Unit Overview

This packet of resources is designed for students and their parents who wish to support in-school learning with activities that can be done independently and/or with a partner at home. This packet includes ten activities that support major scientific content, focused on science literacy appropriate for the grade. These activities should take 40-60 minutes and may be completed in any order.

How to use this guide

For each activity, you will find:

- List of vocabulary words and its meanings for a better understanding of the reading passages
- Reading passages on a topic of interest and related to the science content
- Multiple choice questions
- Short writing assignments
- A short description and link for activities and informal science institutions that support the understanding of the content of each assignment.

Students and their families are invited to further explore these topics by conducting the activities found at the end of each assignment and/or by visiting the recommended informal science institutions.
Day 1 Science

The Hoover Dam

Vocabulary
Learn the new vocabulary words below. You will use these vocabulary words in today’s activity.

- **Hydropower** (noun) - electricity produced by machines that are run by moving water.
- **Electricity** (noun) - a form of energy that is carried through wires and is used to operate machines, lights, etc.
- **Irrigation** (noun) – the watering of the land by artificial means to foster plant growth.
- **Power** (noun) – a source or means of supplying energy.
- **Work** (noun) – activity in which one exerts strength or faculties to do or perform something.
- **Nuclear Power** (noun) – (nuclear energy) is the use of exothermic nuclear processes
- **Endangered** (verb/adjective) – being in a dangerous place or situation.

Directions
- Read the article below and answer the questions that follow.

The Hoover Dam
By Michael Stahl

Hydropower is energy generated by a process that uses running or falling water. Mankind has used it for centuries. Around the globe during more primitive times, man used hydropower for irrigation of crops located miles around local water sources. Later, hydropower was used to energize mills that manufactured all sorts of things from paper to paint. These days, hydropower is looked to for the generation of electricity more than any other type of energy, so it is now often referred to as “hydro-electric power.” Hydropower has both positive and negative effects. If one were to try and find a perfect example of what hydropower can do for society, both positive and negative, they would need to look no further than the border between the states of Nevada and...
Arizona in the United States of America. There, they would find one of the most iconic and recognizable structures in the entire country. There, they would find the Hoover Dam.

For decades, the people of the United States of America knew that the Colorado River would be a tremendously useful resource. The Colorado River was used to irrigate farmlands for miles, which brought thousands upon thousands of settlers to the Southwest region. At the turn of the twentieth century though, the government became aware of the many technological improvements being made in the world of hydropower. It had been used famously to power steamboats, but these new developments were making it easier for hydropower to be used to generate electricity. With the invention of the light bulb in 1879, it was just a matter of time before electricity, especially amounts generated by hydropower, would become incredibly important in people’s day-to-day lives. It didn’t take much time either! In Wisconsin, just three years after the light bulb was invented, the first hydroelectric plant opened, proving that the technology in the field of hydropower was being updated rapidly. Therefore, by 1900, the United States felt that action should be taken in the Southwest in order to capitalize on the availability of these new advances, while improving life for both present and future settlers that were moving westward.

It took quite a while for the outlining of formal plans for a new dam in that area to be agreed upon. For almost thirty years, there were disagreements on where the dam should be built and how it should be built. However, during that time, the technology only improved. In a way then, the delays only helped create a more outstanding final product. Finally, in 1928, President Coolidge approved the building of what would become the Hoover Dam. More planning took place that spanned three additional years. It was decided that the dam would be 726 feet tall, 1200 feet wide at its crest, and 660 feet thick at its base. 6.6 million tons of concrete would be needed then for the 91.8 billion cubic-foot facing. Finally, in 1931 President Herbert Hoover, the man which the dam would eventually be named after, ordered that the work begin on the $40 million project, which, in 2013, would now cost in excess of $700 million.

Thirty-five miles north of the dam site in the state of Nevada was a small city called Las Vegas. Once word got out that the tremendous new dam would be built at the Nevada-Arizona border, tens of thousands unemployed workers who were suffering through some of the peak years of The Great Depression flocked to the nearby city and its population quadrupled almost instantly. Though the working conditions were extremely difficult due to high summer temperatures (sixteen people died in just one month from heat stroke), the new Las Vegas citizens were desperate to take any work they could get. Employment for the dam peaked at over 5,000 workers being paid at one time in 1934. By the time the Hoover Dam was completed two years later, 112 people had died during its construction, while many more fell ill from pneumonia caused by the working conditions over the course of the months and years to come. Some of those cases resulted in unfortunate fatalities as well. A memorial tribute to the workers who lost their lives rests on the dam site with the inscription: “They died to make the desert bloom.” And bloom it did.

The Hoover Dam has many functions with one of them being irrigation. One million acres of land around the dam and the All-American Canal, which has water fed to it from the Hoover Dam, are irrigated because of the manmade colossus and the hydropower it produces. Irrigation is incredibly important to the survival of the species of man. One-third of all food in the world that is produced comes from irrigated lands. Obviously, the Hoover Dam is quite helpful in that regard.

The Hoover Dam not only provides water to crops, but also to people. Lake Mead is a nearby lake that is the largest reservoir in the United States. It’s a manmade lake that, like the All-
American Canal, gets its water from what is collected at the dam. Lake Mead has a surface area of 247 square miles and services eight million people with water in Arizona, Nevada, and California. Because so much water moves through the Hoover Dam and into the All-American Canal and Lake Mead, potential floods are also kept under control, making local areas much safer and less susceptible to flooding than in the days before the Hoover Dam.

Still, the biggest reason the Hoover Dam exists is its ability to provide electricity for people in the outlying areas. Each year, the dam generates an average of 4.2 billion kilowatt-hours of electricity. A kilowatt-hour is the energy it takes for a kilowatt to work for one hour. This kind of power is potent enough for the roughly one million people who use electricity from the Hoover Dam to enjoy it. The Hoover Dam has been a key factor in the development of major American cities like Las Vegas and Los Angeles because of the availability of electricity it provides to those sections of the Southwestern states of the U.S.

Safety to people in the surrounding areas and cleanliness are two of the main reasons why hydropower would be a favored source of energy over others. Once oil burns off after use, like in an automobile, toxic gases and contaminants are thrown into the air, polluting the atmosphere. Coal has a similar, dirty impact. Though nuclear power is also very clean, as well as cost-efficient, there are massive risks to people who live near nuclear power plants should something unfortunate occur at one. Atomic energy creates radiation, which is extremely hazardous if it is leaked into the environment. In general, nuclear power plant activity has not resulted in as many deaths as those associated with the generation of other types of power; however, there is a great risk that it could. Hydropower creates very few gaseous emissions. Safety at the Hoover Dam is a top priority as the workers there constantly inspect the dam for damage. There have been very few incidents since the dam opened nearly eighty years ago.

Even though there clearly are numerous advantages to the activation of the Hoover Dam and the work done at the site, there are a few environmental impacts that are harsh. Local ecosystems have declined as a result of water being used up by the Dam and its emptying into the Lake Mead reservoir. The water levels in the Colorado River have been reduced. Plant life then in the immediate area has suffered because the plants have difficulty growing roots long enough to find drinking water. Therefore, they have been sacrificed so that crops abroad could flourish. The dam has impacted the temperatures of the water in the Colorado River. Certain fish that can only survive in particular water temperatures have been almost completely wiped out, including four species of fish that have since been placed on the Endangered Species list. The turbines that draw in the water and use it to help transform energy also draw in fish that are killed from time to time as well. Scientists and engineers have been working to address these environmental issues for years. Progress has been made as they have invented “fish friendly” turbines that allow fish to pass through them unharmed.

There is widespread awareness of these problems, but, clearly, a majority of legislators agree that the benefits of the Hoover Dam greatly outweigh the negatives. President Barack Obama signed extensions allowing the operations of The Hoover Dam to continue through at least the year 2067. The people of the Southwest region of the United States will be able to enjoy the benefits that the Hoover Dam provides them: food, water, and electricity. On top of all of that, the local economy will also benefit, due to tourism, with over ten million people taking in the boating and sun of Lake Mead and seven million people visiting the dam each year.
Question 1: What is hydroelectric power?

1. A form of hydropower that is no longer used to generate electricity.
2. A form of hydropower that uses running or falling water to generate electricity.
3. A form of hydropower that uses electricity to move water.
4. A form of hydropower that uses electricity to build dams.

Question 2: What does the author describe in the passage?

1. The history of the Hoover Dam and its impact on the Southwest region.
2. The development of different types of hydropower.
3. The political environment in America during the construction of the Hoover Dam.
4. Improvements in irrigation along the Colorado River before the Hoover Dam was built.

Question 3: The Hoover Dam provides water to crops and people, keeps potential floods under control, and generates electricity for people in the outlying areas.

Based on this evidence, it can be concluded that the Hoover Dam

1. has had a negative impact on the environment of the Southwest region.
2. has had a negative impact on the people living in the Southwest region.
3. has had more than one positive impact on the Southwest region.
4. has had only one positive impact on the Southwest region.

Question 4: Based on the passage, the benefits of the Hoover Dam

1. are limited to humans.
2. are limited to the environment.
3. are decreasing over time as the dam becomes old.
4. are greater than the negative results of the dam.
Question 5: This passage is mostly about

1. the Hoover Dam and the impact hydropower can have on a region.
2. why different politicians are in favor of extending the operations of the Hoover Dam.
3. the advantages of using hydropower over other sources of energy.
4. the effects the Hoover Dam has had on the environment.

Question 6: Read the sentences:

“In Wisconsin, just three years after the light bulb was invented, the first hydroelectric plant opened, proving that the technology in the field of hydropower was being updated rapidly. Therefore, by 1900, the United States felt that action should be taken in the Southwest in order to capitalize on the availability of these new advances, while improving life for both present and future settlers that were moving westward.”

What word or phrase could best replace capitalize on as used in this sentence?

1. take advantage of
2. make money off of
3. eliminate
4. block from future use

Question 7: Choose the answer that best completes the sentence below.

____________ there is widespread awareness of the Hoover Dam’s negative environmental impacts, a majority of legislators agree that the dam’s benefits outweigh these negative impacts.

1. Because
2. When
3. Although
4. Instead of
Day 2 Science

The Hoover Dam

Please complete the questions below and at least one of the Family Engagement Activities.

**Question 8:** Hydropower is a more favorable source of energy compared to other sources such as coal and nuclear power.

Support this statement by using evidence from the text.

_______________________________________________________________________________

_______________________________________________________________________________

_______________________________________________________________________________

_______________________________________________________________________________

**Question 9:** List at least two positive effects and two negative effects of the Hoover Dam.

_______________________________________________________________________________

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_______________________________________________________________________________

Reading passage and exercises from http://www.readworks.org

Family Engagement Activity
Activity #1: Check which ways you are currently saving energy at home. How can you influence your family for doing even more to save energy?

### The Easy Energy Action Plan Checklist

**10 Simple Ways to Use Energy Wisely**

<table>
<thead>
<tr>
<th>Activity</th>
<th>Description</th>
<th>Checklist</th>
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<tbody>
<tr>
<td>1</td>
<td>Turn off lights.</td>
<td>[ ]</td>
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<tr>
<td>2</td>
<td>Use energy-saving light bulbs.</td>
<td>[ ]</td>
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<tr>
<td>3</td>
<td>Shut off computers.</td>
<td>[ ]</td>
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<tr>
<td>4</td>
<td>Use “smart” power strips.</td>
<td>[ ]</td>
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<tr>
<td>5</td>
<td>Turn off entertainment devices when not in use (TV, game systems, etc.).</td>
<td>[ ]</td>
</tr>
<tr>
<td>6</td>
<td>Use natural light, heat and cooling.</td>
<td>[ ]</td>
</tr>
<tr>
<td>7</td>
<td>Unplug chargers when not in use.</td>
<td>[ ]</td>
</tr>
<tr>
<td>8</td>
<td>Talk to your parents about ENERGY STAR® appliances.</td>
<td>[ ]</td>
</tr>
<tr>
<td>9</td>
<td>Talk to your parents about programmable digital thermostats.</td>
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<tr>
<td>10</td>
<td>Talk to your parents about home improvements to save energy such as windows, doors, and roofs.</td>
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Activity #2:
Students and their families may continue exploring the topic of energy following the information on this link, completing the online activities. [http://www.eia.gov/kids/]
Activity: The Cooling from the Warmth of Nature

Vocabulary
Learn the new vocabulary words below. You will use these vocabulary words in today's activity.

- **Mold** (noun) – a type of fungus that produces a superficial, often woody growth, on damp or decaying organic matter or on living organisms
- **Solar power** (noun) – is the conversion of sunlight into electricity, either directly using photovoltaics, or indirectly using concentrated solar power.
- **Photoelectric effect** (noun) – refers to the emission, or ejection, of electrons form the surface of a metal in response to incident light.
- **Electrons** (noun) – a stable subatomic particle with a negative charge, found in all atoms and acting as the primary carrier of electricity in solids.
- **Greenhouse gases** (noun) – a gas that contributes to the greenhouse effect by absorbing infrared radiation, e.g., carbon dioxide and chlorofluorocarbons.

Directions
- Read the article below and answer the questions that follow.

**The Cooling from the Warmth of Nature**

By Michael Stahl

David and Karen Sullivan bought their first home after building their savings over the course of the first three years of their marriage. Buying a home was an important goal for them. Like many folks who buy a house, they feel their purchase is primarily a place to live but is also an investment.

There are hopes for many homeowners that, if necessary or possible, they might one day resell their property at a higher price than originally purchased. Such fortune is called a “return” on an investment. David and Karen were certainly considering such an outcome when they decided to
choose that particular home, though it was also going to be the place where they anticipated raising a child or two. It was a very nice house with three bedrooms, two bathrooms, a basement and an attic. There was a backyard and a lawn, plus a driveway and garage. David and Karen bought it for an unexpectedly low price, but there was a good reason for that. The one thing that was unappealing about the house was that it was well over 50 years old and needed to be fixed up a bit. David and Karen decided to use the extra money they had left over from their purchase to update the home and make it a little bit more modern. Then, they would feel more comfortable raising their future children there, and David and Karen would also be a little more confident that they would one day get a return on their investment.

"We definitely need to get the basement walls redone to keep the mold out," said Karen to David over lunch the day after their successful, fun housewarming party.

"I agree. Mold can be poisonous and, really, it’s just a matter of time before the foundation is too old and deteriorated to prevent mold from growing," replied David.

They agreed to make the basement project their top priority. However, they would still have some money left over for even more home improvements.

"Maybe we should just save the money for when we need it," Karen pondered aloud.

"I just read somewhere recently that solar power panels can be a wonderful investment, though," replied David.

“Oh?” Karen asked. “How so?”

David popped open his laptop and found the article he had read on the Internet a few days prior. It was not long after reading it alongside his wife that both he and Karen agreed: solar power panels would be the way to go for them and their new home.

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Solar power is simply the use of sunlight to create electricity. Machines that are capable of performing such a transformation use lenses or mirrors to harness all of the sunlight they can absorb into one concentrated beam. A process called the “photoelectric effect” strips electrons from out of the atoms that make up the rays of light, creating electricity. From that point on, the solar power electricity can be used for anything that typically needs an electric current: power tools, televisions, lighting, and air conditioning.

One particular reason David and Karen thought powering their home by using the sun’s rays was a good idea is that solar power is considered one of the “greenest” energies available. In other words, using solar energy is much less harmful to the environment than many other forms. For instance, when it comes to toxic or greenhouse gases, like carbon, it is estimated that solar energy releases somewhere between one-tenth and one-twentieth of the amount of oil and gas energy—an incredible ratio.

Many scientists argue that the rise in greenhouse gases in the atmosphere has jumpstarted the global warming the earth is undoubtedly experiencing. David and Karen quickly found that using solar energy would reduce their “carbon footprint.” A carbon footprint is the average
amount of carbon a person will unleash into the air. It is based on the way people live and how much energy they typically use on a day-to-day basis. So, David and Karen’s installation of solar power panels would make them feel proud to have helped the earth in a positive way.

Many of the earth’s resources are used for energy purposes. Aside from the fact that coal and oil negatively impact the environment when put into use, they also become scarcer. Nobody is exactly sure how much oil remains underneath the earth’s surface or how much coal may be down in the mines. However, many people have speculated that these two particular resources, which are depended upon greatly by mankind, are finite. This means that, eventually, the earth will run out of them.

To battle this, governments, including the United States, have begun to give out financial benefits to those who decide to invest in solar power for their own personal needs, provided that they follow certain requirements. Officials think it is virtually impossible to completely change how people get their energy in a span of a few years or even decades. It seems clear, though, that government officials feel this change is something that will eventually happen, and perhaps must happen if mankind is going to truly try and help improve the environment of the planet they call home. So, various heads of state are seeing that more and more people feel compelled to get solar power for their homes with the hope that, over time, the industry will become less costly, thus naturally influencing even more people to make the switch.

In David and Karen’s case, the U.S. government offered them a tax refund for installing their solar power panels. They had expected cash back from the government, which was a big reason for their decision to turn to solar power, but it was not the only way that David and Karen would financially benefit from using solar power for their home.

Local electric companies work in conjunction with the owners of homes who have installed solar power panels. The sun provides electricity to the home, but not as much when clouds are not overhead. So, the electric company powers the home when the sun cannot. The solar power system in a home can store electricity when it is needed at a later date—saving it for a rainy day, literally! The electric company can charge homeowners for the power that they provide. Between all of the sunny days and the time when the reserve power is used by the home, this adds up to significant potential savings for homeowners on their electric bills.

For David and Karen, installing solar power panels was a no-brainer. As time went on, the cost for the panels eventually found its way back into their pockets, just in time for the arrival of their first child, Janie, who enjoys low-cost air conditioning in her first bedroom.

**Question 1:** What do David and Karen use to help power their home?

1. windmills
2. water wheels
3. steam shovels
4. solar panels
Question 2: What does this passage compare and contrast with solar energy?

1. This passage compares and contrasts wind and nuclear energy with solar energy.
2. This passage compares and contrasts oil and gas energy with solar energy.
3. This passage compares and contrasts geothermal energy with solar energy.
4. This passage compares and contrasts microwave energy with solar energy.

Question 3: Solar energy is less harmful to the environment than many other forms of energy. What evidence from the passage supports this statement?

1. Solar energy releases one-tenth to one-twentieth as much toxic greenhouse gas as oil and gas energy.
2. The machines capable of turning solar energy into electricity use lenses or mirrors to harness sunlight.
3. Many scientists argue that global warming is a result of more greenhouse gases in the atmosphere than before.
4. The house that David and Karen buy has three bedrooms, two bathrooms, a basement, and an attic.

Question 4: Why might the United States government offer financial benefits to people who install solar panels in their homes?

1. To encourage people to vote
2. To discourage people from voting
3. To encourage people to use solar power
4. To discourage people from using solar power

Question 5: What is this passage mostly about?

1. Gas energy, the photoelectric effect, greenhouse gases, and carbon footprints.
2. The reason that a young married couple was able to buy a nice house for a low price.
3. The financial benefits that some governments offer people who use solar panels for their homes.
4. Solar power, and a married couple who installed solar panels for their home.
Question 6: Read the following sentence: “Solar power is simply the use of sunlight to create electricity.”

What does the word solar mean?

1. Having to do with the sun
2. Having to do with the wind
3. Having to do with the ocean
4. Having to do with animals

Question 7: Choose the answer that best completes the sentence below.

David and Karen want to improve their home; _______ they decided to have solar panels added to it.

1. however
2. on the other hand
3. previously
4. consequently
Day 4 Science

Activity: The Cooling from the Warmth of Nature

Please complete the questions below and at least one of the Family Engagement Activities.

Question 8: What can electricity from solar power be used for?

_______________________________________________________________________________
_______________________________________________________________________________
_______________________________________________________________________________
_______________________________________________________________________________

Question 9: According to the passage, how can people save money by using solar power in their home?

_______________________________________________________________________________
_______________________________________________________________________________
_______________________________________________________________________________
_______________________________________________________________________________

Reading passage and exercises from http://www.readworks.org
Family Engagement Activity

Activity #1: Follow the procedure on the worksheet to build a model that will help you better understand global warming.

Global Warming in a Jar

Perhaps you have heard of the greenhouse effect. In a greenhouse, short-wave radiation from sunlight passes freely through the glass and is converted to long-wave radiation inside. But the long-wave radiation cannot pass back out through the glass. The result is a build-up of heat inside the greenhouse from the captured solar energy. Certain gases in Earth’s atmosphere—especially water vapor and carbon dioxide—act in much the same way as the glass in a greenhouse. We call this situation the greenhouse effect, and we call these gases the greenhouse gases, because of their ability to trap energy from sunlight. Most greenhouse gases occur naturally, but some are being added to the atmosphere because of human actions.

Global warming refers to the rise in temperatures at Earth’s surface and lower atmosphere over the last century. Most scientists believe that greenhouse gases produced by human activity are contributing to global warming. The danger in this warming is that it could disrupt Earth’s climate patterns, cause coastal flooding, and force major adjustments in the way people live. The more we are able to learn about the causes and effects of global warming, the better prepared we may be to deal with the possible consequences of a changing environment.

In this set of experiments you will use models of Earth’s atmosphere to see how it is warmed by sunlight. You will also discover how lakes and seas affect this warming by storing and releasing energy from the sun.

Materials: Large pickle jars, smaller jelly jar, laboratory thermometers, white cardboard, sheets of 8½” x 11” white paper, transparent tape, clear plastic wrap, rubber bands, water, anti-fog solution, timer or clock, activity log sheet, graph sheet, question-and-answer sheet.

Preparation: This activity requires a location where there is direct sunlight for a sustained period of time. The experiments use three different models for Earth’s atmosphere, as shown below.

A – Open  
B – Covered  
C – Covered / Water

Two different experiments are presented, each experiment using a different pair of models:

Experiment 1: Models A and B, where A is the control, and the cover (B) is the variable.
Experiment 2: Models B and C, where B is the control, and water (C) is the variable.

Your teacher will tell you which experiments to do and which models to use. Directions for building the models are given on the next page. Note: Prepare each model out of direct sunlight.
Activity #2:

Students and their families may want to continue exploring the topic of climate change by conducting the online activities found at the EPA website.  
Day 5 Science

Activity: Will this Oil Fly?

Vocabulary
Learn the new vocabulary words below. You will use these vocabulary words in today’s activity.

- **Alternative fuel** (noun): a fuel other than regular gasoline, usually one that is better for the environment
- **Carbon neutral** (adjective): leaving no carbon dioxide in the atmosphere
- **Comparable** (adjective): similar
- **Biofuel** – a fuel (as wood or ethanol) composed of or produced from biological raw materials.

Directions
- Read the article below and answer the questions that follow.

Will This Oil Fly?

WELLINGTON, New Zealand (Achieve3000, January 28, 2009). Air New Zealand recently announced that it had successfully flown a passenger jet that was powered in part by a type of vegetable oil. The airline believes that replacing regular jet fuel with this biofuel could cut costs and be better for the environment.

The two-hour test flight included a full-power takeoff and cruising to 35,000 feet. One of the four engines on the Boeing 747-400 airplane was powered by a 50-50 blend of standard A1 jet fuel and oil from jatropha plants. Air New Zealand Chief Executive Rob Fyle called the flight "a milestone for the airline and commercial aviation."

The test flight took place at a time when airlines are making a push for alternative fuels. These companies are struggling to make money. Why? The petroleum that airplanes have always used as fuel became extremely costly in 2008. In addition, now that the economy has slowed down, airlines are bracing for a drop in business. Taken together, these two factors have prompted airlines to look for ways to save money.

Many people feel that biofuels offer a promising solution. That’s true not only because they could be cheaper to produce than jet fuel, but also because they may be better for the environment.
Biofuels are made from plants, such as sugar, corn, or soybeans. They are sustainable fuels because unlike petroleum, the oil can be made again and again as new crops are grown. However, many biofuels have been criticized because they use food crops and may end up reducing the world's food supply.

According to Air New Zealand officials, jatropha oil is a superior biofuel. Why? The jatropha plant is not a food crop. And since it can grow with little water on land that is considered poor for farming, it does not compete with food crops for land. Like jet fuels, jatropha oil blends emit greenhouse gases when they are burned. However, airline officials insist that jatropha oil is carbon neutral because the jatropha plant absorbs the air's harmful carbon dioxide when it is growing.

Air New Zealand chief pilot Captain David Morgan, who was onboard the airplane during the test flight, said the airline wants jatropha to become a certified aviation fuel. The company hopes that by 2013, 10 percent of its flights will be powered, at least in part, by biofuels.

Reaching this goal may help the environment, but would it also have an economic benefit, as Air New Zealand is hoping? So far, officials could not say whether their jatropha fuel blend would be cheaper than standard jet fuel. They do expect the cost of the blend to at least be comparable to that of jet fuel.

Still, the cost of fuel depends on the supply. If there is an adequate supply, the cost will be lower. If the supply is low, the cost will be higher. Currently, jatropha isn't being widely grown because it is not in demand. Therefore, Air New Zealand Group Manager Ed Sims cautioned that the company would not be able to ensure easy access to large quantities of jatropha oil until at least 2013.

"[To have the] amount of fuel around the world to be able to power the world's airlines is still some years off," said Sims.

*The Associated Press contributed to this story.*
**Question 1:** The best alternate headline for this article would be __________________________.

1. Jetliner Flies Partly on Biofuel
2. Jetliner Cruises at 35,000 Feet
3. Airlines Struggling To Make Money
4. Airlines Seeking Certified Aviation Fuel

**Question 2:** According to the article, what is one reason why jatropha oil is considered a superior biofuel?

1. The jatropha plant can grow with little water on land that makes poor farmland, so it doesn't compete for agricultural space with food crops.
2. The jatropha plant is not a popular food, so only part of the crop yield is used for food while the rest can be used for biofuel.
3. Jatropha oil does not emit harmful carbon dioxide when it is burned, but most other biofuels do.
4. Jatropha oil is a certified aviation fuel that is widely used by airlines, while other forms of biofuel have not yet been certified.

**Question 3:** Which is the closest synonym for the word *comparable*?

1. Equivalent
2. Temporary
3. Beneficial
4. Commercial

**Question 4:** Suppose that Marcus wants to find out about other uses for biofuels. He would find most of his information __________________________.

1. Under the heading "biofuel applications" in a reference book about alternative fuels
2. Under the heading "petroleum" on a Web site about traditional fuel sources
3. In a textbook entry about the manufacturing process of various biofuels
4. In a newspaper article about the many types of fuels used by airlines
Read the passage below and think about the article.

The article states:

*Biofuels are made from plants, such as sugar, corn, or soybeans. They are sustainable fuels because unlike petroleum, their oil can be made again and again as new crops are grown. However, many biofuels have been criticized because they use food crops and may end up reducing the world’s food supply.*

**Question 5:** Which of the following is probably true of a fuel that is *sustainable*?

1. It is a renewable source of energy.
2. It is harmful to most marine life.
3. It emits greenhouse gases as it grows.
4. It can be considered a petroleum byproduct.

**Question 6:** Which of these is not a statement of fact?

1. Jatropha oil is by far the best alternative energy source available on the market today.
2. Jatropha plants absorb some of the air's carbon dioxide when they are growing.
3. Biofuels are made from plants such as sugar, corn, soybeans, and jatropha.
4. Biofuel was mixed with jet fuel during a recent Air New Zealand test flight.

**Question 7:** Which of these is most important to include in a summary of this article?

1. Air New Zealand recently conducted a successful test flight using a mix of biofuel and jet fuel.
2. Air New Zealand Chief Executive Rob Fyfe said that he was excited about a recent airline flight.
3. Biofuels have been criticized because they can use food crops and may end up reducing the world's food supply.
4. Biofuels that are made from jatropha oil blends emit greenhouse gasses when they are burned.
Day 6 Science

Activity: Will this Oil Fly?

What to Do

Using the information you read previously, imagine that you had to prepare a script for your school's news show that explains the important details from this article. Prepare a script that a student newscaster could read for the broadcast. Be sure to:

- Include the narration of the test flight
- Make sure that the script is logically organized and that you develop the content of the script with relevant, well-chosen facts, concrete details and quotations
- Include definitions in your script of technical words you think your audience may be unfamiliar with
- Think about what images or types of multimedia might enhance this news clip (you don't need to find these images or clips, but you can describe them and how they could be used to enhance your audience's understanding of the news story)

Be sure that your script adheres to the style and tone of a non-cable news broadcast.

www.teenbiz3000.com
Family Engagement Activities
Complete at least one of these Family Engagement Activities.

Activity #1:
If you needed to choose **ONE** alternative energy from the ones shown, which one would you use? Develop an argument based on the information in the chart and in the article.

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**U.S. energy consumption by source, 2017**

- **biomass**: renewable; heating, electricity, transportation (5.0%)
- **petroleum**: nonrenewable; transportation, manufacturing (37.1%)
- **hydropower**: renewable; electricity (2.8%)
- **natural gas**: nonrenewable; heating, manufacturing, electricity (28.7%)
- **geothermal**: renewable; heating, electricity (0.2%)
- **coal**: nonrenewable; electricity, manufacturing (14.2%)
- **wind**: renewable; electricity (2.4%)
- **uranium**: nonrenewable; electricity (8.6%)
- **solar & other**: renewable; light, heating, electricity (0.8%)

*Sum of individual percentages may not equal 100 because of independent rounding.*
*Source: U.S. Energy Information Administration, Monthly Energy Review, Table 1.3, April 2018, preliminary data*
Activity #2:

Students and their families may continue exploring the topic of fossil fuels and energy by conducting various online activities found here. [https://www.eia.gov/kids/](https://www.eia.gov/kids/)
Vocabulary

Learn the new vocabulary words below. You will use these vocabulary words in today’s activity.

- **Energy** (*noun*): capacity or power to do work
- **Organisms** (*noun*): an individual animal, plant, or single-celled life form
- **Absorb** (*verb*): take in or soak up (energy, or a liquid or other substance) by chemical or physical action, typically gradually
- **Photosynthesis** (*noun*): the process by which green plants and some other organisms use sunlight to synthesize foods from carbon dioxide and water. Photosynthesis in plants generally involves the green pigment chlorophyll and generates oxygen as a byproduct.
- **Carbon dioxide** (*noun*): a colorless, odorless gas produced by burning carbon and organic compounds and by respiration. It is usually present in the air (about 0.03 percent) and is absorbed by plants in photosynthesis.
- **Carbohydrate** (*noun*): any of a large group of organic compounds occurring in foods and living tissues and including sugars, starch, and cellulose. They contain hydrogen and oxygen in the same ratio (2:1) and typically can be broken down to release energy in the animal body.
- **Nutrients** (*noun*): a substance that provides nourishment essential for growth and the maintenance of life.
- **Survival** (*noun*): the state or fact of continuing to live or exist, typically in spite of an accident, ordeal, or difficult circumstances.
- **Targeted** (*verb*): select as an object of attention or attack; aim or direct (something).
- **Preyed** (*verb*): hunt and kill for food.
- **Decompose** (*verb*): to cause something (such as dead plants and animals) to be slowly destroyed and broken down by natural processes, chemicals, etc.
An ecosystem is a community of living organisms interacting with one another as well as with nonliving things. One very important aspect of an ecosystem is the energy that flows through it. Energy is exchanged between members of an ecosystem, creating an energy flow and assisting in the continuation of life. However, not all of the organisms living in an ecosystem absorb equal amounts of energy. An eco pyramid effectively illustrates the amounts of energy that are absorbed by the different types of organisms in an ecosystem.

The power of the earth’s sun gets the energy flow of most ecosystems going. Solar rays enter the earth’s atmosphere and reach the surface where plants utilize the energy from them. Through a process called photosynthesis, plants like trees, grass, and bushes, create food for themselves. Plants are able to take in carbon dioxide from the atmosphere, and their roots absorb water from the surrounding soil. Plants then use the solar energy and the hydrogen from water to transform the carbon dioxide into a nourishing carbohydrate. With photosynthesis complete and food and energy absorbed, the plants release the oxygen part of the water that they had taken from the soil back out into the atmosphere. Other living things, like human beings, take in oxygen in the breathing process. The plants of an ecosystem are called “autotrophs,” which means “self-feeders.” They are also called “producers” in an ecosystem. The carbohydrates that were produced by the photosynthesis process give the plant energy to continue on living. Herbivores are animals that eat mostly, if not strictly, plant life. Termites, koalas, field mice, and deer are a few examples of herbivores. Deer feed on leaves and grass, consuming the green plant life’s energy. To consume means to eat something and absorb its nutrients for survival. After eating the plants of their choice, deer will then digest the plants and use whatever nutrients the plant had stored inside to create energy so that they can continue to live. The herbivores of an ecosystem are called “primary consumers.” Some of the energy that the herbivores use is lost in the ecosystem when they create body heat. For example, when deer run and their bodies warm up, the excess heat within their bodies escapes into the atmosphere. If that did not happen, the deer’s bodies would get too hot and their organs would fail to work any longer.

Energy is transferred again in an ecosystem’s energy flow from primary consumers to “secondary consumers.” Carnivores, or meat eaters, act as secondary consumers. Lions, tigers, and polar bears are carnivorous. They eat the meat of the herbivores after a hunt. When tigers eat their prey’s meat, they go on
to digest it and use the energy from it for their own survival. Like the herbivores in the previous section of the energy flow, carnivores also give off heat energy when their bodies warm up from exercise. Unfortunately for the carnivorous secondary consumers, they too will eventually find themselves targeted for their energy by other members of their ecosystem: the tertiary consumers.

Secondary consumers are carnivorous predators, meaning that they hunt down other animals and kill them for food. However, these animals are not at the very top of the food chain and they too can be hunted and utilized as a meal. Tertiary consumers are predators who lie at the top of the food chain. Human beings are the most obvious example of a tertiary consumer. Unlike the secondary consumers, tertiary consumers are not normally preyed upon by other members of the ecosystem.

Like the primary and secondary consumers, the tertiary consumers give off body heat. That energy is released into the atmosphere. Even if consumers or producers aren’t hunted or eaten, all living things eventually die. When they do, they decompose. Bacteria and fungi attach themselves to a dead producer or consumer and begin to break down the matter of the body, releasing nutrients into the soil. These nutrients are then used to give life to new plants so that new energy from the sun can flow through the eco pyramid.

**Question 1: What is an ecosystem?**

1. A process in which plants take carbon dioxide from the atmosphere and hydrogen from water, and release oxygen into the atmosphere.

2. A group of living organisms interacting with one another as well as with nonliving things.

3. A predator that lies at the top of the food chain and may feed on plants, primary consumers, or secondary consumers.

4. An organism that attaches itself to dead tertiary consumers and breaks down the matter of their bodies

**Question 2: What is a list of the types of organisms in an eco pyramid?**

1. nonliving things, bacteria, fungi, sunlight, water secondary consumers, tertiary consumers

2. primary consumers, deer, bacteria, fungi, nonliving things, tertiary consumers

3. producers, primary consumers, secondary consumers, tertiary consumers
4. producers, primary consumers, secondary consumers, carbohydrates, water

**Question 3:** In an ecosystem, primary consumers eat plants. Secondary consumers eat primary consumers. Tertiary consumers eat secondary consumers.

What can be concluded from this information?
1. Plants need both carbon dioxide and water for photosynthesis to occur.
2. Different types of organisms within an ecosystem need each other to live.
3. Bacteria and fungi are needed to break down the dead bodies of producers and consumers.
4. Light from the sun is necessary for most ecosystems on Earth to get going.

**Question 4:** Which members of an ecosystem are part of the energy flow?
1. ONLY the living things in the ecosystem
2. ONLY the nonliving things in the ecosystem
3. Living and nonliving things in the ecosystem
4. The energy flow is not dependent on any members of the ecosystem.

**Question 5:** What is this passage mostly about?
1. The energy flow of an ecosystem and the different types of organisms within an ecosystem.
2. The function of secondary consumers and their importance to an ecosystem.
3. The problems for ecosystems that result from humans hunting animals such as deer and tigers.
4. The creation of body heat in primary consumers and the release of that heat into the atmosphere.

**Question 6:** Read the following sentences: “Energy is transferred again in an ecosystem’s energy flow from primary consumers to secondary consumers. Carnivores, or meat eaters, act as secondary consumers. Lions, tigers, and polar bears are carnivorous. They eat the meat of the herbivores after a hunt. When tigers eat their prey’s meat, they go on to digest it and use the energy from it for their own survival.”

As used in the passage, what does the word “transferred” mean?
1. stopped
2. moved
3. changed
4. destroyed

**Question 7**: Choose the answer that best completes the sentence below.

Living and nonliving things in an ecosystem interact with each other; ________plants use energy from the sun.

1. on the other hand
2. in the end
3. in particular
4. previously
Day 8 Science

The Eco Pyramid

Please complete the questions below using the article you read previously and your knowledge of science, and at least one of the Family Engagement Activities.

**Question 8**: What are herbivores?

_________________________________________________________________________________
_________________________________________________________________________________
_________________________________________________________________________________
_________________________________________________________________________________

**Question 9**: How do secondary consumers obtain their energy? Provide evidence from the passage above.

_________________________________________________________________________________
_________________________________________________________________________________
_________________________________________________________________________________
_________________________________________________________________________________

**Question 10**: If one type of organism described in the passage were removed from an ecosystem, what would happen to the ecosystem? Explain your answer using evidence from the passage.

_________________________________________________________________________________
_________________________________________________________________________________
_________________________________________________________________________________
_________________________________________________________________________________

Reading passage and exercises from http://www.readworks.org
Family Engagement Activities

Activity #1: Build your own food web model, using the organisms in the illustration below. Explain in your own words how energy and matter flow through your food web.

**Build a Food Web - Activity**

Draw an arrow from each plant or animal to the living thing that consumes it. Your food web should include the acorns, blue jay, chipmunk, grass, grasshopper, hawk, lynx, mouse, mushrooms, rabbit, shrubs, snake, tree and stick insect.

![Food Web Illustration](image)

© Sheri Amsel

www.exploringnature.org

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________________________________________________________________________________
Activity #2:

Use the food web to explain what would happen with the flow of energy if you remove the mouse out of the forest.
Day 9 Science

Activity: The Meteor

Vocabulary

Learn the new vocabulary words below. You will use these vocabulary words in today’s activity.

- **Lit (verb):** provide with light or lightning; illuminate
- **Meteor (noun):** a small body of matter from outer space that enters the earth’s atmosphere, becoming incandescent as a result of friction and appearing as a streak of light.
- **Strike (verb):** (of a disaster, disease, or other unwelcome phenomenon) occur suddenly and have harmful or damaging effects.
- **Plume (noun):** large quantity of smoke, dust, fire or water that rises into the air in a column.
- **Dense (adjective):** closely compacted in substance
- **Heat wave (noun):** a prolonged period of abnormally hot weather
- **Shock wave (noun):** a sharp change of pressure in a narrow region traveling through a medium, especially air, caused by explosion or by a body moving faster than sound
- **Slam (verb):** shut (a door, window, or lid) forcefully and loudly
- **Energy (noun):** capacity or power to do work
- **Radiated (verb):** emit (energy, especially light or heat) in the form of rays or waves
- **Blinding (adjective):** (of light) very bright and likely to dazzle or temporarily blind someone
- **Flattened (verb):** to make or become flat or flatter
- **Thinly (adverb):** in a thin layer or piece
Directions

- Read the article below and answer the questions that follow.

The Meteor

Sergei Bobunets, lead singer of a Russian rock band, had just stepped outside when the sky fell apart.

“I looked up, and suddenly the sky lit up with a bright light, and something that looked like the sun fell,” Bobunets said, trying to make sense of one of the most powerful events on Earth: a meteor strike. Bobunets was standing 125 miles north of Chelyabinsk, a city in Russia which on February 15, 2013, witnessed perhaps the best-documented meteor fall in human history.

Eyewitnesses recorded the fireball with their phones and digital cameras. A European weather satellite took a photo of the meteor as it streaked through the atmosphere, and a Chinese satellite captured the meteor’s vapor plume. Thousands of people saw the flash of light and felt the shock wave after the meteor crashed into Earth.

"I looked out the window and saw a huge line of smoke, like you get from a plane, but many times bigger," Sergei Serskov, an office worker in Chelyabinsk, told the BBC. "A few minutes later the window suddenly came open, and there was a huge explosion, followed by lots of little explosions. It felt like a war zone."

The meteor was not very big. It was about 57 feet long, a little longer than a normal city bus. But it was super dense, weighing about 11,000 tons—more than the Eiffel Tower. And it was moving extremely fast. Scientists estimated its speed at 41,000 miles per hour, or about 50 times the
speed of sound. Its tremendous speed was the main factor in its enormous destructive power. When the meteor exploded 14 miles above the Earth it released a bright flash of light, a powerful heat wave, and a shock wave with roughly 20 to 30 times more energy than the atomic bomb detonated at Hiroshima. The explosion damaged 7,200 buildings in six cities and about 1,500 people were injured, mostly from flying glass.

“My eyes are still hurting,” an eyewitness wrote on an Internet forum soon after the impact. “Oh, my God, I thought the war had begun.”

The widespread destruction caused by the Chelyabinsk meteor gives proof to the rule of physics that the faster an object is moving, the more energy it has. A bus on the street that loses control could slam into a building and kill a few people. A bus flying through space at 50 times the speed of sound could wipe out an entire city.

The Chelyabinsk meteor is also an example of how energy moves. First there was the meteor itself, which was moving energy simply by its movement through space. As it encountered Earth’s atmosphere, the meteor ran into increased resistance from air and dust molecules, which released some of its energy in the forms of heat and light. And when it exploded, the meteor radiated its energy over the Russian sky in the forms of blinding light, piercing sound, a shock wave strong enough to collapse buildings and knock people off their feet, and continued physical motion in the form of thousands rocks falling to the ground. The only known type of energy the meteor did not give off was electricity.

While the Chelyabinsk meteor was the best-documented in history, it was not especially large or powerful as meteors go. The most destructive event in recorded history is believed to have been a meteorite that crashed into Earth above Russia’s Tunguska River in 1908. Scientists estimate the object was about 330 feet across. It flattened 80 million trees over 830 square miles of forest, and created a destructive force 1,000 times more powerful than the atomic bomb dropped over Hiroshima. The shock wave shook buildings and knocked people off their feet hundreds of miles away. For the next few nights, night skies across Europe and Asia glowed, possibly caused by sunlight bouncing off particles left by the meteor’s tail and dust raised by its impact.

Widespread casualties were avoided because the area was so thinly populated, but there were eyewitnesses to the explosion. “The sky split in two, and fire appeared high and wide over the forest,” a witness named S. Semenov told a researcher. “At that moment I became so hot that I couldn’t bear it, as if my shirt was on fire… I wanted to tear off my shirt and throw it down, but then the sky shut closed, and a strong thump sounded, and I was thrown a few meters.”

No other object visible to humans travels as fast or carries as much energy as meteors do. As the world fills with electronic cameras and sensors, we may be able to learn more about smaller meteors such as the one at Chelyabinsk before once more facing the destructive power of a mammoth meteor like the one at Tunguska.
Question 1: What did Sergei Bobunets witness?

1. a meteor strike
2. a plane crash
3. the bombing of Hiroshima
4. the sun falling

Question 2: How does the author describe the meteor strike at Chelyabinsk?

1. The meteor strike had very few witnesses and was not well documented.
2. It was the most destructive meteor strike in documented history.
3. The meteor strike created a bright flash of light, a heat wave, and a shock wave.
4. The meteor strike was in a thinly populated area and did not hurt anyone.

Question 3: The Chelyabinsk meteor was a little longer than a normal city bus and moved at 50 times the speed of sound. A bus on the street that loses control could slam into a building and kill a few people. A bus flying through space at 50 times the speed of sound could wipe out an entire city.

Which conclusion does this information best support?

1. Objects release energy.
2. The faster an object is moving, the more energy it has.
3. Bus-sized objects can be dangerous.
4. The size of an object determines how fast it can move.

Question 4: When did the Chelyabinsk meteor most likely contain the most energy?

1. After it exploded
2. When it exploded
3. As it encountered Earth’s atmosphere
4. Before it encountered Earth’s atmosphere
Question 5: What is this passage mostly about?

1. Sergei Bobunets
2. Atomic bombs
3. Meteor strikes
4. Astrophysics

Question 6: Read the following sentence: “As the world fills with electronic cameras and sensors, we may be able to learn more about smaller meteors such as the one at Chelyabinsk before once more facing the destructive power of a **mammoth** meteor like the one at Tunguska.”

What does “**mammoth**” mean in this context?

1. very, very large
2. a hairy animal from the Ice Age
3. something frightening
4. lacking in force

Question 7: Choose the answer that best completes the sentence below.

When a meteor explodes in the sky, it radiates its energy in various forms, ________ light, sound, and heat.

1. consequently
2. above all
3. currently
4. including
Day 10 Science

Activity: The Meteor

Please answer the questions below and complete at least one the Family Engagement Activities.

**Question 8:** What object visible to humans travels the fastest and carries the most energy?
________________________________________________________________________________
________________________________________________________________________________

**Question 9:** What were the differences between the meteor strikes at Chelyabinsk and Tunguska?
________________________________________________________________________________
________________________________________________________________________________
________________________________________________________________________________

**Question 10:** Explain why it is important to study meteors. Support your answer with details from the passage.
________________________________________________________________________________
________________________________________________________________________________
________________________________________________________________________________

Reading passage and exercises from http://www.readworks.org
Family Engagement Activity

Activity #1:
Modeling Craters and Meteor Impact

Investigate how the size of a meteorite is related to the size of the crater it makes upon impact.

Materials and Equipment

- Different-sized objects that are nearly spherical (at least 3 total), such as a rubber ball, a baseball, and a piece of roundish fruit.
  - Tip: Solid objects may work better than hollow ones.
  - Note: Smaller objects, such as marbles and beads, will not work well for this science project unless you use metal or magnetic balls and a magnet to carefully remove them, as was shown in the DragonflyTV video in the Background.
- Ruler, metric
- Cardboard box; it should be larger than a shoebox and fairly deep. Something like a small moving box would be perfect.
- Flour (10-lb bag)
- Cocoa powder
- Flour sifter or sieve

Experimental Procedure

1. Make a data table like Table 1.
   a. Be sure to include the types of objects that you will be testing.
2. Using a ruler, measure the diameter of each of your nearly spherical objects (in centimeters [cm]). The diameter is the distance across the middle of the sphere, from one side to the other. Write your measurements in the data table in your lab notebook. Each object will serve as a "meteorite" in this science project.

<table>
<thead>
<tr>
<th>Object</th>
<th>Diameter of Object (cm)</th>
<th>Diameter of Craters (cm)</th>
<th>Average Crater Diameter (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rubber ball</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseball</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Round fruit</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Etc.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 1. In your lab notebook, make a data table like this one to record your measurements and data in.

3. Prepare your meteorite landing area.
   a. Slowly pour a 10-lb bag of flour into the cardboard box. Shift the box from side to side to evenly distribute the flour. The flour should be a depth of at least 5 cm in your box. If there is not enough flour, you can either transfer the flour to a smaller box, or add another bag of flour.
   b. Use a sifter or sieve to add a thin layer of cocoa powder.
   c. When you are done preparing it, your box should look similar to the one in Figure 3.
4. Now drop one of your "meteorites" into the box by holding the object out at arm's length over the box and letting go. Use the ruler to make sure you drop the meteorite from a height of 50 cm above the flour.
5. After the "meteorite" impacts the flour, carefully remove the object without disturbing the "crater" left behind.
6. Repeat steps 4 to 5 two more times using the same object, each time in a different spot in the box. Remember to drop the meteorite the same way and from the same height each time for accurate results. You should now have three craters made by the first object.
7. Measure the diameter of the first crater by measuring the distance across the center of the depression in the flour, as shown in Figure 4. Be very careful not to disturb the flour and cocoa with your ruler, by breathing too hard, or by shaking the box. Write the diameter of the first crater in the data table in your lab notebook.

8. Repeat step 7 for the other two craters, writing each measurement in the data table.
9. Calculate the average crater diameter by adding up the three measurements and then dividing your answer by three. Write the answer in your data table.
10. Prepare your box for the next "meteorite".
    a. Mix the cocoa into the flour.
    b. Shake the box from side to side to even out the flour until it is smooth and level.
    c. Add a new thin layer of cocoa.
11. Repeat steps 4-10 for all of your objects, each time recording the diameter of the three craters and the averages in the data table in your lab notebook.
   a. Be sure to always drop the meteorites the same way and from the same height so that your results are accurate.

12. Now make a graph of your data.
   a. You can make a graph by hand using graph paper or use a website like Create a Graph to make a graph on the computer and print it.
   b. On the left axis (y-axis), plot the average diameter of the crater (in cm), and on the bottom axis (x-axis), plot the diameter of the meteorite (in cm).

13. What size craters did the smallest objects make? What size craters did the biggest objects make? Do you notice any pattern between the size of the crater and the size of the meteorite? What do you think your results tell you about how the diameter of a meteorite is related to the diameter of the crater it makes upon impact?
Activity #2:

Students and their families can further explore the topic of meteors, planets and space science by conducting the activities described in the NASA New York City Research Initiative website found here [https://www.giss.nasa.gov/edu/nycri/](https://www.giss.nasa.gov/edu/nycri/).