

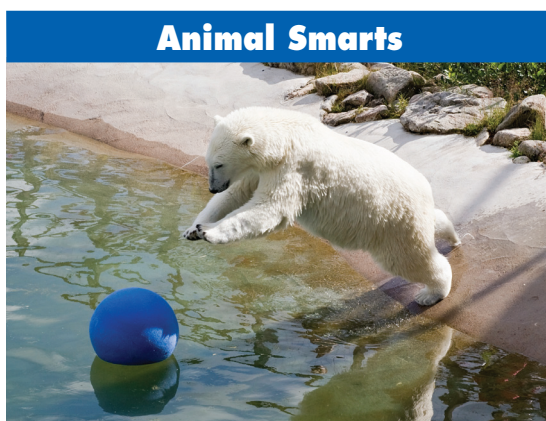


KIDS' SCIENCE CHALLENGE

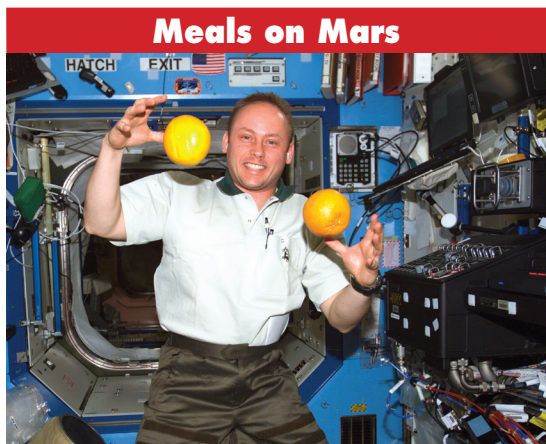
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KIDS' SCIENCE CHALLENGE

LESSON PLANS

ZERO WASTE

Introduction

This guide contains four hands-on, project-based lessons, which will develop students' awareness of the field of sustainable packaging. Students will become aware of the problems we face because of over-packaging including overcrowded landfills, needless use of energy and natural resources, and litter. They will learn the three R's of responsible waste management – reduce, reuse and recycle. They will also learn that some packaging is necessary and while it is best to reduce where possible, some packaging must exist in order to keep products fresh, safe and transportable. They'll find out about innovations in packaging and how sustainable packaging uses less energy to produce. They'll learn that when it's ready to be discarded, it will cause less harm to our Earth.

The four lesson plans are:



Lesson 1 – Grades: 3 – 6

Packaging 101

Students think outside of the box while they're introduced to topic of sustainable packaging. They learn the benefits of packaging and the three rules of sustainable living – reduce, reuse and recycle.



Lesson 2 – Grades: 3 – 6

Lunch Weigh In

Students will find out that lunch is not all sandwiches, apples and chocolate chip cookies. Packaging makes up a large portion of students' lunches. Your students will discover exactly how much.



Lesson 3 – Grades: 3 – 6

Trash Pie

Students will monitor classroom garbage to find out what makes up most of the waste in the class. They'll measure the data and create a classroom pie chart to share the trashy results.



Lesson 4 – Grades: 3 – 6

Garbage Gone Wild

Students learn about the harm that litter can do to the environment. Then they will think of ways that they can help win the battle against loose litter as they fight to save the planet from garbage gone wild.

National Standards

The following standards are covered by the lessons in this Lesson Plan.

Standards Alignments:

ZERO WASTE

Lesson – Grades: 3 – 6

Packaging 101

SCIENCE STANDARDS

- Understanding about scientific inquiry
- Properties of objects and materials
- Populations and ecosystems
- Distinguish between natural and human-made objects
- Understanding about science and technology
- Populations, resources, and environments
- Natural hazards
- Science and technology in society

MATHEMATICS

- Represent and interpret data

SOCIAL STUDIES

- Science, technology and society

Lesson 2 – Grades: 3 – 6

Lunch Weigh In

SCIENCE STANDARDS

- Understanding about scientific inquiry
- Properties of objects and materials
- Distinguish between natural and human-made objects
- Understanding about science and technology
- Populations, resources, and environments
- Risks and benefits
- Science and technology in society

MATHEMATICS

- Solve problems using the four operations
- Represent and solve problems using multiplication and division
- Generate and analyze patterns
- Represent and interpret data

SOCIAL STUDIES

- Science, technology and society.

Lesson 3 – Grades: 3 – 6

Trash Pie

SCIENCE STANDARDS

- Understanding about scientific inquiry
- Properties of objects and materials
- Distinguish between natural and human-made objects
- Understanding about science and technology
- Populations, resources, and environments
- Risks and benefits
- Science and technology in society

MATHEMATICS

- Solve problems using the four operations
- Generate and analyze patterns
- Represent and interpret data

SOCIAL STUDIES

- Science, technology and society
- Production, distribution and consumption

ENGLISH LANGUAGE ARTS

- Integration of knowledge and ideas

Lesson 4 – Grades: 3 – 6

Garbage Gone Wild

SCIENCE STANDARDS

- Distinguish between natural and human-made objects
- Understanding about science and technology
- Populations, resources, and environments
- Natural hazards
- Risks and benefits
- Science and technology in society

MATHEMATICS

- Represent and interpret data

SOCIAL STUDIES

- Science, technology and society
- Production, distribution and consumption

ENGLISH LANGUAGE ARTS

- Reading informational text
- Integration of knowledge and ideas

Kids' Science Challenge received advice and support for the Zero Waste Topic from the Sustainable Packaging Coalition - GreenBlue and Design and Source Productions distributor of Terraskin®.



Packaging 101



Lesson 1 – Grades: 3 – 6

Packaging 101

Time: 45 minutes

Objectives

- Students will identify different kinds of packages
- Students will understand that certain packages can be recycled
- Students will research some environmental problems caused by packaging
- Students will explore practices that go into sustainable packaging and understand why sustainable packaging is less harmful to the environment

Overview

Packaging is all around us. Almost everything we buy and use comes packaged. While students come into contact with packaging every day, they likely do not think about the packaging they are using or its potential impact on the environment. Used, empty packaging makes up more than two thirds of what we throw away. Much of what students buy is over-packaged. More packaging is used than is needed to protect or transport the product. Yet some packaging is necessary to keep food products from rotting and other products from breaking.

In this lesson, students learn the basics of packaging and are introduced to the concept of sustainable packaging.

What You Need

- Different kinds of packaging that students bring from home
- Tables for sorting
- Packaging Life Cycle Loop graphic (see page 6)
- Markers for signs
- Package Investigation Worksheet
- Latex gloves (optional)

Wrap Rap

Packaging makes
up about 65%
of household trash

Before the Lesson Begins

You will need to read about the recycling rules in your community to guide students to understand what can and what cannot be recycled. Look up what the different recycling symbols mean and share the information with your students. Then tell them which symbols can be recycled locally. If your town is not recycling research why it is not doing so.

What You Do

1. Before the day of your lesson, ask students to bring in a variety of packages from their homes.
2. Set up a K-W-L chart to find out what students KNOW, what they WANT to know, and, at the end of the lesson, what they have LEARNED.
3. Ask them to talk about what they already know about packaging. Ask probing questions such as:
 - What kinds of products do you buy in packages?
 - What is the point of packaging? How does it help the products?
 - Why would one product use one kind of packaging and a different product use a different kind of packaging? Is all packaging the same? What makes it the same or different?
 - What kind of information is printed on packages? Why is it there?
 - What do you think is meant by the term “over-packaging”?
4. Show students the Packaging Life Cycle Loop graphic. Explain the term “life cycle” by comparing it to the life cycle of a butterfly or even a human. Then point out each stage in a package’s life cycle as illustrated in the graphic. Introduce the term “sustainable packaging” Sustainable packaging is safe and healthy for the community at every stage of the package’s life cycle. This means using less energy and fewer resources to make the package. It also means that the package won’t end up polluting the environment when it’s done being used. Perhaps the package can be composted or recycled, or maybe it can even be used for something else.
5. Lay out all the packages students have brought in on tables or desks. You may want children to wear latex gloves to handle the packages in case any have not been cleaned. Have them look at the different packages.
6. Ask for some volunteers to create six signs. (You could use cardboard from the packages to make them.) The signs should say; Paper; Plastic; Metal; Glass; Mixed; Other. Set up the signs around the sorting table.
7. Give students time to sort through the different packages. Then allow students to pick packages and bring them to the area where they belong, according to their signs. Have them keep going until all the packages have been sorted.
8. Look through each of the piles and discuss the packages. Which of these packages can be recycled? Share the information you learned when you researched your community’s recycling rules. Which of these packages can be reused? Can they find examples of sustainable packages? How can they tell?
9. Have each student choose one package to study in more detail. Ask them:
 - What is the purpose of this package?
 - What materials were used to make this package?
 - What might happen to this package after the product is used?

Then hand out the Package Investigation Worksheet and ask them to fill it out (this will take about 10 minutes).

10. Come back together as a group and share some of the information from their worksheets. What have they learned about their packages? What can they say about packaging in general? Use the KWL chart and fill in the last column “Learn”. What have students learned about packages that they hadn’t known before? Does any of this new information differ from what they originally had thought?

Wrap Up and Reflect:

Ask students to recall the new vocabulary they learned in the lesson. Have them reflect on the meaning of a life cycle as applied to the life of a package. Can they remember the stages of a package's life cycle? What does it mean to be sustainable? Can they provide examples of sustainable packaging? Why is it a good idea to buy products that use sustainable packaging? What is recycling? How is recycling done in your community? Ask them to think about the package they studied. Was it a sustainable package? What could they do to make that package more ecologically friendly?

Extend:

Set up a recycling center in your classroom. As a class, research the specific recycling rules in your community. Then designate an area of your classroom for recycling, Sort the packages that can be recycled. Teach your students to identify the recycling symbols that indicate a package can be recycled. You may want to designate an area for packages that can be reused and create criteria for reuse. Invite the custodian into your classroom to talk about the recycling program that already exists in your school building, if any does. What gets recycled and what doesn't? How does it work? Can it be extended? Visit a recycling center if one is nearby. Most have classroom programs that provide an up close and personal look at the recycling process and the mountains of trash on its way to becoming treasure.

Brain Squeezer

The word "sustainable" literally means "capable of being sustained, or held up, supported, kept going" Why do you think the term "sustainable packaging" describes packaging that is better for the environment?

Packaging Life Cycle Loop

Name _____ Class _____ Date _____



K-W-L Chart

What do you KNOW?	What do you WANT to know?	What have you LEARNED?

Packaging Investigation Worksheet

Name _____ Class _____ Date _____

Directions: Study your package. Fill in the answers below. If you can't answer a question, leave it blank. Decide how to make your package more sustainable.

Name of product: _____

Type of product: _____

Type of package: _____

Material(s) used for package: _____

Where do you think the package comes from? Is that far away?

How does the package help the product? _____

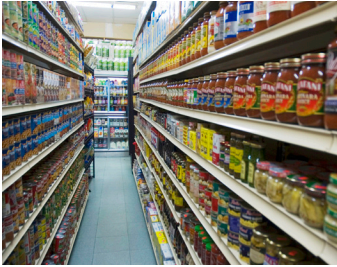
What will happen to the package now? _____

Is this a sustainable package? _____

If it is not, how can you change it to make it sustainable? If it is, what can you do to make it more sustainable? _____



The Lunch Weigh-In



Lesson 2 – Grades: 3 – 6

Lunch Weigh In

Time 45 minutes for the lesson, 45 minutes to eat lunch in between

Objectives

- Students will recognize that they are contributing to the garbage problem by using disposable lunch bags
- Students will use skills such as observation and measurement to estimate the amount of waste they generate
- Students will brainstorm ways to reduce their lunchtime waste

Overview

Parents love things that are convenient – it makes their busy lives a little easier. But many parents pack their children’s lunches using single-serving containers and non-recyclable items such as juice boxes and plastic sandwich bags. Much of the nation’s trash comes from packaging from our food. Lunches make up a significant proportion of that trash. On average, children who take lunches to school in disposable containers with single-use packages make 67 pounds of waste every school year per child. That ends up totaling about 18,760 pounds of garbage from lunch per year for just one average-size elementary school!

This is an easy problem to fix. Lunches can be packaged in reusable containers that can be taken home, cleaned, and used again. Students can use reusable lunch bags and water bottles. Items that cannot be used again can be brought home and cleaned and recycled. But first children need to become aware of this problem a problem that they themselves are contributing to but one that they can also help to fix.

What You Need

- Students’ regular lunches
- Classroom scale(s)
- Chart paper and writing paper
- Pens and pencils
- Lunch Detectives chart

Wrap Rap

Each person in the United States creates, on average, 4.6 pounds of waste each day. That equals 230 million tons of trash every year! Only one quarter of that trash is recycled, even though much more can be.

What You Do

1. Talk to your students about how much garbage they think they are responsible for producing. Ask them to brainstorm when it is that they might be responsible for creating all that garbage. Ask them if they think their lunches are environmentally friendly or a source of extra garbage. Explain that it is better to produce less garbage. Once garbage is produced, if it is not recycled, it ends up in landfills or incinerators. Garbage in landfills stays around for a long time without breaking down, and many landfills are no longer accepting new garbage. Also, landfills can leak waste into the water running below it. This can pollute a community's water supply. Incinerators burn garbage and pollute the environment by leaking poisons into the air.
2. Before lunchtime, ask your students to weigh their lunch bags. Hand out the Lunch Detectives chart and have them follow the directions on their worksheets. They will start by filling in their lunch weights. If you have more than one scale, groups of students can take turns helping each other weigh in. Ask students who purchase lunch from the school cafeteria to do the same if possible.
3. As students unpack their lunch bags, have them continue to fill in their charts, recording the types of packaging they find in their lunches.
4. Ask students to sit together during lunch and discuss ways that they can protect the Earth from too much garbage. Ask them to brainstorm what they can do to use less packaging and make less garbage.
5. When lunch is over, students will continue to follow the directions on their Lunch Detectives chart. They will weigh what's left over after they take out any reusable containers or food waste. Are they left with plastic bags? Foil wrappers? Paper bags? Have students fill in the final weight. That number represents the amount of disposable packaging produced by your students' lunches.
6. Then have them do the math to subtract the end weight from the beginning weight. The result represents how much of the lunch is actually food.
7. Was the weight of the food greater or less than the weight of the packaging? If the weight of the packaging was more, that's a good indication that there is too much packaging in the lunches. They can tally their scores and find out what kind of lunches they have.

Wrap Up and Reflect:

Have students compare results and discuss. Who had the least waste? What was the weight of that lunch? What was in it? What kinds of packages accounted for most of the packaging waste? What ideas do students have for cutting down on their lunch garbage?

Extend:

Ask students to try this activity again a week later. This time give them advanced warning. Now that they've had a chance to reflect on this activity, are they and their parents able to create a lunch that makes less waste? Weigh in again and find out if your students have learned how to have a healthy lunch for their bodies as well as the Earth.

Wrap Rap

The juice box arrived in the
United States in 1980. Today, more
than 25% of all the juice we
drink comes in a box. Most juice
boxes cannot be recycled.

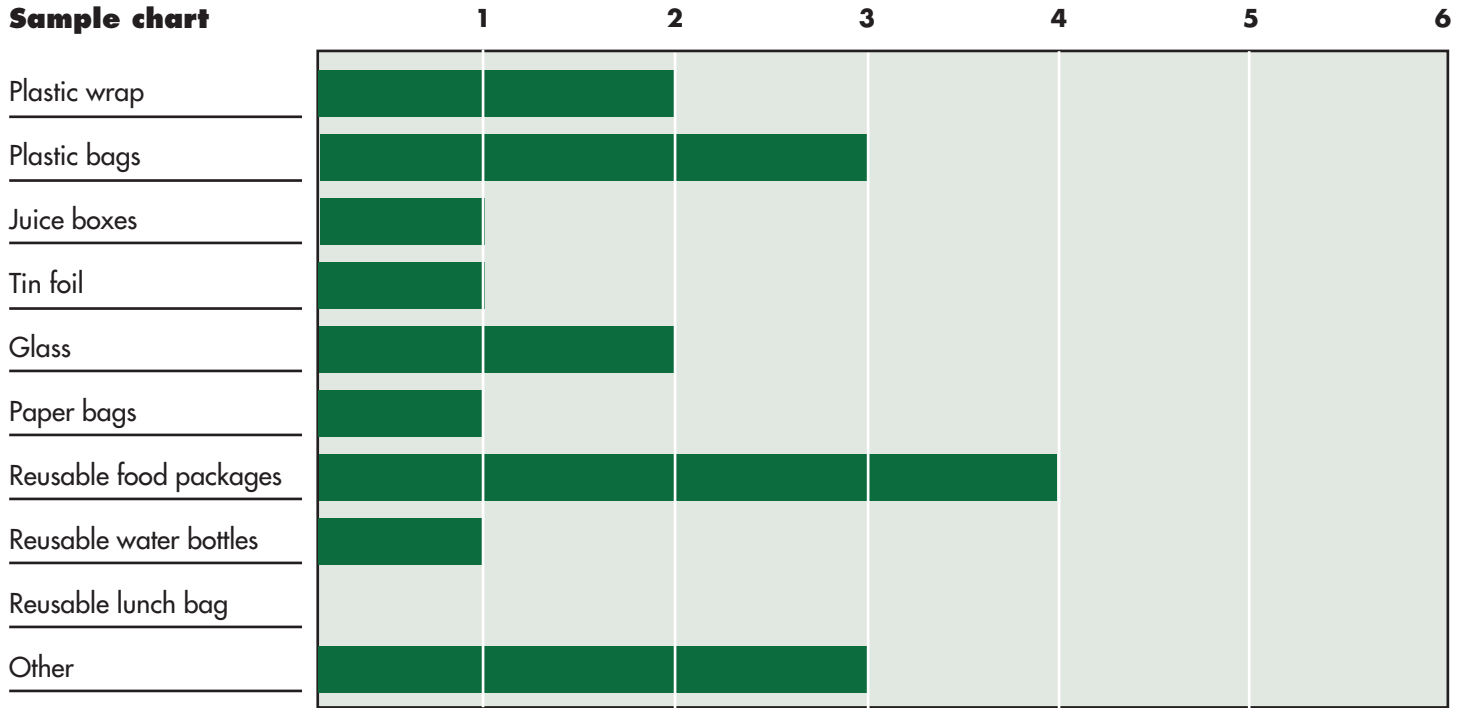
Lunch Detectives

Name _____ Class _____ Date _____

Directions: Weigh your lunch before and after you eat it. Follow directions and write down how much your lunch weighed and how much your lunch garbage weighed.

Make a chart that shows the kinds of packaging in your lunch. Draw a bar showing how many of each kind of package you had in your lunch.

Sample chart



My lunch waste chart

	1	2	3	4	5	6
Plastic wrap						
Plastic bags						
Juice boxes						
Tin foil						
Glass						
Paper bags						
Reusable food packages						
Reusable water bottles						
Reusable lunch bag						
Other						

A. Weigh your lunch before you eat.

How much does it weigh? _____

After lunch it's time to weigh your garbage!

B. Weigh your lunch after you eat.

(Don't weigh any packages or bottles that you will re-use another day. Don't weigh any food leftovers, such as apple cores).

How much do they weigh? _____

Score Sheet

Give yourself 10 points for every reusable package in your lunch. _____ points

If you had no packaging garbage left over at all, give yourself 20 points. _____ points

If "B" weighed less than one quarter of "A", give yourself 10 points. _____ points

If "B" weighed less than one half of "A", give yourself 5 points _____ points

If "B" weighed one half or more than "A", give yourself 0 points _____ points

Score Sheet

Now add up your points _____ points

How Did You Do?

- 0-5 points:** You are a Mystery Meat Garbage Special -- research how to pack your lunch with fewer packages and try again.
- 6-10 points:** You are a Three-Day Old Blue Cheese Salad – you can do better. Figure out how to use fewer packages.
- 11-20 points:** You are a Fresh Fruit Cobbler in a Recycled Box – good job using less packaging.
- 21 points or more:** You are a Five Star Lunch – show off your lunch bag and take a bow.

Wrap Rap

Plastic bags and other plastic garbage thrown into the ocean kill as many as 1,000,000 sea creatures each year.



Trash Pie



Lesson 3 – Grades: 3 – 6

Trash Pie

Time 30 - 45 minutes

Objectives

- Students identify the different kinds of garbage that are thrown away in the classroom
- Students compare and contrast classroom garbage to garbage produced at home
- Students brainstorm ways to reduce classroom garbage
- Students develop presentations to communicate information about garbage types

Overview

A certain amount of packaging is necessary to protect products and to keep food from going bad. But not all packaging is equal. Some products need only a small amount of packaging to protect them and other products need no packaging at all. Where packaging is discarded is also not equal. If there are not options for recycling. Can you recycle your water bottle at the mall? Do you recycle your newspapers at home?

Your students have a lot of control over what gets discarded in their classroom. They can try to choose products with less packaging and they can try to reuse the packaging garbage they create. But the first step to becoming a more sustainable user is to become aware of packaging garbage they create.

What You Need

- Classroom garbage
- Tables or desks covered in newspaper
- Paper
- Markers
- Latex gloves (optional)

Wrap Rap

Classroom garbage is different from garbage produced at home. A typical family uses 182 gallons of soda, 29 gallons of juice, 104 gallons of milk, and 26 gallons of bottled water each year. Where do all those bottles go?

What You Do

1. Have your class brainstorm the type of garbage they think they produce at school. List some ideas on a chart. How much of that garbage do they think is packaging? Tell them that well over half a typical pile of garbage is made up of packaging.
2. Ask students to put on the latex gloves. Gloves are optional but you may want your

students to wear them since they may be encountering food wastes, broken ink pens, newspapers, and other messy items. While you're protecting your students' hands, lay newspaper on your worktable to protect your classroom furniture as well.

3. Now allow students to take turns going over to the classroom garbage, picking out an item, and placing it on the worktable. Ask students to leave food garbage in the wastebasket if they can. Though food may make up a large proportion of classroom garbage, the amounts can be discovered through observation alone.
4. When students are finished going through the garbage and sorting the items, stand around the worktable to discuss the findings. Ask questions to generate discussion. Questions can include:
 - What do you notice about the garbage?
 - Is there more garbage than you expected?
 - About how much of the garbage consists of packaging waste?
 - What kinds of packaging do you see?
 - What are the types of products that the packages were designed to protect?
 - What materials do the packages consist of most frequently?
 - Can any of these packages be reused? If so, how?
 - Were all these packages necessary? If not, what else could have been done to protect the product?
5. Tell your students that you plan to sort the garbage into piles that go together. Ask for suggestions of the types of categories to sort the garbage in to. Help the class come to a consensus about the categories and then allow them to move the garbage around so it is in the categories the class defined.
6. Demonstrate for students how to draw a pie chart by drawing a sample pie chart on the board. You can make the sample pie chart about another topic, such as the number of boys and girls in the class, or the types of sports played by your students.
7. Give students paper and markers. Now have each student draw a pie chart representing the types of garbage that your class throws out. They can put all non-packaging garbage into one category in order to focus in more detail on just the packaging garbage. They can use approximate numbers and sizes or be very specific with their ideas.
8. When your students have completed the pie charts, ask for volunteers to share their work. Are there any differences between the different pie charts? Did students come to similar conclusions or did any discover different information?

Wrap Up and Reflect

What did students learn about their garbage habits at school from studying the classroom garbage? Were they surprised by the quantity of packaging in the garbage? Do they believe their home garbage would have more packaging or less? What ideas do they have for reducing the amount of garbage that your classroom generates?

Extend

Ask students to draw pie charts representing their home garbage. You may want to suggest that they limit their investigation to the garbage in their rooms or in the kitchen so parents do not feel that their privacy is being invaded. Work with them to compare the two pie charts and form hypotheses about the differences.



Garbage Gone Wild!



Lesson 4 – Grades: 3 – 6

Garbage Gone Wild

Time 30 - 45 minutes to create posters, 1 hour or more to research the issues

Objectives

- Students will study the impact of litter on the environment
- Students will present their findings in order to persuade others to stop littering

Overview

Imagine the Pacific Ocean – tranquil blue waves under a clear blue sky. But floating just below the surface is the Great Pacific Garbage Patch – an area twice the size of Texas filled with millions of pounds of plastic and chemical waste. Small fish eat this garbage, bigger fish eat the smaller fish and we eat the bigger fish, taking plastic particles and chemical sludge into our bodies. Litter finds its way into lakes, streams and oceans. Millions of marine animals die each year because they eat litter or get stuck in litter and suffocate. The worst kind of litter is plastic bags and plastic six-pack rings, which trap marine mammals so they can't breathe. Fifty percent of lakes in the US are unfit for swimming or fishing because they are so polluted. And polluted waters cause illness in humans as well. Littering also costs money. In 2005, 135 billion beverage bottles were not brought back to be recycled, many ending up as litter instead. That totaled more than 2.1 billion dollars in the value of the metal that could have gone back into the recycling system. Also, it costs cities millions of dollars each year to clean litter off the roadways. It's estimated that one mile of highway contains 16,000 pieces of litter! Cigarette butts contribute to litter problem with 4.5 trillion cigarette butts ending up as litter each year. And over 50% of litter consists of beverage containers – either the cans themselves or the pull-tabs or caps that go with them. Those cans would be worth a lot of money as scrap metal. Recycling them would mean that we wouldn't have to dig out new metal each year. Students might also be surprised to learn that chewing gum is a dangerous form of litter. Animals eat the gum which make some sick and even kill others.

Kids can do something about this problem. First, they have to become aware. It's easy for them to think that it's okay to litter when they see litter everywhere. Once they understand that littering is bad for the environment and everyone in it, they can do some simple things to help stop the litter problem:

- ✓ Set an example by not littering
- ✓ Pick up litter when they see it (nothing dangerous)
- ✓ Pick up the litter in front of their homes
- ✓ Carry a litter bag with you
- ✓ Ask your friends to help you clean a local park
- ✓ Adopt an area and keep it litter-free
- ✓ Plant flowers in an area where litter gathers
- ✓ Ask store owners to put trash cans in front of their stores

What You Need

- Access to research (Internet, books, magazine articles, media)
- Oak tag or card board or heavy paper
- Magazines that can be cut up
- Scissors
- Glue or glue sticks
- Markers

What You Do

1. Ask students if they know what littering is. Do they think littering is a problem? Why or why not? Ask them if they have ever littered. They might be surprised to learn that more than 75% of Americans have admitted to littering over the past five years.
2. Brainstorm a list of the problems associated with littering. You might want to get them started by talking about categories such as:
 - Hurting marine life
 - Polluted streets
 - Littering attracting more litter
 - Polluted waters
 - Wasted resources such as metal
 - Wasted money spent on clean up
3. Divide students into partners or groups of three and ask each group to choose one aspect of littering to focus on.
4. Allow each group time (from an hour to several days) to research the problem.
5. When students are finished researching, ask them to work together to create a poster campaign. Each group will focus on the area they researched and create a poster that explains the problem and attempts to encourage people to stop littering. Remind them that the posters can also provide a positive message about what can be done to solve the problem.

Wrap Up and Reflect

Set up the posters around the classroom. Invite other classes in to view your poster campaign. Have students stand by their posters and explain the problem while guests walk from poster to poster learning about the problems... and the proposed solutions.

Extend

After students complete their posters, encourage them to extend their presentations. Have them use multimedia tools to work on a media rich presentation. They can produce a video using video or cell phone cameras and simple editing tools, a photo slide show, a Power Point or Open Office presentation, a pod cast or other presentation formats.

Wrap Rap

Tobacco products, mostly cigarette butts, are the most littered item on US roads (38%), followed by paper (22%), and then by plastic (19%).



KIDS' SCIENCE CHALLENGE

LESSON PLANS

ANIMAL SMARTS

Introduction

This guide contains three hands-on, project-based lessons, which will develop students' awareness of the field of animal cognition -- its background and features. Students will develop an understanding of the reasons that animals have developed the ability to solve problems, what problem solving means in the animal world. And how we humans can contribute to animal cognition by helping to enrich the lives of the animals with whom we share the planet.

The three lesson plans are:



Lesson 1 – Grades: 3 – 6

World Without Words

Students learn about the challenges of communicating without using words and practice non-verbal communication skills while explaining to their partner how to put together a unique structure.



Lesson 2 – Grades: 3 – 6

Watch It!

In this lesson, students watch animal life up close, by either observing classroom pets or by watching animals in a natural environment outside. Students in rural, suburban or urban settings can find animals in their natural environments to observe. Students will find out what we can learn from watching closely.



Lesson 3 – Grades: 3 – 6

Research and Role Play

Students select an animal to learn more about. After doing research on the Internet, in the school library, or through visits to local zoos or wildlife centers, students will prepare a presentation showcasing an aspect of animal cognition.

National Standards

The following standards are covered by the lessons in this Lesson Plan.

Standards Alignments:

ANIMAL SMARTS

Lesson 1 – Grades: 3 – 6

World Without Words

SCIENCE STANDARDS (National Science Standards)

- Abilities necessary to do scientific inquiry
- Regulation and behavior
- Properties of objects and materials
- Diversity and adaptations of organisms
- Abilities of technological design

MATHEMATICS (Mathematic Common Core Standards)

- Analyze patterns and relationships

SOCIAL STUDIES (National Standards for Social Studies)

- Culture and cultural diversity
- Individual Development and Identity

ENGLISH LANGUAGE ARTS (ELA Common Core Standards)

- Speaking and listening
- Production and distribution of writing

Lesson 2 – Grades: 3 – 6

Watch It!

SCIENCE STANDARDS (National Science Standards)

- Abilities necessary to do scientific inquiry
- Understanding about scientific inquiry
- Regulation and behavior
- Diversity and adaptations of organisms
- Characteristics of organisms
- Populations and ecosystems
- Populations, resources and environments

MATHEMATICS (Mathematic Common Core Standards)

- Analyze patterns and relationships
- Represent and interpret data

SOCIAL STUDIES (National Standards for Social Studies)

- People, places and environments

ENGLISH LANGUAGE ARTS (ELA Common Core Standards)

- Key ideas and details
- Research to build and present knowledge
- Production and distribution of writing
- College and career readiness

Lesson 3 – Grades: 3 – 6

Research and Role Play

SCIENCE STANDARDS (National Science Standards)

- Abilities necessary to do scientific inquiry
- Understanding about scientific inquiry
- Characteristics of organisms

- Life cycles of organisms
- Regulation of behavior
- Diversity and adaptations of organisms
- Populations and ecosystems

SOCIAL STUDIES (National Standards for Social Studies)

- People, places and environments
- Science, technology and society

ENGLISH LANGUAGE ARTS (ELA Common Core Standards)

- Integration of knowledge and ideas
- Research to build and present knowledge
- Production and distribution of writing

Kids' Science Challenge received advice and support from Dave Shepherdson Ph.D., Portland, Oregon Zoo, Brian Hare Ph.D. from the Canine Cognition Center at Duke University, Diana Reiss professor at Hunter College of the City University of New York, and Martin Weiss Ph.D, and Tara Chudoda from New York Hall of Science Wild Minds Exhibit.



World Without Words



Lesson 1 – Grades: 3 – 6

World Without Words

Time: 45 minutes

Objectives

- Students will become aware of their reliance on verbal communication
- Students will practice nonverbal communication skills
- Students will collaborate to solve a problem

Overview

Animals show that they're thinking in many different ways. One important way that animals display "cognition" is by communicating. However, it is often easy to overlook animal communication, or to fail to pay attention to how finely tuned animals are to nonverbal cues. One reason for this is that humans tend to rely so much on verbal communication that they might not notice all the nonverbal cues they use. This lesson is especially relevant in a world in which students spend so much time online, communicating with others without the benefit of nonverbal clues.

In this lesson, students will practice working together to solve a problem using only one kind of communication – their words. They will learn that words aren't always enough and realize the extent that humans, and other animals, rely on nonverbal cues for understanding. Students will begin to develop a sense for the complex systems of communications that animals use to make their ideas known.

What You Need

- Craft sticks (tongue depressors) of different colors
- A table where two students can sit facing each other, or two desks positioned back-to-back
- A thick book that will stand up
- A timer

Animal Fact

Honey Bees communicate the location of a delicious field of flowers to the rest of their hive by performing a waggle dance.

The particular way that the bee waggles shows the direction of the nectar as well as the distance from the hive.

What You Do

1. Ask your students if they think animals communicate. Some students may think they don't. Probe why. When they think about communicating, are they referring specifically to verbal communication? Ask if there are other kinds of communication? What are they? Can they provide any examples of animals who use nonverbal communication?
2. Ask students how much they rely on verbal communication (such as words) versus nonverbal communication (such as body language or other senses). What do animals rely on? Tell them that they'll be doing an experiment to see what happens when they use only one type of communication.
3. Have students choose a partner to work with. Then have them set up their desks so they are facing each other, or have them sit across a table.
4. Ask students to place a large book in between them, standing upright, so that the book blocks the area right in front of them on the table.
5. Then have students each select 10 differently colored craft sticks. Make sure that the partners have the same 10 colors.
6. Assign one student in each group to be Partner A and the other to be Partner B. Now give all the Partner A's five minutes to create a design using their craft sticks. It can be a picture of something or an abstract design. Make sure the other partner can't see it.
7. When five minutes are up, give each group five minutes for Partner A to describe their design using only words (no hand gestures) to Partner B. During those five minutes, Partner B will have to try to replicate Partner A's design, using the same colors. They can ask questions as they go.
8. After five minutes, the partners must stop designing and take their hands off their craft sticks. Now the partners can lift up their book and see what happened. Are the designs mirror images of each other or did the partners have trouble communicating? If they are not mirror images, what went wrong?
9. After they've had a chance to debrief, allow the groups to switch. Did they improve on their second try?

Wrap Up and Reflect:

Ask students again to reflect on the question – how much do you rely on communication and how much of your communication goes beyond words? Ask students to debrief on their performance. Were they satisfied with the outcome? Ask students if they thought they would have been more or less successful if they were close friends with their partner and already communicated well. Would that have made a difference? Why or why not? What about the design? Was it abstract or realistic? Did that help or make it harder? What would they do in the future to have more success at this activity?

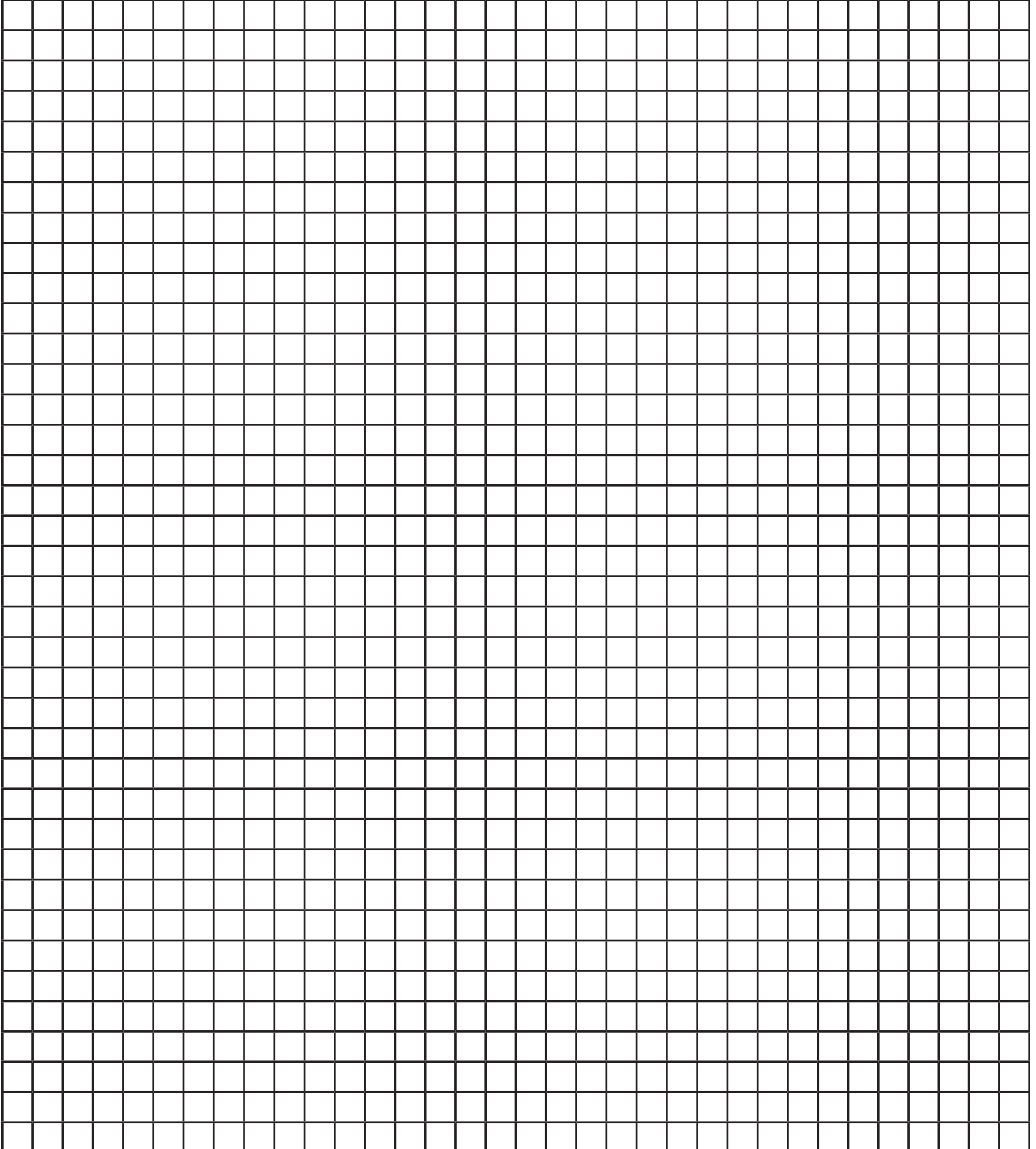
Extend:

Animals communicate in many different ways. Brainstorm a list of animals and the ways that they work together to communicate important information. Then read about the animals on your list and create a poster explaining how they communicate. Your students may wish to try the class activity at home. They can use the "Mirror Image" handout to create a drawing, which they can have a family member try to replicate. Let them know that the activity might be easier if the family member uses graph paper for their design. Remind students to use what they've learned about communication techniques to be successful when they try this at home.

Mirror Image

Name _____ Class _____ Date _____

Directions: Draw a design in the area below. Use different colors. Can your friends and family create the same design based only on the words you use to describe it?





Watch It!



Lesson 2 – Grades: 3 – 6

Watch It!

Time: 60 minutes

Objectives

- Students will use their senses to do careful observations of the natural world
- Students will make hypotheses about the natural world
- Students will look for patterns in their observations

Overview

How large is a squirrel's range? Why do hawks fly in circles? When are cats most active? Do fish notice each other in the water? Where do ants go in the rain? The natural world is all around us and is filled with wonders. We can answer questions about the natural world and learn something about the animals that inhabit it by taking the time to carefully observe what's around us.

No matter where a student lives, they can observe the natural world. Students living in urban neighborhoods can make observations in local parks, backyards, school yards, or inside their homes or schools. They can observe insects, birds, squirrels, rodents or pets. Students in rural or suburban areas can watch a wider array of animals including domesticated animals and animals in the wild. Whatever they choose to observe, careful observation will reveal an array of surprises and patterns.

What You Need

- Paper
- Colored pencils
- Natural environment to observe

Animal Fact:

There are more living organisms in a bucket of soil than there are people in the United States.

What You Do

1. Have your students brainstorm the different animals in their local environments. Remind them that they can include pets they might find at home and in the classroom as well as animals in parks, yards, and in other local areas. Go back over the list to make sure it is inclusive. Did they remember to add insects? Worms?
2. Going through the list, ask them how they would go about observing the different animals on it. Which ones could they observe during the day? Which do they think are out at night?
3. Brainstorm a list of questions they might want to know about the animals on their list. Capture this on a chart.
4. Look at the list of animals and ask students which ones they might find in or nearby the classroom. Circle the animals they name.
5. Then have them look at the list of questions and ask them which questions are answerable through observation. Circle the questions they identify.
6. Tell students they are going to try to find and observe the circled animals on the list and answer the circled questions.
7. Distribute two sheets of blank typing paper to each student. Have them hold the paper, one on top of the other, side-to-side (horizontally). Then have them fold the two pages in half. Have each student staple the top and bottom of the page in the middle where it folds. They should have a blank book with a front and back cover and six inside pages. This is their Field Journal.
8. Allow them to decorate their Field Journal covers and remind them to add their names.
9. Before heading to the observation zone, talk about observation protocol. When students observe in nature, they must be quiet and move as little as possible. Ask students to practice being calm and quiet. Have them try to find a comfortable position that they can stay in for a while. Remind them that the more they watch, the quieter they can be, and the longer they can stay in one place, the greater the chance that they will find an animal to observe.
10. Tell students that they should leave things as they found them. Share the following quote and ask them if they can figure out what it means: "Take only pictures, leave only footprints."
11. Then talk to them about the kinds of observations they might record in their Field Journals. Hand out the Field Journal Observation Chart and have them insert the sheet into the center of their Field Journals.
12. Decide where you will go to observe. It can be inside the classroom, outside in the school yard, or another local area. Head to the area with your class. Remind students about observation protocol. Have them spread out and begin to observe, encouraging them to take notes or draw pictures if and when they see an animal.
13. After 10-20 minutes, head back to the classroom. Join together as a group. Debrief on what you saw. Were students successful in finding and observing an animal? Have them look back at their list of questions. Can they answer any of the questions now that they have observed the animal? Was it easy or difficult to stay still and quiet? Did it help? Ask them to hypothesize what would happen if they went back to the same spot the next day. Would they see the same things?

Wrap Up and Reflect:

Ask students to take turns sharing the observations in their Field Journals with the class. Create a chart of classroom observations. List the animals that were observed and place a tally mark indicating how many times each animal was observed. What can students say about an area based on the animals that live there? What can students say about the habits of the animals they observed? What can they do to help their animal neighbors?

Extend:

Sense of sight is not the only sense your students can use to observe nature. Have students make and record observations with their other senses including sense of smell and sound. Have them create an audio journal about what they hear around them.

Animal Fact

Some birds such as parrots can teach and learn hundreds or even thousands of different calls. Other animals have these kinds of language skills as well.

Birds, bats, dolphins, whales, elephants, and of course, people, have very sophisticated communication skills.

Field Journal Observation Chart

Name _____ Class _____ Date _____

Animal	Location	Time	Notes



Research and Role Play



Lesson 3 – Grades: 3 – 6

Research and Role Play

Time 45 - 60 minutes - up to 60 minutes (or more) to research, 10-45 minutes to prepare and share their presentations

Objectives

- Students will engage in higher order thinking by asking questions and coming up with ways to answer these questions.
- Students will practice their research skills by engaging in offline and online research (including video viewing)
- Students will demonstrate understanding by creating a presentation of one thing they learned through research.

Overview

When students apply scientific reasoning to solve problems, they are behaving like scientists. Behaving like scientists means going through the same processes that scientists go through when they solve problems and answer questions. Thinking like scientists think involves asking questions and devising ways to answer those questions. Students also need to learn to form hypotheses and work out a plan to test out their hypotheses. Scientists must know how to conduct research and how to create and carry out experiments to gather new information. Remind students that good hypotheses can be proven wrong. If they know for sure that a hypothesis is true, there's no point in asking the question. Finding out the answer to a question is only half the work. Good 21st century learners also know how to communicate the information they discover. By researching and presenting to each other about the natural world, students will learn something about the world around them, and also about themselves.

What You Need

- Research tools (school or public library, internet, people to talk to)
- Presentation tools (poster board, colored pencils or markers, computer presentation programs)

Animal Fact

Chameleons can see two views at once, one with each eye. They can even look forward and backwards at the same time! So think like a chameleon when observing nature!

What You Do

1. As a class, make a list of questions students have about the natural world. Remind them to think about different categories of animal behavior such as food and shelter to generate ideas for questions. Spend some time talking about the ways that animals show they are thinking and have students generate questions about that.
2. Once students begin to run out of ideas and you have probed them to go beyond their initial brainstorm, have the class review the list. Then divide students into pairs and have each pair select a question from the list.
3. Ask each pair to form a hypothesis about their question – or put simply, have them make a reasonable guess at the answer to their question. Tell them they will be doing research to see if their hypotheses are correct.
4. Hand out a Project Proposal sheet to each set of partners. They can fill out this sheet as they work through their projects.
5. Help each pair figure out how to find information to answer their questions. Suggest that groups use library resources, Internet resources, as well as visits and personal interviews with experts. For those students who are interviewing, work with them to create interview questions. You may want partners to practice with each other to prepare to conduct an interview. For those students doing research on the Internet, spend some time talking about how to identify high-quality web sites. The Library Media Specialist may be able to help work with pairs of students.
6. Give students time to conduct research. You may wish to do this over several days.
7. When they are finished collecting information, work with students to decide on a presentation technique. They may wish to create a computer presentation such as a short movie using Imovie or using a low cost digital camera or cell phone cameras. They may wish to make a presentation on PowerPoint or Open Office (free software). They could create a poster display using photos, cut-outs from magazines, text and charts. They could also act out the information they discovered. A play, a role-play or short vignette is a great way to get the class engaged in the information.
8. The rest of the class should fill out a presentation evaluation. Work with them on conducting fair evaluations using the Research Rubric. Share the Research Rubric with the class before they prepare their presentations so students will know how they are being assessed.

Wrap Up and Reflect

What did students learn about the animals they studied? Were they surprised by the results of their investigations? How well did they conduct their research and how did they feel about the quality of their presentations? Go over the Research Rubric with the class – did students feel that they were able to work to the goals and expectations on the rubric? What would they do differently next time?

Extend

Ask each pair of students to come up with two more questions as follow up questions to the one that they researched. Tell them that scientists often arrive at new questions based on the research they conduct and that new discoveries are often made in this way.

Project Proposal

Name _____ Class _____ Date _____

What topic do you want to study? _____

What is your question? _____

How will you find your information? List some possible sources.

How will you present your findings? Write your ideas below.

Use the rest of this page to brainstorm your ideas or add other thoughts or images.

Research Rubric

Name _____ Class _____ Date _____

Directions: Use the rubric to assess your classmates' research presentations and to guide your work.

	Okay: 1	Good: 2	Fantastic: 3
Quality of Question	Students asked a question that was easy to answer	Students asked an original question that was fairly easy to answer but interesting	Students asked a unique question that they had to work hard to find an answer to
Quality of Research	Students used 1-2 research sources	Students used more than two, high-quality sources	Students used three or more sources, they were all high-quality and they were different types of sources (ex Internet and book)
Quality of Presentation	The presentation did not follow a particular order. The presentation was not too original.	The presentation was clear and well organized. Things were presented in a unique or interesting way.	The presentation was clear and organized. It was presented using many different styles which were all engaging.
Effectiveness of Presentation	I did not learn very much from this presentation.	I learned something from this presentation.	I learned a lot from this presentation.
Totals			

Name of Presentation: _____ Name(s) of Presenter(s) _____ Total Score _____

Name of Presentation: _____ Name(s) of Presenter(s) _____ Total Score _____

Name of Presentation: _____ Name(s) of Presenter(s) _____ Total Score _____

Name of Presentation: _____ Name(s) of Presenter(s) _____ Total Score _____





KIDS' SCIENCE CHALLENGE

LESSON PLANS

MEALS ON MARS

Introduction

This guide contains four hands-on, inquiry based lessons which are designed to encourage students to think about all the planning that must go into creating a meal plan for a space mission. NASA food scientists must consider such factors as the conditions during space travel, eating in zero-gravity, keeping food fresh, the need to travel light, and making sure astronauts find the food appealing. These four lessons develop students' understanding that eating uses more than just the sense of taste. Many different factors go into making food appealing. And space food must be appealing, because a well-fed astronaut is a happy astronaut.

The four lesson plans are:



Lesson 1 – Grades: 3 – 6

Appeal of the Meal

In this lesson, students interview each other about what makes certain food appealing to some people and not to others. Students use communication skills during interviews and math skills when they graph the data as bar graphs.



NASA

Lesson 2 – Grades: 3 – 6

Taste This!

This lesson focuses on a simple experiment in which volunteers have to hypothesize about the flavor of juice, which has been colored purple and red. They learn that many senses influence how food actually tastes.



Lesson 3 – Grades: 3 – 6

Menus for Mars

In this lesson, students play the role of an astronaut and are allowed to sample food in preparation for their upcoming missions. They follow this up by planning their own menus for space.



Lesson 4 – Grades: 3 – 6

Space Shake

In this lesson, adapted from NASA, students compare different ingredients for making the perfect space shake – one that is both nutritious and delicious.

National Standards

The following standards are covered by the lessons in this Lesson Plan.

Standards Alignments:

MEALS ON MARS

Lesson 1 – Grades: 3 – 6

Appeal of the Meal

SCIENCE STANDARDS (National Science Standards)

- Abilities necessary to do scientific inquiry
- Understanding about scientific inquiry
- Matter, energy, and organizations in living systems
- Personal health
- Abilities of technological design
- Understanding about science and technology
- Science and technology in society

MATHEMATICS (Mathematic Common Core Standards)

- Solve problems involving the four operations
- Analyze patterns and relationships
- Represent and interpret data

SOCIAL STUDIES (National Standards for Social Studies)

- Culture and cultural diversity
- People, places and environment
- Represent and interpret data

ENGLISH LANGUAGE ARTS (ELA Common Core Standards)

- Integration of knowledge and ideas
- Research to build and present knowledge

Lesson 2 – Grades: 3 – 6

Taste This!

SCIENCE STANDARDS (National Science Standards)

- Abilities necessary to do scientific inquiry
- Understanding about scientific inquiry
- Regulation and behavior
- Diversity and adaptations of organisms
- Personal health
- Abilities of technological design
- Understanding about science and technology
- Science and technology in society

MATHEMATICS (Mathematic Common Core Standards)

- Analyze patterns and relationships
- Represent and interpret data

SOCIAL STUDIES (National Standards for Social Studies)

- Science, technology and society

ENGLISH LANGUAGE ARTS (ELA Common Core Standards)

- Integration of knowledge and ideas
- Research to build and present knowledge

Lesson 3 – Grades: 3 – 6

Menus for Mars

SCIENCE STANDARDS (National Science Standards)

- Abilities necessary to do scientific inquiry
- Understanding about scientific inquiry
- Regulation of behavior
- Personal health
- Abilities of technological design
- Understanding about science and technology
- Science and technology in society

MATHEMATICS (Mathematic Common Core Standards)

- Generate and analyze patterns
- Analyze patterns and relationships
- Represent and interpret data

SOCIAL STUDIES (National Standards for Social Studies)

- Culture and cultural diversity
- People, places and environments
- Individuals, groups and institutions
- Science, technology and society
- Psychology

ENGLISH LANGUAGE ARTS (ELA Common Core Standards)

- Integration of knowledge and ideas
- Research to build and present knowledge
- College and career readiness

Lesson 4 – Grades: 3 – 6

Space Shake

SCIENCE STANDARDS (National Science Standards)

- Abilities necessary to do scientific inquiry
- Understanding about scientific inquiry
- Personal health
- Properties and changes of properties in matter
- Diversity and adaptations of organisms
- Abilities of technological design
- Science and technology in society

MATHEMATICS (Mathematic Common Core Standards)

- Generate and analyze patterns
- Analyze patterns and relationships
- Represent and interpret data

SOCIAL STUDIES (National Standards for Social Studies)

- Culture and cultural diversity
- People, places and environment
- Science, technology and society
- Psychology

ENGLISH LANGUAGE ARTS (ELA Common Core Standards)

- Main ideas and details
- Integration of knowledge and ideas
- Research to build and present knowledge



Appeal of the Meal



Lesson 1 – Grades: 3 – 6

Appeal of the Meal

Time: 45 - 60 minutes

Objectives

- Students will identify the various senses they use while eating and tasting food
- Students will practice interviews with partners to derive information
- Students will chart the information they gather on a bar graph
- Students will form theories about the validity of data

Overview

Our ancestors had to use all their senses to stay alive in ancient times. And like them, we engage many of our senses when we take part in our most fundamental survival activity – eating. Many senses are at work while we eat our food. We use our eyes to make sure the food is ripe and fresh; we use our hands to find and prepare the food, and then get it ready to be eaten; we use our nose to smell the food and make sure it's appealing; and of course, we use our taste buds to find out what we're eating and to enjoy it and want more. Students will discover that they use more than one sense while eating.

It's very important that astronauts on space missions have a healthy and delicious selection of food to eat in space. The longer the mission, the more important it is that the astronauts are happy about their space diet. Food scientists at NASA do not only have to figure out how many calories and what types of food astronauts need to stay in shape in space, they also have to find out what kinds of foods will make the astronauts happy. This activity will show your students how all of our senses contribute to the appeal of a meal.

What You Need

- Chart paper
- 2 sheets of blank typing paper and pencils
- Rulers
- Colored markers
- Computer and Internet connection for optional extension activity

Space Food Fact

Did you know our tongues only recognize 5 tastes? They are sweet, sour, salty, bitter, and savory (sometimes called umami).

The rest of the food flavor comes from aromas (smells).

What You Do

1. With the whole class, talk about foods they like and don't like.
2. The students will be creating 3 charts. Label the first chart #1: Foods We Like; label the second chart #2: Foods We Like & Don't Like; and label the last chart #3: Foods We Don't Like. On chart #1, list some of the most popular foods that many of your students like. On chart #2, list those foods that some students like and some do not. On chart #3, list the foods most disliked by the majority of students in your class. Encourage students to use descriptive language to discuss what they like and dislike about these foods. Guide them to move beyond words like "gross" or "yucky" or "disgusting" or "delicious" to more telling words such as "sweet" or "brightly colored" or "bitter smelling".
3. The students will be creating a bar chart. Ask each student to create an X and Y axis on a piece of paper, using a ruler. Each student to chooses 2-3 foods from each of the charts the class created in step number 2. List those foods on a second piece of paper where they will be keeping a tally. Using the bar chart write in the list of foods across the x axis. Each food spaced about an inch apart across the bottom of the page.
4. Now allow each student 20 minutes to walk around the room and interview at least 10 other students. Each pair of 10 will take turns interviewing each other. For each interview, the interviewer will ask the interviewee if they like or dislike the foods on their list. They will write the answer (like or dislike) next to each food on their list. You may wish to teach them about tally marks, or other symbolic notations, as a shortcut to writing in all the words. They can simply write in a representation next to each food – perhaps using a check for "like" and an x for "dislike".
5. When the interviews are completed, ask students to add up the likes and dislikes for each food.
6. Next, show them how to set up their bar chart. If they have not done so already, have them write the foods across the bottom of their pages, on the x axis. Then ask them to choose a color to represent "like" and "dislike". Each food will have a bar colored in for "like" and a bar colored in for "dislike". Then have them number the y axis (the vertical line) with the number of students they interviewed, since this is the highest number of marks a food could have received.
7. Once the bar chart is set up, they can fill it in. If, for instance, 9 classmates said they "liked" apples and 1 said they "disliked" apples, then students will draw a bar, going upward from the word "apple", that reaches the 9th row. They will fill in that bar with the color they chose to represent "like". Right next to that bar, they will draw a second bar. This one will only go up one notch. They will fill in that bar with the color representing "dislike". They will repeat this process for every food.

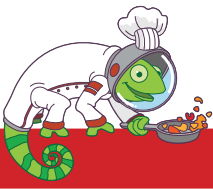
Wrap Up and Reflect:

When the students have completed their bar graphs, bring the whole class back together again. Reflect on the information students gained in their interviews. Did the information they learned in one-on-one interviews match the data you collected for the whole class? How can you find out? If the information differs, how does it differ? What can account for arriving at different sets of information?

What did students learn about likes and dislikes about food? What makes one person like a food that another person dislikes? Is the taste of food all about the sense of taste? If not, what other senses or other factors might be involved?

Extend:

- Create a list of words that students have used to describe the foods they like or dislike.
- Post the list for the class.
- Have each student create a poem or song using some of the words on the list.
- Type the list into <http://www.wordle.net> to create a Word Cloud of tastes for your class.



Taste This!



NASA

Lesson 2 – Grades: 3 – 6

Taste This!

Time: 30 minutes

Objectives

- participate in an experiment
- learn specific experiment protocol such as forming a hypothesis
- learn that many senses are used when “tasting” food.

Overview

The sight of a purple cup of juice can influence us more than the taste of an apple. For humans, sense of sight is one of the most important senses and one that humans often rely on the most. What we see, or what we think we see, influences how we know, recognize, think about and judge something. This simple experiment will enable your students to appreciate the power of this very important sense.

When NASA food scientists plan a menu for a space mission, they not only take an astronaut’s nutritional needs into account. They also think about making all of their senses happy. Use this activity to get your students to think about what might go into making a space meal that will satisfy an astronaut’s hunger by using all their senses.

What You Need

- 2 containers of apple juice
- Food coloring (red and blue)
- Volunteers (2-3)
- Small cups

Space Food Fact

In space, astronauts have a harder time using their sense of smell.

That’s why they tend to use a lot of spices on their foods - they need their food to taste strong!

What You Do

1. Tell your students that you are going to have them participate in an experiment that may change the way they think about food and their sense of taste. Ask students to make a hypothesis. Ask, “Which of your senses is most important in determining how something tastes?” Most students will probably hypothesize that their sense of taste is their most important sense when it comes to eating. While it’s true that their sense of taste is very important in figuring out what a food is like, they may be surprised to find out that other senses are extremely important as well.

2. You can do this experiment in a large group with most of the class acting as observers. In this case, choose 2-3 student volunteers to be in the experiment. As an option, you can also divide the class into pairs and have one student conduct the experiment on the other student. If you set up the activity in this way, make sure you have time at the end for the pairs to report back their results in the context of a whole group discussion.
3. To start the experiment, make sure the student volunteers are out of the room while you set up the experiment. Then open one apple juice container and ask a student to add red food coloring one drop at a time to turn the juice red. Have her close the container and gently shake to mix.
4. Have another student open the second apple juice container and add red and blue food coloring one drop at a time to turn the juice purple. Have him close the container and gently shake to mix.
5. Make sure no one in the class tells the volunteers that the juice you are using is apple juice. That must be kept secret from them.
6. Now bring the volunteers back into the room. Have another student pour one cup of the red juice and one cup of the purple juice for each volunteer. (If you have 3 student volunteers, you will need 3 cups of red juice and 3 cups of purple juice.)
7. BEFORE tasting the juice, ask your volunteers to make a hypothesis. Ask them, "What is the flavor of the juice?" Have another student record their responses on the board.
8. Now allow the volunteers to taste the juice and ask them to identify the flavor of each juice.

Wrap Up and Reflect:

Did your volunteers give a correct hypothesis? Did their answers change after trying the juice? Did the juices taste the same? Do they think that the colors had an effect on the flavor of the juice? What do the rest of the students think? Ask them to think about what other senses or additional factors affect the flavor of food or drinks. Ask students if this has ever happened to them before. Were they expecting one thing but got another? Ask them to describe that experience.

Extend:

Other senses are involved in how something tastes. Ask students, "Do you think your sense of smell has an effect on taste?" Ask students to drink some juice while holding their noses. Ask them what they can taste. Can they identify the flavor? Explain that the sense of smell has a lot to do with how something tastes. That's why things seem to taste different, or less strong, when they are sick or have stuffed noses. Now ask them, "What if you closed your eyes and held your noses?" Invite them to try it and find out what they taste!



Menus for Mars



Lesson 3 – Grades: 3 – 6

Menus for Mars

Time 45 - 60 minutes

Objectives

- Students will use their senses to make determinations
- Students will use consistent criteria to form evaluations
- Students will communicate collected data using charts
- Students will experience different careers through role play

Overview

Students will role play astronauts who are preparing for their upcoming space mission and will determine which foods will be most suitable for them during space travel. Students will participate in a sensory taste panel, using food samples derived from real space flights. They will judge the acceptability of these foods based on a set of established criteria.

Astronauts select their menus for space about 5 months before they leave Earth. Astronauts going to the International Space Station must choose a 30-day flight menu. One day, when astronauts get ready to visit Mars, they will need a menu that will last 5 years! A special taste panel is set up for the astronauts to taste a variety of foods in order to plan these menus. This lets the astronauts know whether they like the food before going into space. Foods are judged against criteria such as appearance, color, odor, flavor, and texture.

What You Need

- Tray
- Paper plates
- Food samples (from menu list at end of lesson)
- Drink samples (from menu list at end of lesson)
- Cups for drink samples
- Toothpicks for food samples
- Napkins
- Soap or dry soap for frequent hand washing
- Water
- Crackers
- Taste Judging Form
- Food Groups handout

Space Food Fact

There are 180 food and beverages for astronauts to choose from which have been approved for space travel.

What You Do

1. Gather your students into a group and tell them that they are going to pretend to act as astronauts. Ask them to picture themselves as astronauts. Then ask them to think about all the things they would need to plan for if they were going on a mission to space.
2. Encourage students to brainstorm different things they would need to plan. This might include making sure that they are physically fit, learning to fly the space craft, and saying

good bye to their families. Tell them that they also need to plan their own menus of the foods they will eat while they are gone.

3. Tell your class that they are going to be part of a food panel. Groups of students will taste different groups of food. This food comes from lists of actual foods that have been used in space missions.
4. Set the stage for developing an understanding of what foods would be suitable for spaceflight based on the following questions. Encourage students to come up with their own questions as well.
 - How do astronauts eat in space?
 - Is eating in space the same as eating on Earth?
 - Do astronauts eat the same foods we do?
 - How do the astronauts make sandwiches?
 - How do the astronauts drink?
 - What if astronauts want ketchup on their food?
5. Divide the class into eight groups. Distribute the two handouts called Taste Judging Form and Food Groups. Give one Taste Judging Form to each student, but give only one copy of the Food Groups handout to each group.
6. Look through the Taste Judging Form together. Explain to students that this form is a set of features, or criteria, against which they will be judging the food choices. Tell them that at NASA, any food that scores below a 6 does not go into space with the astronaut who gave it that score. Also explain that students will be filling out the form on their own and should not discuss their thoughts until after they have scored the foods.
7. Then look through the Food Groups handout. Assign each group a different Food Group. You may want to have one group for every food group on the sheet. If you cannot get all the foods on the list, you can mix and match the foods or substitute these foods for something easier to find.
8. Set out the foods at different tables and have each group go to their work area. Students must take turns tasting the food samples and recording their responses. Remind students to follow health rules – pick up food samples with toothpicks or napkins. Wash hands frequently. No sneezing on the food!
9. After students have scored the food, they may discuss their choices within their groups. Then bring the groups together for a class discussion. Have each group give a brief presentation in which they report on the most and least popular food choices from their group. Which foods scored a 9? Which foods scored below a 6?

Wrap Up and Reflect

Ask students to discuss the following questions:

- Were any foods popular with all members of the group? If so, which one(s)?
- Were any foods unpopular with all members of the group? If so, which one(s)?
- Did those foods that were most or least popular have anything in common?
- What was it like to taste the food? Was it hard? Easy? What were the challenges to judging fairly?
- What would it be like if you had to plan your meals so far in advance?
- Why do you think it is important that you test the foods before you take them into space?

Extend

Keep students in groups and have each group plan a day-long menu using the foods that they found to be most popular with the group as well as any foods they want from the other groups. Is this menu both healthy and appealing?

Taste Judging Form

Name _____ Class _____ Date _____

Criteria	Food Item				
Appearance (What does it look like?)					
Color (Does its color make you want it?)					
Odor (How does it smell?)					
Flavor (How does it taste?)					
Texture (How does it feel?)					
Handling (How easy is it to handle?)					
Overall (How good is it overall? Would you want to eat it?)					

High Scores:

9-Like sooo much
8-Like a lot
7-Like a little

Mid Scores:

6-Like a tiny bit
5-Neither like nor dislike
4-Dislike a tiny bit

Low Scores:

3-Dislike a little
2-Dislike a lot
1-Dislike sooo much

Food Groups

Name _____ Class _____ Date _____

<p>Breakfast Foods #1</p> <ul style="list-style-type: none"> • Granola • Breakfast Roll • Eggs (All Styles) • Fruit (Banana or Strawberries) • Pancakes 	<p>Breakfast Foods #2</p> <ul style="list-style-type: none"> • Cereal (Rice Krispies® or Cornflakes) • Bagel with Cream Cheese • Eggs (All Styles) • Fruit (Grapefruit or Orange) • Cinnamon Rolls
<p>Lunch Foods #1</p> <ul style="list-style-type: none"> • Pizza • Fruit (Apple or Peach) • Granola Bar • Macaroni and Cheese • Tuna Salad (or Chicken Salad) on Bread 	<p>Lunch Foods #2</p> <ul style="list-style-type: none"> • Hot dogs • Peanut Butter and Jelly Sandwich • Fruit (Apple or Peach) • Sliced (Lunch) Meat • Ice Cream (Chocolate or Vanilla)
<p>Dinner Foods #1</p> <ul style="list-style-type: none"> • Chicken (Sweet and Sour) • Veggies (Celery or Carrot Sticks) • Beef Fajita • Rice • Cheese Cubes 	<p>Dinner Foods #2</p> <ul style="list-style-type: none"> • Shrimp Cocktail • Veggies (Broccoli or Cauliflower) • Chicken Pot Pie • Baked Potatoes • Pasta
<p>Snack Foods #1</p> <ul style="list-style-type: none"> • Gum • Brownies • Fruit Cocktail • Goldfish® or Crackers • Nuts (Almonds or Cashews) 	<p>Snack Foods #2</p> <ul style="list-style-type: none"> • Life Savers® • Nuts (Cashews or Peanuts) • Pudding (Chocolate or Vanilla) • Fruit (Pineapple or Banana) • Pretzels

*The list of foods was adapted from NASA educational lesson appendix.



Space Shake



Lesson 4 – Grades: 3 – 6

Space Shake

Time 60 minutes

Objectives

- Students will use measurement to create consistent food products
- Students will choose different ingredients and compare and contrast the results
- Students will make observations and learn basic principles about properties of matter
- Students will consider the nutritional and appeal features necessary in choosing and creating food for space missions

Overview

Foods are needed for long-term space habitation on the moon and Mars. NASA has identified 15 foods to be grown in space that will make up the majority of astronauts' diets on long-term space missions. Beyond these foods, food scientists have been able to include a wide array of other nutritious and tasty foods with missions requiring shorter stays than a mission to Mars will require. It is possible that food scientists will figure out a way to send these foods on the mission to Mars.

Astronauts have very specific nutritional needs, especially on longer-term missions. Food scientists must account for the conditions in the spacecraft during space travel and then in space while they live there. Making food light enough to travel, keeping food from going bad, and enabling astronauts to eat in zero gravity are all challenges of designing foods for space missions. Satisfying astronaut's nutritional needs, as well as their needs for appealing and tasty foods, is the major focus of food scientists at NASA. In this lesson, students will act as NASA food scientists and construct a tasty yet nutritious beverage out of a variety of possible ingredients, each with its own benefits and drawbacks.

What You Need

- Space Shake Handout (one per student)
- Space Shake Evaluation Sheet (one per student)
- Line Graph Chart (one per group)
- Space Shake Score Sheet (one per group)
- Sample Foods with Nutritional Labels
- Pencils/Pens (one per student)
- Large zipper-lock plastic bags (one per student)
- Snack size zipper-lock plastic bags (one per student)
- Straws (one per student)
- Small cups (6 oz.)
- Plastic spoons

What You Do

1. Explain to students that food scientists must plan very carefully when they prepare meals for astronauts. Ask students to use what they've learned in the previous lessons and name some of the challenges of planning meals for space missions. Capture student responses on the board or chart paper. Answers may include:
 - Extreme conditions
 - Traveling in zero gravity
 - Need very light-weight food
 - Crumbs can hurt the machinery
 - Difficult to grow your own food

- Food must stay fresh for a long time
 - No refrigeration
 - Astronauts need certain nutrients
 - Astronauts can't have certain things
 - Astronauts have to be kept happy
2. Then hand out the Space Shake Handout, and the Space Shake Evaluation Sheet, one to each student. Distribute the Line Spread Chart and the Space Shake Score Sheet, one to each group. Go through the instruction and answer any questions.
 3. Allow students to choose or assign different roles. Each student may need to take on two roles at least. There are many jobs for the whole group to do as well.
 4. After students choose their ingredients and create their shakes, they will need your help looking at the ingredients for nutritional information. Since this will be the first time many students have done this, they may need help in figuring out where to look and what they're looking for.
 5. Students may also need your help looking through the Space Shake Score Sheet and transferring values. You may want to do this as a whole group activity before you split into groups

Wrap Up and Reflect

Bring the groups back together and compare results. What ingredients did the different groups use? Did some shakes come out better than others? Is there any way they could have improved the healthiness of the shake? What about the flavor?

Usually, too many calories is considered to be unhealthy, but in this case, the shakes with the most calories got a higher score. Why is a lot of calories a good thing for astronauts?

What did students think about the criteria they used to rate their shakes? What criteria would they use if they were rating a shake to have after school on a hot day? Guide students to understand that different features may be more or less beneficial depending on the context.

Ask your students to consider why we used a plastic bag to mix the shake instead of using a blender?

Extend

Learning to read the nutritional content on labels is a new skill for students this age. Now that you have introduced them to this concept, have them bring in food labels and explore other food for nutritional values. What are the foods they like to eat? How do they rate on calcium, protein, and calorie content?

Space Shake Handout

Mission

Your mission is to create a very healthy shake that is thick like an ice cream shake and tastes great, but will stay fresh on a space mission.

Make a Shake!

1. Choose your jobs! Everyone needs to choose at least one job before you can start.

Mission Director (choose the ingredients, organize) _____

Mission Supply Specialist (gather the ingredients) _____

Mission Communication Specialist (write the information) _____

Mission Food Science Specialist (mix the ingredients) _____

Mission Financial Director (works with team to fill out chart) _____

Mission Publicity Manager (presents findings to the class) _____

Mission Maintenance Manager (helps keep the work space clean) _____

2. Select one substitute for cow's milk (either soy milk or rice milk) and pour it into a zipper-lock plastic bag.
3. Choose one thickener: plain yogurt, vanilla yogurt, or instant pudding. Mix the thickener with the milk by closing the bag and kneading (rubbing) as if you were making bread.
4. Choose one flavoring. Tang®, Kool-Aid®, Gatorade®, or hot chocolate mix. Open the bag and add the flavoring. Close the bag and mix again.
5. Name your Space Shake _____

Space Shake Evaluation Sheet

Rate your Shake!

In order to determine how healthy your shake is, you need to do two things. First, look at the labels on the packages of the foods you used. Write down the number values of the nutrients such as protein and calcium. Then, look at the point values listed on the Space Shake Score Sheet. You can use those point values to fill in your chart below. Work with your group to add the point values for each ingredient you selected. When you have added those point values together, you will have an idea, in points value, of how healthy your shake is.

Protein (g) per 1 cup:

Milk _____ + Thickener _____ + Flavor _____ = Total _____

Calcium (mg) per 1 cup

Milk _____ + Thickener _____ + Flavor _____ = Total _____

Calories per 1 cup

Milk _____ + Thickener _____ + Flavor _____ = Total _____

Measure the thickness of your shake by placing one spoonful onto the center of the Line Spread Chart. Measure how much the shake spreads in 15 seconds by measuring the lines at the four numbered locations. Add the four numbers and divide by four for the average score: _____

1 = Our shake was between the 10-15 mark

2 = Our shake was between the 5-10 marks

3 = Our shake was between the 1-5 marks

Pour some of the shake into small zipper-lock bags so each of your group members has some to taste. Insert a straw. Close the bag. By drinking from a bag and straw, you are drinking your shake just like an astronaut would. Taste your shake and mark with your score: _____

1 = Yuck! I'd never drink this shake again!!

2 = Hmmm! I might drink this shake again

3 = Mmmm! I love this shake. I'd make it again for sure!

Space Shake Score Sheet

Space Shake Score Sheet

- _____ 1. Score for protein content
 1 point = 1-3 g protein
 2 points = 4-7 g protein
 3 points = 8-10 g protein
- _____ 2. Score for calcium content
 1 point = 50-100 mg calcium
 2 points = 100-200 mg calcium
 3 points > 200 mg calcium
- _____ 3. Score for calorie content
 1 point = 100-149 kcal
 2 points = 150-200 kcal
 3 points > 200 kcal
- _____ 4. Score for thickness
 1 point = Shake was between 10-15 mark
 2 points = Shake was between 5-10 mark
 3 points = Shake was between 1-5 mark
- _____ 5. Score for flavor
 1 point = Yuck! I'd never drink this shake again
 2 points = `Hmmm! I might drink this shake again
 3 points = Mmmm! I love this shake! I'd make it again for sure.

Total Score

- 13-15** points Your team is out of this world. Send food to Mars!
9-12 points Your team can send food to the moon!
5-8 points Your team needs to stay on the Earth a little longer!

Line Spread Chart

