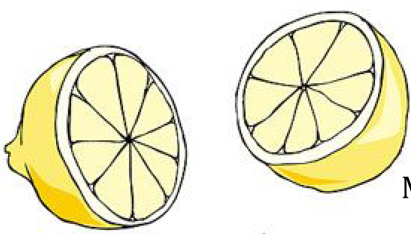
Deserts: A Desiccated Life, Part 2

Day One

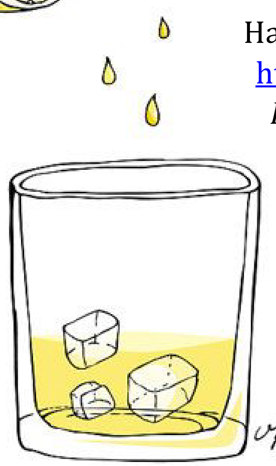
The Search for Water

Imagine we're in the desert. We're lost. We've been walking for hours. We've run out of water. On the horizon, you see a giant, shimmering puddle of water. "Yippeeeeeeeeee", you shout. We're saved!



But...it's not a puddle of water. It's a mirage.

Mirages are optical illusions that have fooled many thirsty explorers.



Have students watch the short and fun Fata Morgana [a mirage.] https://vimeo.com/channels/frodokuipers *Burning in the desert sun, Eduardo - a lemonade seller with a small stand - is fighting the urge to drink his last and final bottle of refreshing lemonade. Then, a thirsty customer comes crawling towards his stand...*

Now that we've gotten our supply list, let's head to the Australian Outback on a mission from Plum! Have students join Cooper, Clementine and Brad as they trek and tumble over rocks and dunes in search of a mysterious, missing lake. (A lake in a desert? It's not as impossible as it sounds!)

http://pbskids.org/plumlanding/educators/context/101_the_lost_lake.html

Ask:

- Where were the Earthlings in the video? What other deserts do you know?
- What makes a desert a desert? How is it the same or different from where we live? *Very low rainfall and high rates of evaporation*

- Did the water in the lake they found really disappear? What happened to the water in it? *The water didn't disappear; it evaporated.*
- What is evaporation? *Evaporation is when water changes from a liquid to a gas called water vapor. This happens when molecules, or microscopic particles of water, separate from one another.*
- So where is the water that evaporated? *In the air. Eventually those water molecules form larger droplets that fall to the Earth as rain or snow.*

The instructor will present a box of sand to the students. (A shoe box with sand in it would work; make sure to tape up any holes in the box.) Ask the students what happens to water when it comes in contact with sand. Explain to the students that if it is a large amount of water then the sand will become soppy/slushy, but if it is a small amount of water the sand soaks it up. Use the sand box to prove this to the students. Have them gather around and spray water on the sand. (A spray bottle of any kind will work). Only spray a small amount to represent the amount of rain that a desert receives. Once the students see how easy it is for the sand to soak up the water explain to them how if the sand was hot like the sand in a desert it would soak up the water even faster. Students can microwave the sand to test their theories and time the rate of evaporation/drying.

How Much Water Do We Need to Survive in the Desert?

The subject of people and water in the desert has generated considerable interest and confusion since the early days of World War II when the U.S. Army was preparing to fight in North Africa. At one time, the U.S. Army thought it could condition men to do with less water by progressively reducing their water supplies during training. They called it water discipline. It caused hundreds of heat casualties.

A key factor in desert survival is understanding the relationship between physical activity, air temperature and water consumption. The body requires a certain amount of water for a certain level of activity at a certain temperature. For example, a person performing hard work in the sun at 43 degrees C (109 degrees Fahrenheit) requires 19 liters (about 5 gallons) of water daily. Lack of the required amount of water causes a rapid decline in an individual’s ability to make decisions and to perform tasks efficiently.

Your body’s normal temperature is 36.9 degrees C (98.6 degrees F). Your body gets rid of excess heat (cools off) by sweating. The warmer your body becomes — whether caused by work, exercise or air temperature — the more you sweat. The more you sweat, the more moisture you lose.

Sweating is the principal cause of water loss. If a person stops sweating during periods of high air temperature and heavy work or exercise, he will quickly develop heatstroke. This is an emergency that requires immediate medical attention.

Celsius vs Fahrenheit

Have students make the conversions of real life math problems comparing the different temperatures of Celsius vs Fahrenheit.

°F to °C	Deduct 32, then multiply by 5, then divide by 9
°C to °F	Multiply by 9, then divide by 5, then add 32

Sweat it!

What you need

- -An outdoor thermometer
- -Cotton ball
- -Rubbing alcohol
- Watch

What to do

Have students

1. Put the thermometer on their work surface for about 5 minutes so that it will register at room temperature. Observe this temperature.

2. Wet the cotton ball with alcohol

3. Spread a thin layer of the wet cotton across the bottom bulb of the thermometer.

4. Blow lightly on the wet cotton for about 30 seconds. Watch happens to the temperature reading.

What it's all about

The temperature goes down as you blow on the wet cotton, because the alcohol on the cotton is evaporating. Evaporation occurs when a liquid absorbs enough heat energy to change into a gas. In this experiment, the alcohol takes heat energy from the mercury in the thermometer. This causes the mercury to contract and move down the thermometer, giving a lower temperature reading.

When it's hot outside your body releases liquid from your skin. As the liquid (sweat) evaporates, it removes heat from your skin and makes you feel cooler.

How much water should I drink?

The body is about 60% water, give or take.
We're constantly losing water from our bodies, primarily via urine and sweat.
There are many different opinions on how much water we should be drinking every day.
The health authorities commonly recommend eight 8-ounce glasses, which equals about 2 liters, or half a gallon.
This is called the 8×8 rule and is very easy to remember.

Make Lemonade!

Old Fashioned Lemonade:

- 4cups water
- ¾ cup sugar
- 8 oz (1 cup) lemon juice
- 4 cups of cold water
- Ice cubes

Have students measure and mix all ingredients together in a pitcher. (makes 6 8oz servings)

Have students each drink an 8 ounce cup of lemonade. How many more glasses would they need to get their recommended intake?

Day One- K-8 Standards Alignment

K

7.3.1 Recognize that living things require water, food, and air.

7.9.2 Observe, discuss, and compare characteristics of liquids, ex. water.

Students will meet these standards through the discussion of what humans and animals in the desert need to survive in the harsh environment. They'll also learn about different characteristics of water and how it behaves in the desert, on our skin, and during the water cycle.

1st

7.7.1 Realize that water, rocks, soil, living organisms, and man-made objects make up the earth's surface.

7.10.1 Investigate the effect of the sun on water, land, and air.

Students will meet these standards during the discussion of the water cycle, through watching the videos, and discussing what materials a desert is made out of. They'll also learn through the sand experiments and during the water cycle discussion/videos how the sun affects water in the desert, on our skin, and in the water cycle.

2nd

7.1.1 Recognize that plants and animals (including humans) are made up of smaller parts and use food, water, and air to survive.

7.9.3 Describe what happens when water is heated to the point of evaporation.

Students will meet these standards during the activities/videos/discussion on what humans need to survive, how skin reacts when a body is heated, how evaporation occurs on our skin, and how water behaves during the water cycle.

3rd

7.3.1 Identify the basic needs of plants and animals (including humans).

7.9.2 Compare and contrast events that demonstrate evaporation.

Students will meet these standards during the discussion of how vital water is, even more important than food, to human survival in the desert ecosystem and what other basic needs we have while traveling through. Students will compare evaporation on their skin, on the cotton, and how it occurs in the desert and in the water cycle in the videos.

4th

7.8.1a Recognize the major components of the water cycle.

7.8.1c Identify the basic features of the water cycle and describe their importance to life on earth.

Students will meet these standards during our discussion of the water cycle after watching the videos about the water cycle and performing the evaporation experiments.

5th

7.9.3 Use data from a simple investigation to determine how evaporation affects the rate of temperature change.

7.9.3 Describe factors that influence the rate at which different types of materials evaporate.

Students will meet these standards during the alcohol and cotton experiment and will discuss how the temperatures in different desert ecosystems and areas can affect the rate of evaporation in general, and on human skin in particular. Ex. would our sweat evaporate faster in a frozen or hot desert?

6th

7.10.2 Analyze the results of various types of energy transfers or transformations.

7.2.3 Draw conclusions from data about interactions between the biotic and abiotic elements of/within a particular environment. (ex. skin and wind)

Students will analyze the results of the evaporation experiment and how they can see the results of energy/heat being pulled from the cotton swab in order to fuel the evaporation of the alcohol by the drop in temperature. They will also discuss how these energy transfers fuel the water cycle in general.

They will discuss how the body's sweat function (biotic) works with the wind (abiotic) in the environment to try and cool the body to an appropriate temperature.

7th

7.1.3 Explain the basic functions of a major organ system, ex. skin, aka integumentary system.

6.3.1 Describe how water cycles between the biotic and abiotic elements of an environment.

Students will learn the major functions the skin plays in protecting and helping humans survive the ecosystems they are in, ex. sweat/cooling function, etc. They will also discuss how water moves in the water cycle through living (humans, animals, plants) and non-living (rivers, sand) elements of the world and how we are all part of the water cycle.

8th

7.5.3 Compare and contrast the ability of an organism to survive under different environmental conditions.

1.5.12 Describe how body temperature is regulated.

Students will meet these standards while discussing how humans can survive in the desert ecosystem and will compare the ability of someone prepared, to someone who hasn't prepped at all, someone with water, and someone without water, etc. Students will make the connection to how body temperature is regulate after performing the alcohol and cotton and thermometer experiment.

Day Two~

Dry Mouth?

If there was a Survivor television show with dietitians as contestants, what foods would they carry along in their backpacks? Though it is important to bring along food and water on any hike, desert hiking comes with its own special needs. It depends entirely what you are doing in the desert... if you are doing anything strenuous then you'll need the calories calories calories! Mix a bag up of peanuts, raisins, sultanas and cashews (salted when in the desert - you'll be losing salt from sweat, otherwise raw). But my golly gosh is food less important than water. (http://www.trails.com/list_8683_list-foods-desert-hike.html)

List of Foods to Take on a Desert Hike

Though it is important to bring along food and water on any hike, desert hiking comes with its own special needs. Your body uses extra energy to help keep you cool in hot climates, and you also need to replace electrolytes. When you lose electrolytes through sweating you can develop hyponatremia, a dangerous condition that can lead to seizures or even death. Water alone will not replace electrolytes, but food can help.

Fresh Fruit

On a short day hike, fresh fruit can be a welcome treat that will hydrate you and provide fructose. For longer hikes, fruit can add **more** weight to your pack than you might like. Try apples or oranges. They have tough enough skins to travel well. Avoid soft fruits such as peaches, pears or bananas.

Energy Bars

Energy bars provide plenty of **protein** and usually have enough sodium to replace the electrolytes that you are losing in the heat. They travel well, are non-perishable and are easy to throw in your pack or even your back pocket. Avoid bars that are chocolate-coated because they will quickly become a melted mess in the heat. Also, look for bars that are low in sugar.

Dehydrated Foods

For longer, overnight hiking trips you may want to bring along some more traditional meals. Find foods that use as little water as possible. Noodle cups are a good choice--they use little water and waste none of it. If you are hiking a great distance or over the course of several days, make sure to bring plenty of meals. According to the rangers at the Grand Canyon, in hot **weather** you will need to consume two or three times your normal food intake in order to provide your body with the energy needed to hike.

Complex Carbohydrates

To maintain energy, eat small snacks of complex carbohydrates throughout the day. Have a few crackers, or some bread or grains every half hour or so. Foods with a lot of protein or fat can upset your stomach in the heat and take a long time to digest. Carbohydrates will give you energy without making your body work overtime.

Foods to Avoid

Avoid perishable food unless you plan on eating it during the first hour or so of hiking. Foods that may melt, such as chocolate, are a bad idea as well. Food that provides nothing but empty **calories** will just add weight to your pack and won't be of any benefit to your body, so leave the gummy bears at home.

Yucky or yummy?

Students will act as professional taste testers. Purchase three different kinds of power or energy bars. Cut them into pieces and have students do a taste test. Have them put their heads down and vote on which bar they think it most delicious. Have the students look over the ingredients and calories. Discuss why the bars would be nutritious or help provide a lot of energy. Remember tribes need to be trying all survival foods to get points for their team!

Rain Sticks

The legend behind the Indian rain stick points to supernatural intervention; the hope is to mimic the soft splash of raindrops in an effort to remind the "spirits" or "Great Spirit" that the people of Earth have need for a drenching rain for their crops, animals and thirst.

Construction

- Native American cultures in the southwest of North America built their rain sticks from hollowed-out, dried cactus tubes, pushing cactus needles into the core to form an obstruction. Small pebbles were then placed inside and the ends of the cactus tube sealed. Flipping over the stick simulated the sound of a gentle shower of rain.

Modern Uses

- The rain stick remains in use today in Native American culture and is present for both sale and use at powwows and other tribal gatherings. It has also been adopted by non-indigenous cultures and is often utilized as a soothing tool for meditation and music production.

Things You'll Need

- Cardboard Tubes
- Duct Tape
- Hot Glue
- Small nails
- Filler materials

Instructions

Use a pencil to draw a spiral beginning at one end of a cardboard tube and ending at the other. Don't follow the natural seam.

Hammer nails that are 1/4 inch shorter than the tube's diameter at 1/2-inch intervals along the spiral.

Cap one end of the tube. If it didn't come with caps, cut a piece of cardboard the same size as the hole and hot glue it securely to the end.

Put some un-popped popcorn, beads, dry beans, pebbles, seeds, gravel, rice or other dry filler into the tube.

Cover the open end with your hand and test the sound by turning it upside down.

Experiment with the amount of filler for a sound you like. When you're satisfied, put a cap on the open end.

Cover all of the nail heads with contact paper or masking or duct tape.

Decorate your rain stick. Try paints, torn paper or corrugated wrapping.

Tips & Warnings

- Empty paper towel rolls are the easiest, but 2- to 2 1/2-inch postal tubes (24 inches long) make the best rain sticks. Make sure to get the plastic caps that go on the ends. You can also use carpet tubing, which you may need to drill before putting in the nails.

Visit these links for additional ideas on rain sticks

http://www.danyabanya.com/DIY-rainsticks-rain-stick-maker/

http://www.enchantedlearning.com/crafts/music/rainstick/

Day Two- K-8 Standards Alignment

K

7.3.1 Recognize that living things require water, food, and air.

7.11.1 Use a variety of objects to demonstrate different types of movement. (e.g., straight line/zigzag, backwards/forward, side to side, in circles, fast/slow).

Students will meet these standards through the discussion of what kinds of foods humans need in order to survive the desert. They will demonstrate movements using their rainsticks and a variety of filler materials and/or construction techniques.

1st Grade

7.11.1 Use familiar objects to explore how the movement can be changed.

7.11.2 Investigate and explain how different surfaces affect the movement of an object.

Students will try and change the movement of the materials in their rainsticks and the rainsticks themselves in order to make the best sounds. They'll explain how the different nails or materials affect the movement of the filler materials.

2nd Grade

7.11.1 Use a variety of objects that vibrate to demonstrate how sounds are produced.

7.11.2 Describe the sounds produced by different types of vibrating objects.

Students will use their rainsticks to produce a variety of different sounds, demonstrate how they are produced, and describe the sounds they can make by changing the motion of the rainstick and why they think those sounds change.

3rd Grade

7.11.2 Use a variety of materials to produce sounds of different pitch and volume.

7.11.4 Identify how sounds with different pitch and volume are produced.

Students will use their rainsticks to produce a variety of different sounds, demonstrate how they are produced, and describe the sounds they can make by changing the motion of the rainstick and why they think those sounds change.

4th Grade

7.11.4 Plan and execute an investigation that demonstrates how friction affects the movement of an object.

7.10.1 Distinguish among heat, radiant, and chemical (ex. in food) forms of energy.

Students will determine how friction along the nails, the sides of the tube, and the other materials inside the tube produce different sounds according to the motion used. They can change and adjust the number of nails or materials in order to change the motion of the filler materials and produce new sounds.

Students will discuss different forms of energy found in the desert, ex. heat from the sand, radiant energy from the sun, and chemical energy our bodies need to survive found in the foods we taste test.

5th Grade

7.10.5 Demonstrate different ways that energy can be transferred from one plant, object, and/or animal to another.

7.5.4 Determine how changes in an environmental variable can affect animals, including humans, within an area.

Students will discuss how humans gain energy from the chemical energy stored in food and how our bodies break it down and transfer it to our cells, but originally it came from the sun, which gave it to plants, which gave it to us/animals, etc. We will discuss how a sudden change in our environment, ex. being put into a different ecosystem like the desert, changes our bodies' needs and how it affects us, ex. an increased need for water and calories.

6th Grade

7.2.3 Draw conclusions from data about interactions between the biotic and abiotic elements of a particular environment.

7.2.1 Compare and contrast the different methods/sources that can be used by organisms to obtain nutrition.

Students will determine how the abiotic elements of the desert affect the biotic elements, humans/plants/animals, who need to travel through and how we interact with them for our benefit or for our detriment.

Students will compare and contrast energy/power bars and give their opinions. Class data will be compared to determine student's favorites and explanations will be given by students for their opinions. We'll compare and contrast the different nutritional levels of each bar, ex. fats and sugars, and use the advice given in the lesson materials to help us determine which one would work best on our trip.

7th Grade

7.T/E.2 Apply the engineering design process to construct a prototype that meets certain specifications.

7.1.6 Describe the function of different organ systems.

Students will determine the function of our digestive system (to break down chemical energy and convert it for our bodies' use) and design a prototype rainstick that will make both loud and soft sounds and sound like rain is falling. They will adjust the prototype as needed to produce the desired result.

8th Grade

7.T/E.2 Apply the engineering design process to construct a prototype that meets certain specifications.

7.5.3 Analyze how structural, behavioral, and/or physiological adaptations allow an organism to survive in a given environment.

Students design a prototype rainstick that will make both loud and soft sounds and sound like rain. They will adjust the prototype as needed to produce the desired result.

Students will determine what behaviors they/we would need to change and how we would need to adjust our clothing, our travel (ex. travel when cooler, not warmer), our water intake, and our food intake in order to survive the desert ecosystem.

Day Three:

Crossing the Sea of Sand

Even more than crossing the mountains themselves, the desert could test the traveler's will to live. The name of the most intimidating of all these deserts, the Taklamakan, is revealing - the place where he who goes in does not come out. The 7th-century pilgrim monk Xuanzang's biographer tells us how he nearly perished on its northern fringes: "Time seems to stop. For four or five days the pilgrim and his horse struggle westward. Not a drop of water anywhere. His mouth, lips, and throat are parched by the burning heat. The evening of the fifth day the horse and rider fall down exhausted....."

Slow Motion Ocean

The force of the wind can literally move mountains. **What examples can students think of of landscapes that are shaped by wind? Sand dunes and snow drifts are two common examples.** If the mountain is made of sand (or snow) the movement can be observed in a relatively short time.

Following water, wind is a major cause of erosion (the gradual wearing away of Earth's surfaces through the action of wind and water) in the desert. Without plants and their anchoring roots, loose desert soil is moved easily by near-constant blowing winds.

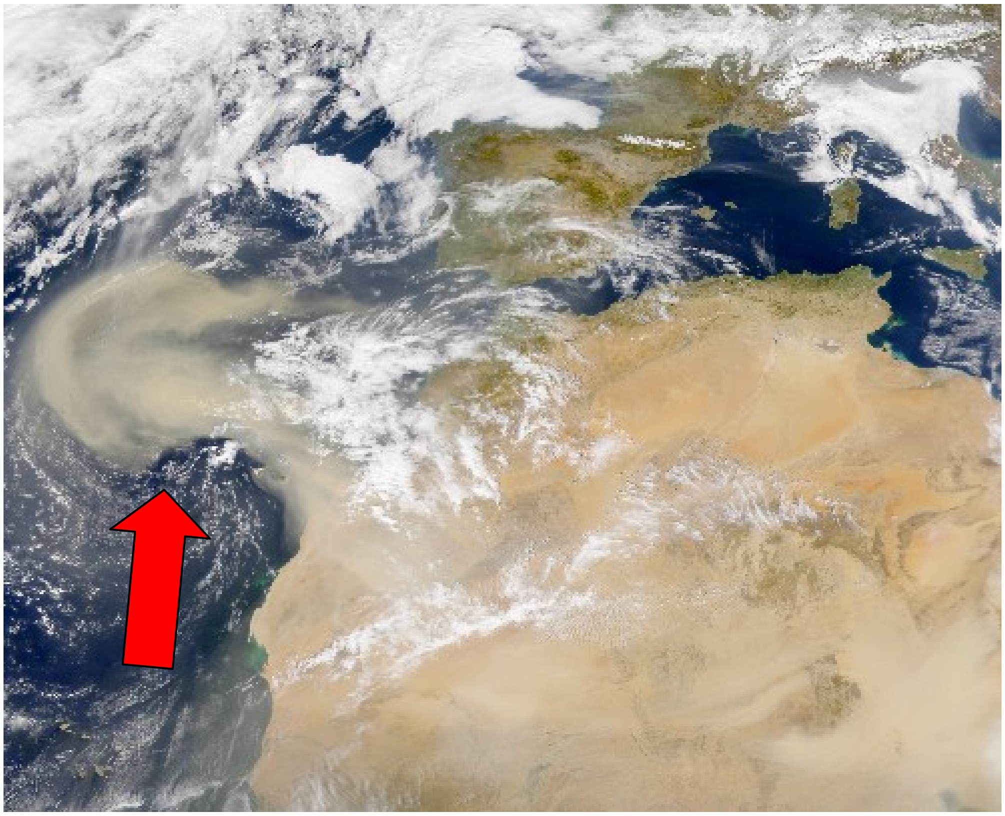
Aeolian (or eolian or æolian) processes, in the study of geology and weather, pertain to wind activity and specifically to the wind's ability to shape the surface of the Earth (or other planets). Winds may erode, transport, and deposit materials, and are effective agents in regions with sparse vegetation and a large supply of unconsolidated (loose) sediments. The wind moves like a fluid, like water, and it can erode only if it is strong enough. Very often, it merely transports material. The strength of the wind determines the amount and type of material it removes from the desert floor. As the wind increases in strength, it is able to move and transport more and larger particles.

Wind is a common element in desert environments because the Sun heats air near the desert surface, causing it to rise. The warmed air is then replaced by cooler air, which is then heated and rises. This constant cycle of air warming, rising, and being replaced results in winds. The lack of desert vegetation also allows winds to blow unrestricted. Strong and unchecked, wind has the ability to transport, erode, and deposit material in the desert, creating and modifying its landforms.

Although water is a much more powerful eroding force than wind, aeolian processes are important in arid (dry) environments such as deserts.

The term is derived from the name of the Greek god, Æolus, the keeper of the winds.

If you are in the desert for any length of time, you will almost certainly encounter and observe Aeolian forces in action, often in the form of a sandstorm. During the spring, winds tend to increase in intensity in the Taklamakan desert. As the spring winds blow, they pick up the sand and dust lying on top of the degraded land and carry it into the air, creating these massive dust and sand storms. The ferocity of a sandstorm



depends on the force of the wind and a sandstorm can range from mildly annoying to a serious threat (some can even be observed from space). A turbulent, suffocating, howling brown wall of particulates reduces visibility to almost zero in a matter of seconds. A violent sandstorm can carry with it larger particles, even small stones and these can cause serious injury. Once a sand storm forms, roaring and howling, it can even uproot large trees.

Videos: Have the students watch as in the Mojave Desert, Bear Grylls demonstrates how to survive in a sandstorm. (Hint: You won't outrun it.)http://www.discovery.com/tv-shows/man-vs-wild/videos/sandstorm-survival.htm

Then, watch some amazing footage of how animals handle the approach of a dust storm http://www.animalplanet.com/tv-shows/animal-planet-presents/videos/wildrussia-animals-weather-sandstorm.htm 9 A giant sandstorm approaches in Russia. Animals dig in to avoid getting swept away. Once it passes, life resumes.)

Nearly all dust storms are capable of causing property damage, injuries and deaths. They are most commonly associated with the Sahara and Gobi desert regions but they can occur in any arid or semi-arid climate. Storms vary in both size and duration. Most are quite small and last only a few minutes, while the largest can extend hundreds of miles, tower more than a mile into the sky and last for many days. Sandstorm conditions are also ideal for thunderstorms and lightning often accompanies a sandstorm. A sandstorm can give a total blackout, so you must not move and if you are with a group, it is best to hold hands or lock arms. If a person has to leave the group, for example during a military operation, the person leaving should be secured by a rope to a member of the group so he/she can find their way back. If you have a camel, sit to the leeward side of it (camels are well adapted to survive sandstorms). Windward is the direction upwind from the point of reference. Leeward is the direction downwind from the point of reference, in this example, the camel.

Camels are well built to protect themselves from sand storms. They *have very wide, flat feet that expand as they put weight on them. This wide, flat foot protects them from slipping on the sand as they walk or run. Camels also have the ability to tightly close their nostrils and this would prevent them from inhaling sand during a sand storm or during blowing sand. In addition, camels also have two or three layers of very thick eye lashes to help keep the sand from getting into their eyes. They also have very thick, coarse hair that outlines the inner parts of their ears so that sand is not able to get inside their ears. Camels also have very strong lips that they can press together to avoid getting sand in their mouth. So, camels are well equipped to handle a sand storm.*

If you are caught on foot in the open, try to take cover behind a rock or other landform to get as much protection as possible. If you are on a sand-dune, do not shelter on the leeward side, although this might seem the obvious thing to do, the force of the wind will move huge amounts of sand quickly and you could easily be buried. There will be a huge amount of surface sand shifting in the storm and the driven sand will also bounce off the surface, so being close to the surface is the worse place to be. Never lay face down, as you risk being injured or buried. If you have time to head for high ground, it is best not to shelter on the highest point (even though the wind blown sand has less density on high ground), as you risk injury from larger flying objects and if there is lightning, from being struck. Do not lie in a dried river bed or ditch because there may be flash flooding, even if there is no accompanying rain, it may be raining elsewhere.

Once engulfed by a sandstorm, the temperature will rise and there will be significantly less available oxygen, so it is a choking, suffocating and blinding experience. To survive it, you should always cover your head and as much exposed skin as possible.

Swallowing sand particles is unpleasant but not a serious health threat. Getting dust and sand particles in the lungs is a health risk. The force of a sandstorm can be equivalent to sandblasting paint off a car.

Blow Aeolis Blow!

Aeolian Landscape is project in which students will create a miniature wind-swept desert landscape using straws, or a small fan and finely ground sand. The motion mimics the process of wind picking up and depositing small particles. It vividly illustrates a landscape where wind is the dominant geologic

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process and huge sand dunes are the most striking feature.

Materials:

- large shallow pan
- sand
- few small pebbles
- flexible straws

Some safety precautions should be observed during this lab. Slightly moisten the sand so it is not scattered quickly. Always use eye protection (goggles) to prevent blown sand from getting in your eyes. Remember to blow steadily outward through the straw — never suck air in through the straw, especially near the sand.

Fill the pan with a layer of sand about one inch thick. (It does not have to be flat or even.) Place a few small pebbles on top of the sand. Spray a fine mist of water across the top of the sand to prevent excessive movement. Gently blow through the straw or direct the fan toward the sand so it begins to move. Does it creates dunes?

Optional: If you have a small handheld battery-operated fan, they can use that instead of a straw.

What happens to the sand and pebbles? If the straw or fan is held in place and a constant breeze blows on the sand dune, what motion does the dune take? Does part of the dune move faster than other parts? What is the over-all shape of the dune as it travels? Does the wind pattern show protected areas near the dune? How does the size and shape of the dune create unique wind pattern shifts? Encourage students to observe how the shape of the miniature dunes influences the pattern of the wind, which in turn influences the shape of the dunes.

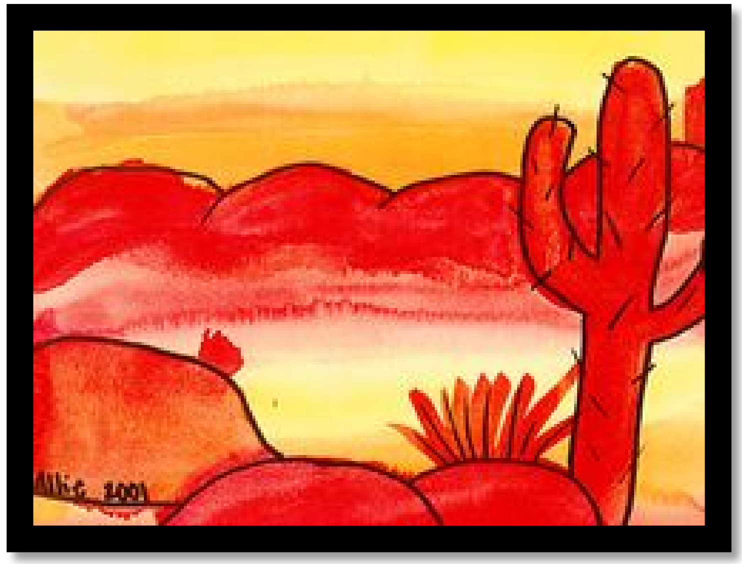
Does it make sense why some deserts might be called sand seas? Why? Ex. They behave like very slow motion oceans.

Imagine yourself about an inch tall and standing in the middle of this miniature environment. What does it look and feel like?

View pictures and video:
https://www.flickr.com//photos/exploratorium_exs/sets/72157622197200143/show/

Desert Day, Desert Night: Warm and Cool Colors

This is an easy lesson to do with any grade level. Starting with a black oil pastel and a piece of white paper, have the children draw two versions of the same desert scene, ex. rolling hills, rounded mountains, cactus, rocks, animals, and finally, a sun/moon with concentric circles. Encourage the children to press hard with their oil pastels.



Now, bring out the watercolors. Students will create two scenes, one day time desert and one of the desert at night. Cool colors (green, purple, blue, grey, etc) turn it into a desert scene at night, warm colors (red, yellow, orange, brown) turn it into a daytime desert.

Note: Create gorgeous stars with watercolors by having the students sprinkle salt on the wet watercolor paint of their sky. DO NOT let them brush it around with their brush, it needs to sit until it dries (absorbing moisture all the while) and then the can be brushed off by hand, leaving beautiful splotchy stars behind.

Day Three- K-8 Standards Alignment

K

7.10.1 Identify the sun as the source of heat and light.

7.11.1 Explore different ways that objects move.

Students will meet this standard through the discussion of desert wind and through the Aeolian landscape sculpture project.

1st

7.11.1a Investigate how forces (push, pull) can move an object or change its direction.

7.10.1 Investigate the effect of the sun on land, water, and air.

Students will meet this standard through the discussion of desert wind and through the Aeolian landscape sculpture project.

2nd

7.10.1 Explain why the sun is the primary source of the earth's energy.

7.10.2 Investigate how the sun affects various objects and materials.

Students will meet this standard through the discussion of desert wind and through the Aeolian landscape sculpture project.

3rd

7.7.1 Compare and contrast two different landforms.

7.11.2 Recognize the relationship between the mass of an object and the force needed to move it.

Students will compare and contrast something they might have experienced, snow drifts, to the desert landscape they might not have experienced. They will recognize that different wind strengths would be needed to move objects of varying size, ex. something with greater mass would need greater force/wind to move it.

4th

7.7.1 Prepare a demonstration to illustrate how wind and/or water affect the earth's surface features.

7.7.2 Design an investigation to demonstrate how erosion and deposition change the earth's surface.

Students will meet this standard through the discussion of desert wind and through the Aeolian landscape sculpture project.

5th

7.8.1 Analyze and predict how atmospheric conditions affect major landforms.

7.11.1 Explain the relationship that exist among mass, force, and distance traveled.

Students will meet this standard through the discussion of desert wind and through the Aeolian landscape sculpture project. They will recognize that different wind strengths would be needed to move objects of varying size, ex. something with greater mass would need greater force/wind to move it for a greater distance, but a greater force could lift something smaller for a longer distance, ex. bring sand across the ocean.

6th

7.8.2 Recognize the connection between the sun's energy and the wind.

7.8.2 Describe how the sun's energy produces the wind.

Students will meet this standard through the discussion of desert wind and through the Aeolian landscape sculpture project.

7th Grade

5.6.7 Describe the processes of erosion and deposition

5.6.1 Recognize that the earth's landforms change over time.

Students will meet this standard through the discussion of desert wind and erosion as well as through the Aeolian landscape sculpture project.

8th Grade

5.6.3 Study the impact of wind as an agent of geologic change.

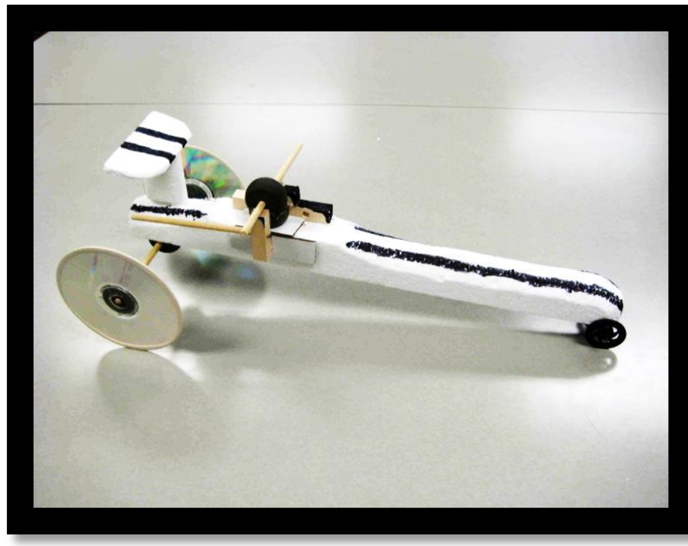
1.1.27 Recognize the effects of Bernoulli's principle on fluid motion and its applications (i.e. the effects of wind moving around/over objects).

Students will meet this standard through the discussion of desert wind and through the Aeolian landscape sculpture project.

Day Four

Are We There Yet?: Designing a Desert Dune Buggy

Students will build a rubber band-powered rover that can scramble across the room test track/sand pit.



In this challenge, kids follow the engineering design process to: (1) design and build a dune buggy out of cardboard; (2) figure out how to use rubber bands to spin the wheels; and (3) improve their design based on testing results. Oh, by the way, your power source is a rubber band!

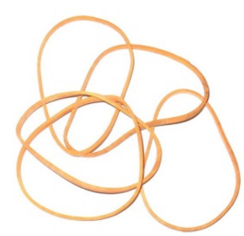
Each team is to build a vehicle, powered solely by the energy of one rubber supplied by the teacher, that will travel the longest distance. By definition, a vehicle is a device with wheels or runners used to carry something, such as a car, bus, bicycle, or sled. Therefore, launching a ball, such as a marble with the rubber band will be ruled illegal.

REGULATIONS:

1. Your vehicle must be powered by a single rubber band supplied by the teacher. Other one rubber bands may not be used.
2. Your vehicle cannot have any additional potential or kinetic energy at the start other than what can be stored in the rubber band itself.
3. The vehicle must steer itself.
4. Racers cannot receive a running start and must start behind the starting line.
5. The start method will consist of releasing the vehicle by the contestant at the starting line.
6. The competition will be measured from the starting line to the tip of the vehicle after it stops.
7. The instructor will supply all materials to be used and has the final decision as to the appropriateness of any additional items that might be used in the construction of the vehicle.
8. Sling-shot type vehicles will not be allowed.
9. The number of wheels can vary between 1 and 4.

MATERIALS:

Materials used will be supplied by the teacher which may include: Rubber bands, drinking straws, dowels, and/or other material (for axles), wheels, CDs, plain and corrugated cardboard, styrofoam, white glue, and hot glue.



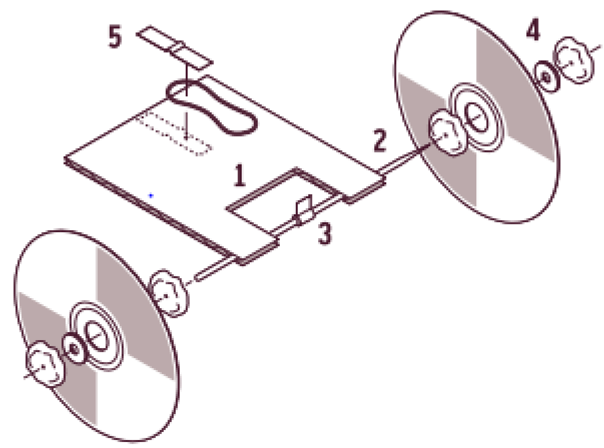
RUNNING THE CONTEST:

1. The track can be any smooth level non-carpeted floor, such as a gymnasium or a hallway.
2. The winner will be determined by the longest distance traveled.
3. Each vehicle will be given three runs for the competition with the longest run winning.
4. Only one rubber band for the power source will be supplied for each vehicle during the competition.

Sample Construction Method:

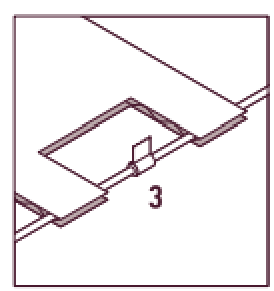
MATERIALS (PER CAR)

- 5 x 6—inch piece of corrugated cardboard (cut so the holes from the corrugation are visible along the long edge)
- Ruler
- Scissors
- 1 wooden skewer (Use the thinnest available skewers. These probably will be 1/8 of an inch thick.)
- Tape (masking or duct)
- 2 faucet washers (Size: 1/4—inch Large)
- 2 CDs
- Poster putty (1/4 package)
- 1 rubber band
- Pencils, pens, or markers

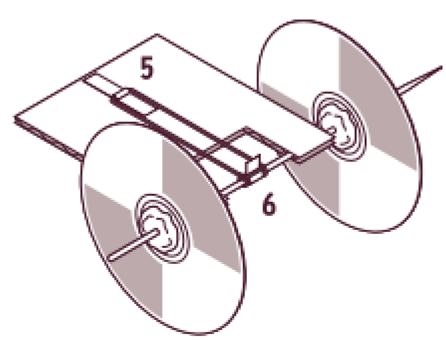


BUILD

1. **Notch the body.**
   Cut a notch in the center of the five—inch side of the cardboard. Make the notch 2 inches wide and 1 1/2—inches deep. Throw away the piece you've cut out.
2. **Make the axle.**
   Slide the skewer through the cardboard, close to the outer edge. Make sure the axle sticks out the same amount from each side of the body. When we made ours, the skewer didn't always rotate freely. If this happens to you, twist it until the opening stretches.



3. **Modify the axle.**
   Find where the skewer goes across the notch. In the middle of this section, wrap a small piece of tape to make a "catch" for the rubber band. Try twisting the tape that is sticking up to make sure the catch is thick enough to hold the rubber band.
4. **Assemble the wheels.**
   Hold a washer in the center hole of a CD. Slide the washer and CD onto the axle, leaving lots of room between the CD and cardboard. Put poster putty on each side of the washer to join



the CD, washer, and axle tightly together—REALLY TIGHTLY. The wheel and axle should now rotate together. Make the second wheel the same way.

5. **Attach the rubber band.**
   Tape one end of a rubber band to the cardboard at the end opposite the axle.
6. **Power your car.**
   Wrap the unattached end of the rubber band over the catch. Turn the axle several times. You've given the rubber band **potential** (stored) energy. When it unwinds, this potential energy is transformed into **kinetic** (motion) energy, and the axle spins. The more you wind the rubber band, the more energy is available for your car's wheels—and the farther and faster your car goes.

TEST

It's off to the races. Set your car on the smooth test track, rubber band side down. What happens when you let your car go? When we made ours, our wheels didn't always turn freely. If this happens to you, make sure the catch isn't hitting the cardboard when the axle spins. Also, check to make sure the rubber band isn't jamming itself against the cardboard. We found that wrapping the rubber band more carefully usually solved the problem, but you can also create more space for the rubber band by making the notch just a little wider.

Now, test it on the desert dune sand track (ex. made from sand in a long tub or container). How does it do?

REDESIGN

You've just built a **prototype**, which is an early version of a product. Prototypes help engineers understand a product's strengths and weaknesses and how it might be improved. Thinking about your car, try to come up with some ways to make it perform even better.

Make sure to redesign it so it works on sand or thick carpet. Brainstorm ideas, revise your design, and then build and test it.

Ex.:

- Make your wheels thicker. Try adding a layer of duct tape or thick paper around your wheels to give them more area to roll—it might make it ride more smoothly!
- Try out different terrains. Try out ways to make your car go over grass or sand! How can you make your car climb a ramp or go on water?
- Make a video. Attach a camera to your car and record its journeys!
- Make it smaller or bigger. Different-sized wheels can change the car’s speed. How about using two or more rubber bands?

INSIDE THE ENGINEERING

Our car is powered by a rubber band, but most cars use gasoline. The average car gets around 20 miles per gallon, but gasoline is an expensive, limited source of energy that pollutes. Many people want an alternative fuel source that is more affordable, more efficient, and more environmentally friendly. In 2006, two engineering students created the MIT Vehicle Design Summit—challenging students from around the world to build cars that didn't use gasoline and could get the equivalent of 500 miles per gallon... and they did it! One car used a hydrogen fuel cell (a device that converts hydrogen and oxygen into electricity.) Another combined human power and solar power, while a third was entirely electric. A fourth car used biodiesel, an environmentally friendly fuel that can be made from grass, corn, or soybeans. Today you're working with rubber bands, but tomorrow, who knows!

Day Four- K-8 Standards Alignment

K

7.1.2 Use building materials to create a whole from the parts.

7.1.3 Take apart an object and describe how the parts work together.

Students will meet these standards while designing, constructing, testing, redesigning, rebuilding, retesting, and competing with their dune buggies. They will have to explain how their car works, what elements provide stability, what elements provide power, and how it works on different surfaces.

1st

7.11.1 Investigate how forces (push, pull) can move an object or change its direction.

7.11.2 Investigate and explain how different surfaces affect the movement of an object.

Students will meet these standards while designing, constructing, testing, redesigning, rebuilding, retesting, and competing with their dune buggies. They will have to explain how their car works, what elements provide stability, what elements provide power, and how it works on different surfaces.

2nd

7.T/E.3 Use tools to measure materials and construct simple products.

7.T/E.2 Apply engineering design and creative thinking to solve practical problems.

Students will meet these standards while designing, constructing, testing, redesigning, rebuilding, retesting, and competing with their dune buggies. They will have to explain how their car works, what elements provide stability, what elements provide power, and how it works on different surfaces.

3rd

7.11.2 Recognize the relationship between the mass of an object and the force needed to move it.

7.11.1 Identify how the direction of a moving object is changed by an applied force.

Students will meet these standards while designing, constructing, testing, redesigning, rebuilding, retesting, and competing with their dune buggies and realizing the more mass and weight they add to their buggy, the more force they will need to move it the required distance or over the testing tracks . They will have to explain how their car is powered, where the force is coming from, how friction is slowing down or affecting how their car turns, etc.

4th

7.11.2 Design an investigation to identify factors that affect the speed and distance traveled by an object in motion.

7.11.4 Plan and execute an investigation that demonstrates how friction affects the movement of an object.

Students will meet these standards while designing, constructing, testing, redesigning, rebuilding, retesting, and competing with their dune buggies and realizing the more mass and weight they add to their buggy, the more force they will need to move it the required distance or over the testing tracks and what other factors are affecting the motion of their dune buggy and how they need to adjust their design to compensate. . They will have to explain how their car is powered, where the force is coming from, how friction is slowing down or affecting how their car turns, etc.

5th

7.11.1 Explain the relationship that exist among mass, force, and distance traveled.

7.11.3 Design and conduct experiments using a simple experimental design to demonstrate the relationship among mass, force, and distance traveled.

Students will meet these standards while designing, constructing, testing, redesigning, rebuilding, retesting, and competing with their dune buggies and realizing the more mass and weight they add to their buggy, the more force they will need to move it the required distance or over the testing tracks and what other factors are affecting the motion of their dune buggy and how they need to adjust their design to compensate. . They will have to explain how their car is powered, where the force is coming from, how friction is slowing down or affecting how their car turns, etc.

6th

7.T/E.2a. Know that the engineering design process involves an ongoing series of events that incorporate design constraints, model building, testing, evaluating, modifying, and retesting.

7.T/E.2b. Apply the engineering design process to construct a prototype that meets certain specifications.

Students will meet these standards while designing, constructing, testing, redesigning, rebuilding, retesting, and competing with their dune buggies and realizing the more mass and weight they add to their buggy, the more force they will need to move it the required distance or over the testing tracks and what other factors are affecting the motion of their dune buggy and how they need to adjust their design to compensate. . They will have to explain how their car is powered, where the force is coming from, how friction is slowing down or affecting how their car turns, etc. They will have to be able to cross a designated distance of sand in order to have a 'certified prototype.'

7th

7.T/E.2a. Know that the engineering design process involves an ongoing series of events that incorporate design constraints, model building, testing, evaluating, modifying, and retesting.

7.T/E.2b. Apply the engineering design process to construct a prototype that meets certain specifications.

Students will meet these standards while designing, constructing, testing, redesigning, rebuilding, retesting, and competing with their dune buggies and realizing the more mass and weight they add to their buggy, the more force they will need to move it the required distance or over the testing tracks and what other factors are affecting the motion of their dune buggy and how they need to adjust their design to compensate. . They will have to explain how their car is powered, where the force is coming from, how friction is slowing down or affecting how their car turns, etc. They will have to be able to cross a designated distance of sand in order to have a 'certified prototype.'

8th

7.T/E.2a. Know that the engineering design process involves an ongoing series of events that incorporate design constraints, model building, testing, evaluating, modifying, and retesting.

7.T/E.2b. Apply the engineering design process to construct a prototype that meets certain specifications.

Students will meet these standards while designing, constructing, testing, redesigning, rebuilding, retesting, and competing with their dune buggies and realizing the more mass and weight they add to their buggy, the more force they will need to move it the required distance or over the testing tracks and what other factors are affecting the motion of their dune buggy and how they need to adjust their design to compensate. . They will have to explain how their car is powered, where the force is coming from, how friction is slowing down or affecting how their car turns, etc. They will have to be able to cross a designated distance of sand in order to have a 'certified prototype.'

Part Two Vocabulary Guide

K

- Day
- Night
- Water
- Basic Needs
- Food
- Clothing
- Shelter
- Human
- Sun
- Thermometer
- Temperature

1

- Environment
- Heat
- Freezing
- Precipitation
- Video/Media
- Character
- Setting
- location

2

- Temperature Pattern
- Observation
- Infer
- Evaporation
- Distance
- Energy
- Compare
- Contrast
- Vibration
- Celsius
- Foot
- Inch
- Likely/unlikely
- Fahrenheit

3

- Force
- Water cycle
- Tools
- Landforms
- Geography
- Pitch
- Volume
- Force
- Character
- Setting
- Cause
- Effect

4

- Condensation
- Ecosystem
- Behavioral adaptation
- Physical adaptation
- Exploration
- Friction
- Energy
- Chemical Energy
- Compare
- Contrast

5

- Solution
- Surface
- Energy
- Theme
- Main idea
- Implied
- Variable
- Model

6

- Control
- Criteria
- Cause
- Effect
-
- Biotic
- Abiotic
- Atmospheric Convection
- Prototype
- Biosphere
- Similarity
- Simulation

7

- Property
- Momentum
- Impact
- Topography
- Climax
- Function
- Property
- Respiration
- Speed
- Simple machine

8

- Tension
- Particle motion
- Sequence
- Base
- Function
- Best fit
- Pitch
- Rate
- Variation