they've learned about climate change.
Objectives	Students will activate prior/background knowledge on the subject of climate change, list their questions about the topic, define how they will learn about their wonderings, and circle back to what they eventually learn after engaging with the text.
Time-Allowed	Allotted 25-30 minutes
Prep / Materials	Four column Anchor Chart labeled Know/Wonder/How/Learned (optional: subheadings "What We Already Know," "What We're Wondering," "How Will We Find Out?," "What Did We Learn?")
Next Gen Science Standards: Crosscutting Concepts-Stability and Change	Small changes in one part of a system might cause large changes in another part.
Common Core State Standard CCSS.ELA-LITERACY.W.6.2	Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content. (monitor understanding)
Common Core State Standard CCSS.ELA-Literacy.RI.2.1	Ask and answer such questions as who, what, where, when, why, and how to demonstrate understanding of key details in a text.
CCSS.ELA-Speaking & ListeningsL4.1	Engage effectively in a range of collaborative discussions (1:1, in groups, and teacher-led) with diverse partners on grade 4 topics and texts, building on others' ideas and expressing their own clearly.

Step 1: KNOW: Before reading the book, engage students in active thinking to determine: "What do we already Know?" Students can turn and talk (think-pair-share) and then identify and make connections to their prior knowledge about climate change. If misconceptions and/or disagreements arise, allow for those musings to formulate questions for further investigation. Record on the anchor chart. Option: share the pen and let students write either directly on the chart or on sticky notes that they post on the chart.

Step 2: WONDER: What do we want or need to find out? Students drive the learning by stating what they want to know about climate change. What do they Wonder? Do a "Think Aloud" that shows students how to revise their wondering into scientific questions to be investigated. Developing essential questions may mean eliminating less relevant wonderings from the brainstormed list if those cannot be answered in this particular unit of study and/or do not pertain to climate change. Again, record/scribe or have students write these on the anchor chart.

Step 3: HOW: How are we going to find out? Students list resources and plan how they will gather the information they need to answer these essential questions. Try listing primary (e.g., observation, measurement, exploration) and secondary (e.g., internet searches, books, interviews with scientists) resources. Record the "how" in the correct column.

Step 4: LEARNED: After completing the lessons outlined and reading the book, fill in the What Did We Learn? column. Students will summarize their new knowledge on the topic of climate change. You can adapt these statements as answers to their previously formulated questions. This often leads to asking more essential questions which require further investigation and/or a class consensus of opinion.

An example of the K/W/H/L chart is below:

CLIMATE CHANGE

KNOW <i>What do I know?</i>	WONDER <i>What do I want to know?</i>	HOW <i>How do I find out?</i>	LEARN <i>What have I learned?</i>
We know that the Earth is warming up.	How fast is it warming up?	Read the book, research online, & ask experts about rate of global warming.	(Later on): We learned that...

LESSON 2: Venn Diagram Anchor Chart of Climate vs. Weather p. 7

Goal	Create a whole-class generated Venn diagram, using the information in the text, to distinguish between climate and weather.
Objectives	Students will compare and contrast the characteristics of weather and climate and be able to define them both after the activity.
Time-Allowed	Allotted 25-30 minutes
Prep / Materials	Prep/Materials Venn Diagram Anchor Chart labeled climate vs. weather (optional: sticky notes with characteristics listed in book prewritten)
Next Gen Science Standard 3.ESS.2.1	<p>Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season.</p> <p>ESS2.D: Weather and Climate-Scientists record patterns of the weather across different times and areas so that they can make predictions about what kind of weather might happen next.</p> <p>Patterns: Patterns of Change can be used to make predictions.</p>
ESS2.A: Earth Materials and Systems	<p>Earth's major systems are the geosphere (solid and molten rock, soil, and sediments), the hydrosphere (water and ice), the atmosphere (air), and the biosphere (living things, including humans). These systems interact in multiple ways to affect Earth's surface materials and processes. The ocean supports a variety of ecosystems and organisms, shapes landforms, and influences climate. Winds and clouds in the atmosphere interact with the landforms to determine patterns of weather.</p>



Step 1: Read p. 7 aloud to the students.

Step 2: Reread the page, asking students to make a C with their hand for Climate or a W with their hands for Weather to indicate if that particular characteristic belongs to climate or weather.

Step 3: Either a) write the characteristics on each side of the Venn diagram; b) share the pen and have kids write them; or c) use prewritten sticky notes to have kids place the characteristic on the correct side.

Step 4: Optional: Students can complete their own Venn Diagram, either in groups or individually (see below) *Active Engagement of Visual and Kinesthetic Learning Modalities

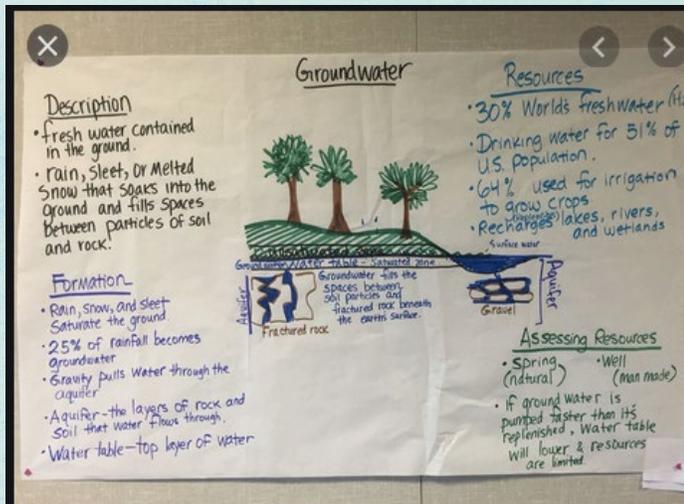


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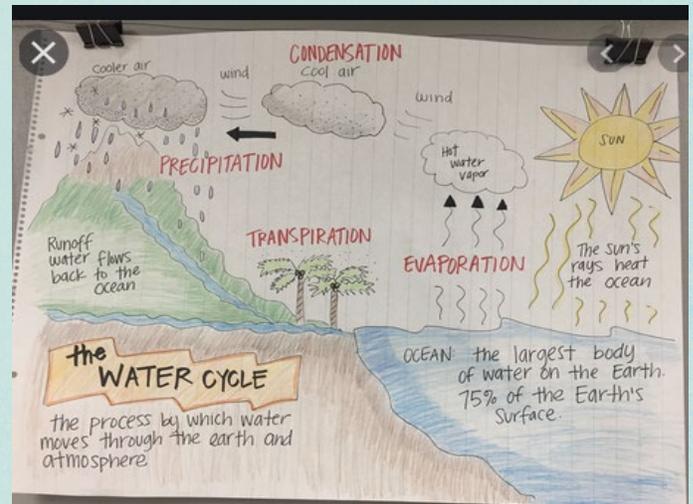
LESSON 3: Pictorial Input Chart of the Water Cycle p. 8

Goal	Create a visual graphic of the water cycle, using the information in the text on page 8.
Objectives	1) Make vocabulary and concepts comprehensible and accessible to students; 2) Draw in front of the students for brain imprinting; 3) Organize information so it is a visual resource for students.
Time-Allowed	Allotted 30 minutes
Prep / Materials	Chart paper, pencil, markers, sticky notes (optional)
Next Gen Science Standard: 5-ESS2-1.	Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.

Example from 3-5



Example K-2



Step 1: Before students arrive, lightly sketch the water cycle in pencil, labeling the key vocabulary words and their definitions. Option: prep sticky notes with vocab words and definitions for students to place on anchor chart.

Step 2: Using page 8 in Mind Mappers, walk students through the key vocabulary and definitions of the water cycle. Upper grade students may be able to delve more deeply into erosion, transpiration, and water resources (see example above for 3-5).

Step 3: Have students either act out (kinesthetic) or draw their own water cycles (visual) to check for understanding.

Step 4: Place as anchor chart in the room.



LESSON 4: Seasons Poetry p. 10

Goal	Create poetry about each season.
Objectives	1) Demonstrate an understanding of the essence of each season; 2) Utilize alliteration; 3) Use onomatopoeia
Time-Allowed	45 minutes (15 min mini-lesson; 20 min write; 10 min share & chart)
Prep / Materials	Chart paper, pencil, markers, lined paper for students
Next Gen Science Standard (related) 3-ESS2-1.	Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season.
ESS2.A: Earth Materials and Systems	Write informative/explanatory texts to examine a topic and convey ideas and information clearly. Use precise language and domain-specific vocabulary to inform about or explain the topic

Step 1: Read page 10 aloud. Stop to discuss each season.

Step 2: Share this sample poem. Then, tell the students that they are going to write their own poems in pairs. Evenly divide students amongst the seasons (i.e., not all pairs can write about summer).

Winter:

*BRRRR! Chilly, cold, chattering chin.
Snow sparkles as shadows show snowmen
Will winter wind whisk away my homework?*

Step 3: For each season's poem, tell students that they must use a word that is onomatopoeia (a word that sounds like the sound associated with it). They also should include words that show alliteration or more words in a row that start with the same sound).

Step 4: Students pair up, write their poem, and then share with the class. Fill in the grid below (with student input) as poems are read aloud.

SEASON	ONOMATOPOEIA	ALLITERATION
Fall		
Winter	BRRRR!!!	Ex: Chilly, cold, chattering chin; Snow sparkles as shadows show snowmen; Will winter wind whisk
Spring		
Summer		



LESSON 5: List-Group-Label (Vocabulary Organization about Climate Zones) p. 12

Goal	Engages students in a three-step, hands-on, minds-on process to organize their understanding of content area vocabulary and concepts, providing them with away to grasp the relationships between words and concepts.
Objectives	Make words come alive through group conversations in which students reflect on the “meaning connections” between words. Actively engage students by building new vocabulary and content knowledge using critical thinking skills.
Time-Allowed	30 minutes (10 min read aloud; 20 min group activity)
Prep / Materials	Note cards, groupings of students, tiered vocabulary pulled from text
Next Gen Science Standard: LS4.D: Biodiversity and Humans	Populations live in a variety of habitats, and change in those habitats affects the organisms living there.

Step 1: READ page 12 to students aloud. Recap the main concept after reading the passage (i.e., rainforest, tundra, desert, prairie grasslands, savannah, etc.)

Step 2: LIST: Ask students to brainstorm all of the words related to the topic of climate zones. Record student responses or have them write each word on a note card (one note card/vocab word per group). Do not correct students' word choices. Some responses may not relate to the main concept but, hopefully, they will figure that out they start grouping words in the next step.

Step 3: GROUP: Divide the class into small groups of 3-5 students. Each group collaborates to put the words into subcategories. As categories emerge, prompt students to explain their rationale for placing those particular words in a group or moving them to a different group. Great conversations can evolve about words that don't immediately fall into one of the categories.

Step 4: LABEL: Challenge students to come up with a title or label for the subgroups of words they have organized. The labels should speak to the reasoning for the grouping. *Option: as a final display, you can use paint chip sample cards from a hardware store and have students record the words on different shades/hues as a category.



LESSON 6: Cognitive Content Dictionary (CCD) with Tiered/Academic Vocabulary

Goal	Introduce students to new vocabulary in an encouraging way in order to increase comprehension and retention of content-based information in the text.
Objectives	Students will predict the meaning of scientific vocabulary, identify if they have heard or know words, define the new words, and use them in a sentence.
Time-Allowed	10 minutes daily
Prep / Materials	Markers, large butcher/roll paper, individual CCDs for students or groups (optional)
CCSS.ELA-Literacy.RL.3.4	Determine the meaning of words and phrases as they are used in a text, distinguishing literal from non-literal language.

Step 1: Make a large t-graph on butcher/roll paper with several rows for words. Create four columns (five if you are adding a picture clue column). Label the columns: WORD, PREDICTION, FINAL MEANING, ORAL SENTENCE, and (optional) PICTURE/CLUE. Write the first new vocab word in the first row under the WORD column. Right under that word (in the same row) make an “H,” an “NH” and a “K”. It is helpful to color-code this chart by column.

Step 2: Introduce the new word. For example, ask students if they have never heard of this word before (count and record the # of students next to NH). Then, ask students to raise their hand if they have heard this word, but don't know what it means or sort-of know what it means, but wouldn't be able to explain it (record that number next to the H). Finally, ask students to raise their hand if they know what the word means and can use it in a sentence (record that next to K).

Step 3: Ask student to think-pair-share/turn-and-talk about what they predict the word means. Record answers.

Step 4: Read a page from the text. Ask students if they can come up with a final meaning. (ex: p. 16 mesosphere)

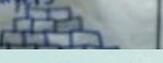
Step 5: Optional: add a visual/picture clue to remind students what the word means. Add a sentence using the word (preferably one a student comes up with). Record synonyms/antonyms. Add a new word, or two, daily.

*English Learner (EL) Additional Strategy: Add a column for cognates like huracán/hurricane, energía/energy

Example from page 16 of the book:

WORD	PREDICTION	FINAL MEANING	PICTURE CLUE	SENTENCE	SYNONYM	ANTONYM
Greenhouse (effect) NH = 12 H = 11 K = 5	A house that is green	The effect that happens in our atmosphere when gasses and other pollutants are trapped.		Greenhouse gases in the atmosphere include carbon dioxide, methane, and water vapor.	TBD (causes global warming)	



New Word	Prediction	Final Meaning
circulate NH-11 H-17 cir-cu-late (v) circulated, circulation, circulates, circulator, circulatory, circulator, circulatory	has to do with a circle Something that moves up and down to move, not on time	to form a circle or to move around in a circle 
diffuse NH-21 H-21 dif-fuse (v) diffused, diffuser, infuse, fusion, fuse, confuse	to blow up has to do with power Something you might not be sure about something	to spread over an area or substance 
stratification NH-6 H-24 strat-i-fi-ca-tion	-Something like Vegas something really high layers of matter	to form or arrange into layers 

COGNITIVE CONTENT DICTIONARY					
NEW WORD	PREDICTION	FINAL MEANING	PICTURE	SENTENCE	SYNONYM
• Have you heard of this word? • What is the part of speech?	• What do you think this word/mean?	• Define the word • Where did you find the word?	• Draw a picture of the word. • Why did you choose to draw that?	• How would you use this word in a sentence?	• Create a synonym for the word.

LESSON 7: Greenhouse Gasses: Cause and Effect T-Graph (p. 15-17)

Goal	Explain the cause and effect relationship between greenhouse gas emission and global warming, etc.
Objectives	Students will identify and be able to explain the greenhouse effect, global warming, and the cause and effect relationship between human activity and climate change. This will build content-rich nonfiction knowledge based on complex texts.
Time-Allowed	One hour (two 30-minute lessons) works well to divide up cognitive demand.
Prep / Materials	Chart paper, markers, book
Next Gen Science Standard: ESS3.C: Human Impacts on Earth Systems	Typically as human populations and per-capita consumption of natural resources increase, so do the negative impacts on Earth unless the activities and technologies involved are engineered otherwise.
MS-PS1-3.	Gather and make sense of information to describe that synthetic materials come from natural resources and impact society.
MS-LS2-4.	Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.
Disciplinary Core Idea: LS2.C: Ecosystem Dynamics, Functioning, and Resilience	Ecosystems are dynamic in nature; their characteristics can vary over time. Disruptions to any physical or biological component of an ecosystem can lead to shifts in all its populations.

Step 1: Read pgs 15-17 & 24-30 of the book either as a Shared Reading, in Small Group Guided Reading, or as a Whole Class Read Aloud.

Step 2: On the t-graph you've prepared, record students' thoughts as to the cause and effect relationship between greenhouse gas emissions, global warming, and other climate change effects (see sample below). You can place an arrow between the cause and effect to show this visually for students.

Step 3: Ask students to use academic language from this complex text, including citing evidence from the text, to demonstrate their understanding of the cause and effect relationship.



CAUSE	EFFECT
Chemical fertilizers for farming are used to grow crops on the same patch of land every year in order to produce more food, faster.	More and more greenhouse gases are released into the atmosphere, decreasing air quality, expanding the ozone layer, and making the temperature on Earth rise.
Forests are cut down to provide wood for fuel, as well as to clear land. The land is used to build towns, or to create farms for cattle (cows) or crops.	When trees are cut down to clear the land, they are often burned. When wood burns, carbon dioxide is released into the air.
(continue with different cause/effect topics from book)	



LESSON 8: Expert Groups-Changes in Weather, p. 34

Goal	Give students agency and gradually release responsibility for learning by forming expert groups on the following topics: wildfires, droughts, melting permafrost, hurricanes, floods, rising sea levels.
Objectives	Students work together in a focused “Expert Group” to research and write about one of the topics listed above. They then jigsaw, mixing with the other groups and each student teaches the others about their area of expertise with regard to climate change.
Time-Allowed	45 minutes, 2-3 separate days, totaling 1.5 hours-2.15 hours.
Prep / Materials	Books about each topic, information compiled on sheet for each group, and/or internet accessibility, heterogeneous ability groups, paper to record findings
Next Gen Science Standard 4.ESS3.-1	Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment. [Clarification Statement: Examples of renewable energy resources could include wind energy, water behind dams, and sunlight; non-renewable energy resources are fossil fuels and fissile materials. Examples of environmental effects could include loss of habitat due to dams, loss of habitat due to surface mining, and air pollution from burning of fossil fuels.]
LS2.C: Ecosystem Dynamics, Functioning, and Resilience	When the environment changes in ways that affect a place’s physical characteristics, temperature, or availability of resources, some organisms survive and reproduce, others move to new locations, yet others move into the transformed environment, and some die. (secondary)
Disciplinary Core Idea LS4.D:	Biodiversity and Humans Changes in biodiversity can influence humans’ resources, such as food, energy, and medicines, as well as ecosystem services that humans rely on—for example, water purification and recycling.
CCSSW.4.7	Conduct short research projects that build knowledge through investigation of different aspects of a topic.

Step 1: Briefly introduce the topics and the concept of Expert Groups. Read page 34 of book aloud. If you are familiar with expert groups, you can create a Process Grid first to chart basic information about each of the topics: wildfires, droughts, melting permafrost, hurricanes, floods, and rising sea levels.

Step 2: Allow students to decide which topic they want to focus on as an expert.

Step 3: Give students time to read, research, discuss, and synthesize information about the topic (1-2 sessions). You can create a sheet of information with more in-depth content on each topic if books are not available. Consider including expository text features such as bold print, subheadings, or graphs.

Step 4: With a template provided, regroup students into jigsaw groups (one student from each topic-group in each new jigsaw group). Students teach each other about their topic.



Example from page 16 of the book:

Wildfire: Definition	A massive, destructive fire that spreads quickly through trees or brush. It is often not planned, wanted, or controlled and takes place in an area of combustible vegetation in rural areas and urban areas.
Recent Wildfire Locations	California, Colorado, Oregon, Australia
Environmental Impact	Smoke from a wildfire decreases air quality in a region. People living nearby may need to shelter indoors and/or wear masks. Animals are often displaced. The fires destroy buildings and take lives. After they are under control, the loss of trees and plant life can cause landslides and erosion the next time it rains.
Specific Example	Northern California's Camp Fire was the deadliest U.S. wildfire in this century. The fast moving flames killed 48 people in the foothills of the Sierra Nevada mountains outside of Sacramento. Climate change has caused fire seasons to become longer. Fire season is a period of hot, dry weather that creates conditions for wildfires to spark and spread. There have always been wildfires. Some are started by lightning strikes, but others are sparked by campfires, cigarettes, car fires, or other human activity. A hundred and fifty years ago there were likely as many wildfires as there are today, but now more people live close together, and near nature. Controlled burning, by firefighters, and new rules about campfires need to be put in place. Being prepared is key.

Sample Process Grid About Changes in Weather:

CHANGE IN WEATHER	LOCATION	CAUSE	EFFECT	SOLUTION
Wildfires	California, Colorado, Oregon, Australia (forested areas that have high temperatures and/or are experiencing droughts)	1) Not enough rainfall/ dry brush 2) Higher temperatures (global warming) 3) Lightning because of warmer storms	1) Air quality decreases 2) Homes/businesses burn and are destroyed 3) Animals lose their habitat	1) Conserve water 2) Use public transportation, walk, or bicycle to school or work 3) Decrease pollution and demand on power grid



LESSON 9: Climate Change Superhero Solver (p. 46-61)

Goal	Read about and discuss ways in which students can stop climate change from happening.
Objectives	Students will identify and pick one way in which they can concretely have a role in halting climate change.
Time-Allowed	45 minutes: 25 minute read aloud, 20 minute integrated discussion after each topic, including a 2 min think-pair-share before final share out
Prep / Materials	Book, chart paper
Next Gen Science Standard: 3-LS4-4.	Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change.
Next Gen Science Standard: 3-ESS3-1.	Make a claim about the merit of a design solution that reduces the impacts of a weather-related hazard.
Next Gen Science Standard: 5-ESS3-1.	Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.
Disciplinary Core Ideas MS-LS2-5	Evaluate competing design solutions for maintaining biodiversity and ecosystem services.

Step 1: Chunk the material from pages 46-61, pausing to discuss each topic along the way: energy use, reduce/reuse/recycle, wind/water/heat/light, reforestation/rewilding, etc.

Step 2: Ask students to turn and talk about which way they will become a Climate Change Superhero Solver. Push them to articulate why they chose that particular solution as their first step. Is it the easiest? Do they already recycle at home?

Step 3: Diversity, Equity, and Inclusion: make sure to include a discussion about the new technology (solar, wind, etc.) and if these are prohibitive for their families because of cost. Talk about the long-term savings vs. short-term investment.

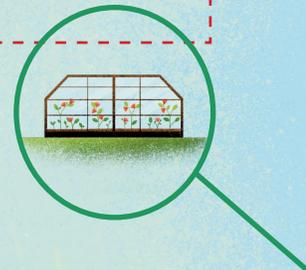
Step 4: Record each student's goal and circle back to this chart for accountability. You can also make a class goal like composting food scraps from snack/lunch or using less energy by turning off the lights more.



LESSON 10: Carbon Footprint Tech Check (p. 48-50)

Goal	Learn more about carbon footprints and how to decrease them.
Objectives	Students will a) reflect upon and record their carbon footprint; b) write a report in a science “journal” using tech like Flipgrid, Jamboard, or Mentimeter; c) compare and evaluate peers’ notes and observations about their carbon footprints.
Time-Allowed	Week-long, 20 minute mini-lesson, 5-10 minute check in daily
Prep / Materials	Book, technology App such as Jamboard, etc. as shared platform
Next Gen Science Standard: Influence of Science, Engineering, and Technology on Society and the Natural World	All human activity draws on natural resources and has both short- and long-term consequences, positive as well as negative, for the health of people and the natural environment.
Next Gen Science Standard: 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.

Example of Jamboard



Step 1: Create Jamboard in which students can record their initial goal (e.g., focus on recycling).

Step 2: Read pgs. 48-50 about carbon footprint and discuss with class to ensure understanding.

Step 3: Have students decide on their focus for carbon footprint reduction.

Step 4: Have them record it in the Jamboard, adding to it daily with totals (e.g., # of bottles recycled, buy steel bottle).

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