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**EVERYDAY MYSTERIES**

*Fun Science Facts from the Library of Congress*

### Question:

Why does chopping an onion make you cry?

### Answer:

Unstable chemicals.

Onions produce the chemical irritant known as syn-propanethial-S-oxide. It stimulates the eyes' lachrymal glands so they release tears. Scientists used to blame the enzyme allinase for the instability of substances in a cut onion. Recent studies from Japan, however, proved that lachrymatory-factor synthase, (a previously undiscovered enzyme) is the culprit (Imani et al, 2002).

The process goes as follows:

1. Lachrymatory-factor synthase is released into the air when we cut an onion.
2. The synthase enzyme converts the sulfoxides (amino acids) of the onion into sulfenic acid.
3. The unstable sulfenic acid rearranges itself into syn-ropanethial-S-oxide.
4. Syn-propanethial-S-oxide gets into the air and comes in contact with our eyes. The lachrymal glands become irritated and produces the tears!



### Question:

How did the grapefruit get its name? It doesn't look like a grape.

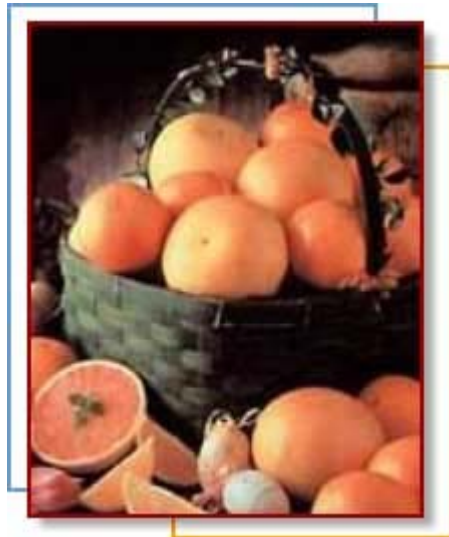
### Answer:

It is believed that the name refers to the manner in which grapefruit grows in clusters on a tree.

Most botanists agree that the grapefruit is a cross between a Pummelo (see <http://pas.byu.edu/AgHrt100/pummelo.htm>) and a sweet orange (see [http://www.floridata.com/ref/C/citr\\_sin.cfm](http://www.floridata.com/ref/C/citr_sin.cfm).)

Grapefruit, like all citrus fruit, is a Hesperidium, or a large modified berry with a thick rind.

If you see grapefruit growing on a tree, you will notice that they grow in clusters. It is suggested that these clusters resemble the shape of large yellow grapes and so the fruit was called a grapefruit. Another explanation is that the premature grapefruit looks similar in shape to unripe green grapes.



### Question:

Why does pepper make you sneeze?

### Answer:

Because the chemical piperine, an irritant, gets into the nose.

A sneeze is a reflex that is triggered when nerve endings inside the mucous membrane of the nose are stimulated.

Pepper, be it white, black, or green, contains an alkaloid of pyridine called piperine. Piperine acts as an irritant if it gets into the nose. It stimulates (or irritates) the nerve endings inside the mucous membrane. This stimulation will cause you to sneeze. Actually, the nose wants to kick out this irritant and the only way it knows how to do this is by sneezing."

Did you know ...

- Sneezing is called sternutation.
- When you sneeze air rushes out your nose at a rate of 100 miles per hour!
- There are an estimated 5 million scent receptors in the human nose.
- Our noses produce an estimated one to two pints of mucus a day.

Pepper facts:

- Known as the "king of spices" because it is one of the oldest and most popular spices in the world.
- Pepper was so valuable that in ancient Greece and Rome it was used as currency.
- It is believed that when the Goths defeated Rome in 410, they demanded a ransom of 3,000 pounds of pepper, along with other valuables such as silk.
- During the middle ages, peppercorns were accepted in lieu of money for dowries, rent and taxes.
- During the 19th century, Salem, Massachusetts played an important role in the world pepper trade and made some of America's first millionaires.



### Question:

Why do turkeys have dark and white meat?

### Answer:

In a turkey the active muscles such as the legs store a lot of oxygen and become dark, while less active muscles like the breast remain white.

Turkeys do not fly, but they do plenty of running around. Active muscles, such as the legs and thighs, are full of blood vessels. These blood vessels contain myoglobin (or muscle hemoglobin), which delivers oxygen to the muscles. The more myoglobin the muscles contain, the darker the muscle.

Scientists often refer to these active muscles as slow-twitch fibers. Slow-twitch fibers are built for endurance, which allows the muscles to work for long periods of time. Thus the turkey can run around all day without getting tired.

On the other hand, white meat is the result of well-rested muscles. The breast muscles, which are used for flying, are hardly used by turkeys. There is no need to have a rich supply of oxygen delivered to these muscles. Scientists refer to these types of muscles as fast-twitch fibers. Fast-twitch fibers are designed for quick bursts of energy, but they fatigue quickly.



### Question:

Who invented the toothbrush and when was it invented?

### Answer:

Various Peoples. 1938 (modern).

The toothbrush as we know it today was not invented until 1938. However, early forms of the toothbrush have been in existence since 3000 BC. Ancient civilizations used a "chew stick," which was a thin twig with a frayed end. These 'chew sticks' were rubbed against the teeth.

The bristle toothbrush, similar to the type used today, was not invented until 1498 in China. The bristles were actually the stiff, coarse hairs taken from the back of a hog's neck and attached to handles made of bone or bamboo.

Boar bristles were used until 1938, when nylon bristles were introduced by Dupont de Nemours. The first nylon toothbrush was called Doctor West's Miracle Toothbrush. Later, Americans were influenced by the disciplined hygiene habits of soldiers from World War II. They became increasingly concerned with the practice of good oral hygiene and quickly adopted the nylon toothbrush.

Some other interesting toothbrush facts:

- The first mass-produced toothbrush was made by William Addis of Clerkenwald, England, around 1780.
- The first American to patent a toothbrush was H. N. Wadsworth in the 1850's.
- Mass production of toothbrushes began in America around 1885.
- One of the first electric toothbrushes to hit the American market was in 1960. It was marketed by the Squibb company under the name Broxodent.



## Question:

Who invented frozen food?

## Answer:

Several individuals, but most credit Clarence Birdseye.

Of course, frozen food has always existed in climates that were cold enough for the food to freeze. Many people developed innovative food-freezing techniques, including Enoch Piper, William Davis, and Daniel E. Somes. However, Clarence Birdseye is credited with inventing in 1924 the quick freezing method, which produces the type of frozen foods that we know today.

While working as a fur trader in Labrador, NF, Canada, Birdseye discovered that the fish that he and the local Inuit caught froze almost immediately after being pulled from the water. He was delighted to discover that the fish was just as delicious when thawed out months later. From this experience, he theorized that food must be frozen very quickly in order for it to retain its taste and texture.

Birdseye was right. Before quick-freezing came along, foods were frozen at a fairly slow rate. This caused large ice crystals to form, which ruptured the cell membranes of the food. When the food was defrosted, the ice crystals melted and water would leak out, taking with it the food's flavor and texture.

Birdseye developed two methods for quick freezing foods, both of which employed the innovation of packaging the food beforehand. In the first technique, the package was held between two metal belts that were chilled to  $-40^{\circ}\text{F}$  to  $-45^{\circ}\text{F}$  using a calcium chloride solution.

In the second and more popular technique, the packaged food was held under pressure between two hollow metal plates that were chilled to  $-25^{\circ}\text{F}$  by the evaporation of ammonia. Using this method, a two-inch-thick package of meat could be frozen to  $0^{\circ}\text{F}$  in about 90 minutes, while fruits and vegetables took about 30 minutes.

Birdseye's quick-freezing process actually ended up creating 168 patents! These covered not only the freezing technique but also the packaging, type of paper used, and related innovations. Fun Fact: March is National Frozen Food Month!



### Question:

Who “invented” the TV dinner?

### Answer:

Several individuals developed the TV dinner.

Like many creations, the story of the development of the TV dinner is not straightforward. Many people and companies played a role in the development of the concept of a complete meal that needed only to be reheated before eating. The invention of the TV dinner has been attributed to at least three different sources, primarily Gerry Thomas, the Swanson Brothers, and Maxson Food Systems, Inc.

Maxson Food Systems, Inc. manufactured the earliest complete frozen meal in 1945. Maxson manufactured “Strato-Plates”– complete meals that were reheated on the plane for military and civilian airplane passengers. The meals consisted of a basic three-part equation of meat, vegetable and potato, each housed in its own separate compartment on a plastic plate. However, due to financial reasons and the death of their founder, Maxson frozen meals never went to the retail market. Some feel that Maxson’s product does not qualify as a true TV dinner, since it was consumed on an airplane rather than in the consumer’s home.

In 1952, the first frozen meals appeared on the retail market, following the same three-part equation, but this time appearing on oven-ready aluminum trays. The first on the scene was devised by Quaker State Foods, which sold its meals under the One-Eye Eskimo Label. Around the same time Frigi-Dinner also started offering its own frozen dinners.

The concept really took hold in 1954 when Swanson’s frozen meals appeared. Swanson was a well-known brand that consumers recognized, and Swanson launched a massive advertising campaign for their product. They also coined the phrase TV Dinner, which helped to transform their frozen meals into a cultural icon.

But, this is where different stories begin to emerge. One of the most widely credited individual inventors of the TV dinner is Gerry Thomas, who was working as a salesman for C.A. Swanson & Son in 1953. Many credit him with creating not only the concept of the TV dinner but also the trademark name and the design of the three-compartment aluminum tray. Thomas was inducted into the Frozen Food Hall of Fame in Orlando, FL.

Conversely, Betty Cronin, a bacteriologist who was also working for the Swanson brothers at that time, asserts that it was the Swanson brothers themselves, Gilbert and Clarke Swanson, who came up with the concept of the TV dinner, while their marketing and advertising teams developed the name and design of the product. Cronin also worked on the project, taking on the technical challenge of composing a dinner in which all the ingredients took the same amount of time to cook, also called synchronization.

So who really invented the TV dinner? It depends on your definition. One thing is for sure, though: the first company to use the name and successfully market the TV Dinner was Swanson.



### Question:

Who is credited as inventing the telephone?  
Was it Alexander Graham Bell, Elisha Gray, or Antonio Meucci?

### Answer:

Alexander Graham Bell was the first to patent the telephone.

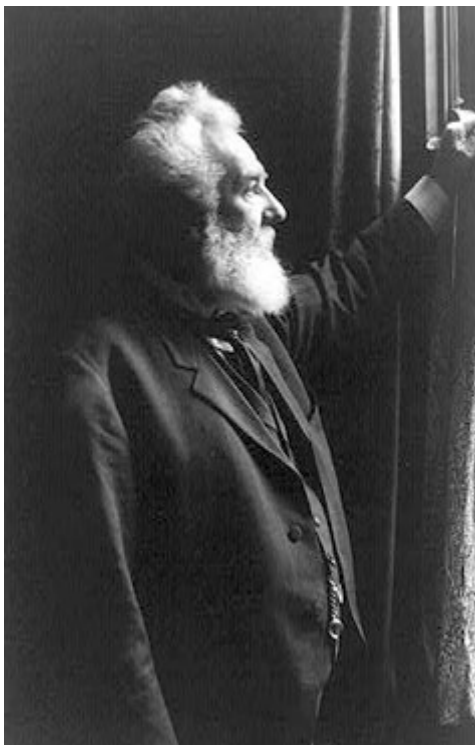
Attributing the true inventor or inventors to a specific invention can be tricky business. Often credit goes to the inventor of the most practical or best working invention rather than to the original inventor(s). This happens to be the case of the invention of the telephone.

There is a lot of controversy and intrigue surrounding the invention of the telephone. There have been court cases, books, and articles generated about the subject. Of course, Alexander Graham Bell is the father of the telephone. After all it was his design that was first patented, however, he was not the first inventor to come up with the idea of a telephone.

Antonio Meucci, an Italian immigrant, began developing the design of a talking telegraph or telephone in 1849. In 1871, he filed a caveat (an announcement of an invention) for his design of a talking telegraph. Due to hardships, Meucci could not renew his caveat. His role in the invention of the telephone was overlooked until the United States House of Representatives passed a Resolution on June 11, 2002, honoring Meucci's contributions and work (To read the report search [Thomas](#) Legislation, Bill summary and Status, 107th Congress, H Res 269 ).

To make matters even more interesting Elisha Gray, a professor at Oberlin College, applied for a caveat of the telephone on the same day Bell applied for his patent of the telephone. In *Historical First Patents: The First United States Patent for Many Everyday Things* (Scarecrow Press, 1994), Travis Brown, reports that Bell got to the patent office first. The date was February 14, 1876 . He was the fifth entry of that day, while Gray was 39th. Therefore, the U.S. Patent Office awarded Bell with the first patent for a telephone, US Patent Number 174,465 rather than honor Gray's caveat.

So, if someone asks who is credited with inventing the telephone, you can explain the controversy that still surrounds this question. The answer is Bell, but be sure to mention Meucci and Gray, because they played important roles in its development.



### Question:

How does an hourglass measure time?

### Answer:

By using carefully calculated amounts of sand.

The hourglass is sometimes referred to as a sand clock or a sandglass. Like other timepieces, it needs to be carefully calibrated. The hourglass maker must test the instrument and fine tune it to measure the correct length of time.

There are many factors that contribute to the ability of an hourglass to accurately measure time. The type and quality of sand is key. It must have a rate of flow that does not fluctuate. Sand that is too coarse will wear away the glass, eventually making the neck too large. Most important is the ratio of the neck (the hole, or tube) width to the diameter of the sand particles.

Here are the other factors that affect the accuracy of an hourglass:

- The amount or volume of sand used
- The size and angle of the glass bulbs
- The quality of the sand or granular material. It must be fine, dry and consistently formed so it can flow smoothly. (Some substances used in the past were fine grain sand, powdered eggshells, and powdered marble.)
- The width of the neck
- A tight seal so no moisture can get into the chambers. Moisture can add weight to the sand or clog up the neck.
- A flat and level surface on which to rest the hourglass

We still use the hourglass to keep track of time. Just think of its many uses for cooking and for playing games!



### Question:

Who invented the automobile?

### Answer:

Karl Benz.

This question does not have a straightforward answer. The history of the automobile is very rich and dates back to the 15th century when Leonardo da Vinci was creating designs and models for transport vehicles.

There are many different types of automobiles - steam, electric, and gasoline - as well as countless styles. Exactly who invented the automobile is a matter of opinion. If we had to give credit to one inventor, it would probably be Karl Benz from Germany. Many suggest that he created the first true automobile in 1885/1886.

Below is a table of some automobile firsts, compiled from information in Leonard Bruno's book *Science and Technology Firsts* (Detroit, c1997) and About.com's *History of the Automobile*.

AUTOMOBILE FIRSTS			
Inventor	Date	Type/Description	Country
Nicolas-Joseph Cugnot (1725-1804)	1769	STEAM / Built the first self propelled road vehicle (military tractor) for the French army: three wheeled, 2.5 mph.	France
Robert Anderson	1832-1839	ELECTRIC / Electric carriage.	Scotland
Karl Friedrich Benz (1844-1929)	1885/86	GASOLINE / First true automobile. Gasoline automobile powered by an internal combustion engine: three wheeled, Four cycle, engine and chassis form a single unit.	Germany Patent DRP No. 37435
Gottlieb Wilhelm Daimler (1834-1900) and Wilhelm Maybach (1846-1929)	1886	GASOLINE / First four wheeled, four-stroke engine- known as the "Cannstatt-Daimler."	Germany
George Baldwin Selden (1846-1922)	1876/95	GASOLINE / Combined internal combustion engine with a carriage: patent no: 549,160 (1895). Never manufactured - Selden collected royalties.	United States
Charles Edgar Duryea (1862-1938) and his brother Frank (1870-1967)	1893	GASOLINE / First successful gas powered car: 4hp, two-stroke motor. The Duryea brothers set up first American car manufacturing company.	United States



### Question:

What is a GPS? How does it work?

### Answer:

The Global Positioning System (GPS) tells you where you are on Earth.

It's eleven o'clock ... do you know where your kids are? Would you like to? One way to track them would be to have a GPS receiver installed in the car! The GPS, or Global Positioning System, is one of the hottest technologies around, and no wonder. Consider these diverse uses:

- Minnesota scientists use GPS to study movements and feeding habits of deer.
- Surveyors used GPS to measure how the buildings shifted after the bombing in Oklahoma City.
- GPS help settle property disputes between land owners.
- Marine archaeologists use GPS to guide research vessels hunting for shipwrecks.
- GPS data has revealed that Mt. Everest is getting taller!

GPS answers five questions simultaneously:

1. "Where am I?"
2. "Where am I going?"
3. "Where are you?"
4. "What's the best way to get there?"
5. "When will I get there?"

GPS is the only system today that can show your exact position on the Earth anytime, in any weather, no matter where you are!

### Development:

Like so many other high-tech developments, GPS was designed by the U. S. military. The concept started in the late '60s but the first satellite wasn't launched until February 1978. In 1989 the Magellan Corp. introduced the first hand-held GPS receiver. In 1992 GPS was used in Operation Desert Storm. On March 1996 the President decided to make GPS free for civilian users.

### System Description:

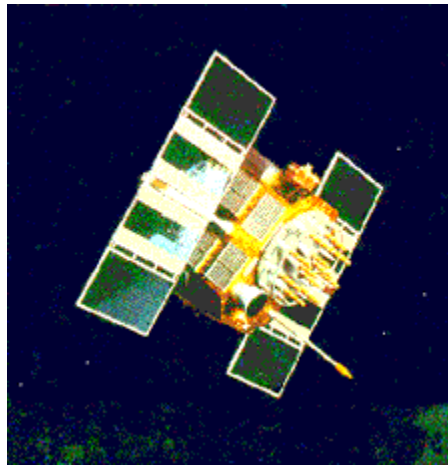
GPS has three 'segments':

1. The **space** segment now consists of 28 satellites, each in its own orbit about 11,000 nautical miles above the Earth.
2. The **user** segment consists of receivers, which you can hold in your hand or mount in your car.

3. The **control** segment consists of ground stations (five of them, located around the world) that make sure the satellites are working properly.

**Civilian Use:**

At first, the military did not want to let civilians use GPS, fearing that smugglers, terrorists, or hostile forces would use it. Finally, bowing to pressure from the companies that built the equipment, The Defense Department made GPS available for non-military purposes, with some restrictions. On May 1, 2000, President Clinton lifted the restrictions, and announced that the option to degrade civil GPS signals during emergencies would be phased out by 2010. The federal government is committed to providing GPS technology for peaceful uses on a worldwide basis, free of charge.



### Question:

What are the seven seas?

### Answer:

There is no definitive answer to this question. The phrase is a figure of speech and has been used to refer to different bodies of water at various times and places.

Some ancient civilizations used the phrase “seven seas” to describe the bodies of water known at that time. The ancient Romans called the lagoons separated from the open sea near Venice the septem maria or seven seas. Most current sources state that "seven seas" referred to the Indian Ocean, Black Sea, Caspian Sea, Adriatic Sea, Persian Gulf, Mediterranean Sea, and the Red Sea.

Not all geographers agree on this list of seven, believing that the seven seas reference will be different depending upon the part of the world and the time period in question.

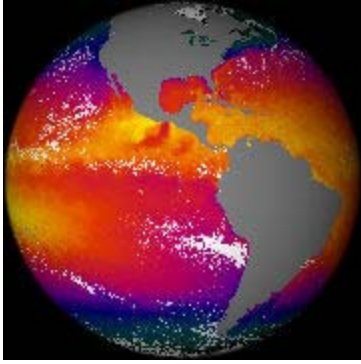
Some geographers point to the Age of Discovery and suggest that the seven seas represent the Atlantic, Pacific, Arctic, and Indian Oceans, as well as the Mediterranean Sea, the Caribbean, and the Gulf of Mexico.

Other geographers state that the seven seas were the Mediterranean and Red Seas, Indian Ocean, Persian Gulf, China Sea, and the West and East African Seas.

Today we recognize more than 50 seas worldwide. A sea is defined as a division of the ocean which is enclosed or partially enclosed by land. With that said, the Caspian Sea, Dead Sea, and Aral Sea are actually saltwater lakes, because they lack an outlet to the ocean. Conversely, by this definition, the Gulf of Mexico and Hudson Bay are seas.

#### Interesting Sea Facts:

- The largest sea is the Bering Sea at 876,000 sq. miles or 2,270,000 sq. kilometers.
- The saltiest sea in the world is the Red Sea with 41 parts of salt per 1,000 parts of water.
- The warmest sea in the world is the Red Sea, where temperatures range from 68 degrees to 87.8 degrees F depending upon which part you measure.
- The coldest seas are found near the poles such as the Greenland, Barents, Beaufort, Kara, Laptev and East Siberian Seas found near the north pole and Weddell and Ross Seas found in the south poles. The Baltic Sea is also considered one of the coldest seas.
- Depending upon the amount of salt in the water, sea water freezes at about 28 degrees F. High salt content lowers the temperature for freezing and low salt content raises the temperature for freezing.



*Question:*

**Why is it hot in summer and cold in winter?**

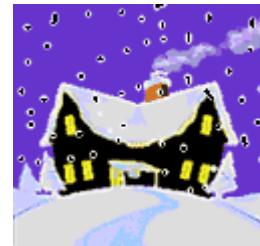
*Answer:*

Because the earth's axis is tilted.

It is all about the tilt of the Earth's axis. Many people believe that the temperature changes because the Earth is closer to the sun in summer and farther from the sun in winter. In fact, the Earth is farthest from the sun in July and is closest to the sun in January! The Earth's movement around the sun causes the seasons, but it does not affect the temperatures during the seasons.

During the summer, the sun's rays hit the Earth at a steep angle. The light does not spread out as much, thus increasing the amount of energy hitting any given spot. Also, the long daylight hours allow the Earth plenty of time to reach warm temperatures.

During the winter, the sun's rays hit the Earth at a shallow angle. These rays are more spread out, which minimizes the amount of energy that hits any given spot. Also, the long nights and short days prevent the Earth from warming up. Thus, we have winter!



### Question:

Does water go down the drain counterclockwise in the northern hemisphere and clockwise in the southern hemisphere?

### Answer:

It all depends upon how the water was introduced and the geometric structure of the drain.

One can find both counterclockwise and clockwise flowing drains in both hemispheres. Some people would like you to believe that the Coriolis force affects the flow of water down the drain in sinks, bathtubs, or toilet bowls. Don't believe them! The Coriolis force is simply too weak to affect such small bodies of water.

In his work "Sur les equations du movements relative des systems des corps" (1835) the French engineer Gaspard Gustav de Coriolis (1792-1843) first described this force. The Coriolis force is caused by the earth's rotation. It responsible for air being pulled to the right (counterclockwise) in the Northern Hemisphere and to the left (clockwise) in the Southern Hemisphere.

The Coriolis Effect is the observed curved path of moving objects relative to the surface of the Earth. Hurricanes are good examples. They curve to the right in the northern hemisphere and to the left in the southern hemisphere. What makes the hurricanes move in this way is the Coriolis force.

What happens at the equator? The Coriolis force is too weak to operate on the moving air at the equator. This means that weather phenomena such as hurricanes are not observed at the equator, although they have been observed at 5 degrees above the equator. In fact, the Coriolis force pulls hurricanes away from the equator.



### Question:

How does static electricity work?

### Answer:

An imbalance between negative and positive charges in objects.

Have you ever walked across the room to pet your dog, but got a shock instead? Perhaps you took your hat off on a dry winter's day and had a "hair raising" experience! Or, maybe you have made a balloon stick on the wall after rubbing it against your clothes?

Why do these things happen? Is it magic? No, it's not magic; it's static electricity!

Before understanding static electricity, we first need to understand the basics of atoms and magnetism.

All physical objects are made up of atoms. Inside an atom are protons, electrons and neutrons. The protons are positively charged, the electrons are negatively charged, and the neutrons are neutral.

Therefore, all things are made up of charges. Opposite charges attract each other (negative to positive). Like charges repel each other (positive to positive or negative to negative). Most of the time positive and negative charges are balanced in an object, which makes that object neutral.

Static electricity is the result of an imbalance between negative and positive charges in an object. These charges can build up on the surface of an object until they find a way to be released or discharged. One way to discharge them is through a circuit.

The rubbing of certain materials against one another can transfer negative charges, or electrons. For example, if you rub your shoe on the carpet, your body collects extra electrons. The electrons cling to your body until they can be released. As you reach and touch your furry friend, you get a shock. Don't worry, it is only the surplus electrons being released from you to your unsuspecting pet.

And what about that "hair raising" experience? As you remove your hat, electrons are transferred from hat to hair, creating that interesting hairdo! Remember, objects with the same charge repel each other. Because they have the same charge, your hair will stand on end. Your hairs are simply trying to get as far away from each other as possible!

When you rub a balloon against your clothes and it sticks to the wall, you are adding a surplus of electrons (negative charges) to the surface of the balloon. The wall is now more positively charged than the balloon. As the two come in contact, the balloon will stick because of the rule that opposites attract (positive to negative).

For more static electricity information and experiments, see the list of Web Resources and Further Reading sections.



**Question:**

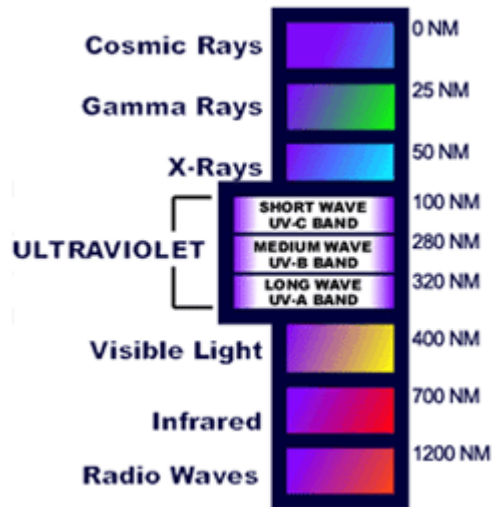
Why does ultraviolet light cause color to fade?

**Answer:**

Because of photodegradation.

It is all about the chemical makeup of an object. The technical term for color fading is photodegradation. There are light absorbing color bodies called chromophores that are present in dyes. The color(s) we see are based upon these chemical bonds and the amount of light that is absorbed in a particular wavelength.

Ultraviolet rays can break down the chemical bonds and thus fade the color(s) in an object - it is a bleaching effect. Some objects may be more prone to fading, such as dyed textiles and watercolors. Other objects may reflect the light more, which makes them less prone to fade.



### Question:

Why is the ocean blue?

### Answer:

There are several theories:

- Blue wavelengths are absorbed the least by the deep ocean water and are scattered and reflected back to the observer's eye
- Particles in the water may help to reflect blue light
- The ocean reflects the blue sky

Most of the time the ocean appears to be blue because this is the color our eyes see. But the ocean can be many other colors depending upon particles in the water, the depth of the water, and the amount of skylight.

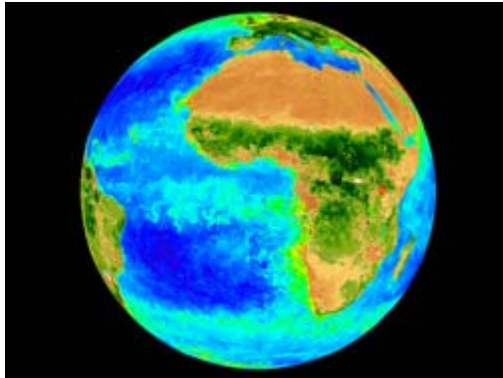
The colors we see depend upon the reflection of the visible wavelengths of light to our eyes. The Franklin Institute provides a good explanation of how we see color at <http://www.fi.edu/color/color.html>.

Wavelengths of light pass through matter differently depending on the material's composition. Blue wavelengths are transmitted to greater depths of the ocean, while red wavelengths are absorbed quickly. Water molecules scatter blue wavelengths by absorbing the light waves, and then rapidly reemitting the light waves in different directions. That is why there are mostly blue wavelengths that are reflected back to our eyes.

Sometimes oceans look green. This maybe because there of an abundance of plant life or sediment from rivers that flow into the ocean. The blue light is absorbed more and the yellow pigments from plants mix with the blue light waves to produce the color green.

Sometimes parts of the oceans will look milky brown after a storm passes. This is because winds and currents associated with the storm churn up sand and sediment from the rivers that lead into the oceans.

The ocean may also reflect the blue sky. However this is prominent only at relatively low angles and when the water is smooth.



### Question:

Can you tell the temperature by listening to the chirping of a cricket?

### Answer:

Yes!

The frequency of chirping varies according to temperature. To get a rough estimate of the temperature in degrees fahrenheit, count the number of chirps in 15 seconds and then add 37. The number you get will be an approximation of the outside temperature.

So, how do crickets make that chirping sound?

Usually, the males are the "singers." The male cricket rubs a scraper (a sharp ridge on his wing) against a series of wrinkles, or "files", on the other wing. The tone of the chirping depends upon the distance between the wrinkles.

There are several reasons why crickets chirp. They may be:

- Calling to attract a female with a a loud and monotonous sound
- Courting a nearby female with a quick, softer chirp
- Behaving aggressively during the encounter of two males
- Sounding a danger alert when sensing trouble

Crickets are part of the family Orthoptera (grasshoppers and katydids).



### Question:

Is it true that no two snow crystals are alike?

### Answer:

Yes!

The probability that two snow crystals will be exactly alike, in molecular structure and in appearance, is very minute. And to prove otherwise would not be easy. Each winter there are about 1 septillion (1, 000, 000, 000, 000, 000, 000, 000 or a trillion trillion) snow crystals that drop from the sky!

To go through all of the snow crystals produced every winter would be a daunting task. So, we rely on cloud physicists, crystallographers, and meteorologists to study snow crystals and explain to us why there are no two snow crystals alike.

First, we need to understand that not all water molecules are exactly alike. Generally speaking, water molecules have two hydrogen molecules with one  $^{16}\text{O}$  atom. However, not all water molecules will have this arrangement. Some water molecules will have an atom of deuterium in place of one of the hydrogen atoms and some water molecules will have an atom of  $^{18}\text{O}$ . Since the molecular makeup of snow crystals varies greatly from one to another, it follows that each snow crystal will be slightly different.

Furthermore, the unique and complex features of snow crystals are very much affected by unstable atmospheric conditions. Snow crystals are sensitive to temperature and will change in shape and design as they fall from the cloud and are exposed to fluctuating temperatures. To have two snow crystals with the same history of development is virtually impossible.



### Question:

Is the old adage “Red sky at night, sailor’s delight. Red sky in morning, sailor’s warning” true, or is it just an old wives’ tale?

### Answer:

Within limits, there is truth in this saying.

Have you ever heard anyone use the proverb above?

Shakespeare did. He said something similar in his play, *Venus and Adonis*. “Like a red morn that ever yet betokened, Wreck to the seaman, tempest to the field, Sorrow to the shepherds, woe unto the birds, Gusts and foul flaws to herdmen and to herds.”

In the Bible, (Matthew XVI: 2-3,) Jesus said, “When in evening, ye say, it will be fair weather: For the sky is red. And in the morning, it will be foul weather today; for the sky is red and lowering.”

Weather lore has been around since people needed to predict the weather and plan their activities. Sailors and farmers relied on it to navigate ships and plant crops.

### **But can weather lore truly predict the weather or seasons?**

Weather lore concerning the appearance of the sky, the conditions of the atmosphere, the type or movement of the clouds, and the direction of the winds may have a scientific basis and likely can predict the weather.

In order to understand why “Red sky at night, sailor’s delight. Red sky in morning, sailor’s warning” can predict the weather, we must understand more about weather and the colors in the sky.

Usually, weather moves from west to east, blown by the westerly trade winds. This means storm systems generally move in from the West.

The colors we see in the sky are due to the rays of sunlight being split into colors of the spectrum as they pass through the atmosphere and ricochet off the water vapor and particles in the atmosphere. The amounts of water vapor and dust particles in the atmosphere are good indicators of weather conditions. They also determine which colors we will see in the sky.

During sunrise and sunset the sun is low in the sky, and it transmits light through the thickest part of the atmosphere. A red sky suggests an atmosphere loaded with dust and moisture particles. We see the red, because red wavelengths (the longest in the color spectrum) are breaking through the atmosphere. The shorter wavelengths, such as blue, are scattered and broken up.

**Red sky at night, sailors delight.**

When we see a red sky at night, this means that the setting sun is sending its light through a high concentration of dust particles. This usually indicates high pressure and stable air coming in from the west. Basically good weather will follow.

**Red sky in morning, sailor's warning.**

A red sunrise reflects the dust particles of a system that has just passed from the west. This indicates that a storm system may be moving to the east. If the morning sky is a deep fiery red, it means a high water content in the atmosphere. So, rain is on its way.





### Question:

How does sunscreen work?

### Answer:

By combining organic and inorganic active ingredients.

Sunscreen works by combining organic and inorganic active ingredients. Inorganic ingredients like zinc oxide or titanium oxide reflect or scatter ultraviolet (UV) radiation. Organic ingredients like octyl methoxycinnamate (OMC) or oxybenzone absorb UV radiation, dissipating it as heat. Some sunscreens protect us from the two types of damaging UV radiation: UV-A and UV-B. Both UV-A and UV-B cause sunburns and damaging effects such as skin cancer.

Ultraviolet radiation is broken into three types of wavelengths:

- UV-A: This is the longest wavelength and is not absorbed by the ozone. It penetrates the skin deeper than UV-B.
- UV-B: Responsible for sunburns. It is partially blocked by the ozone layer.
- UV-C: This is totally absorbed by the earth's atmosphere; we encounter it only from artificial radiation sources.

When purchasing sunscreen, the Sun Protection Factor or SPF measures how effectively the sunscreen formula limits skin exposure to UV-B rays that burn the skin. The higher the SPF the more protection the sunscreen will provide against UV-B rays. SPF does not measure UV-A. If you are looking for UV-A protection, the experts recommend that you purchase a product that has broad-spectrum protection.



### Question:

What causes the noise when you crack a joint?

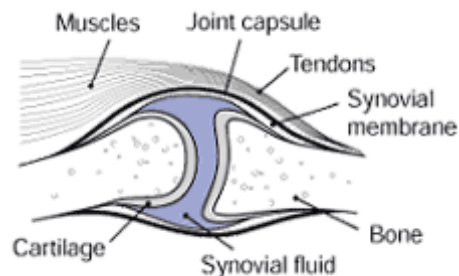
### Answer:

Escaping gases, movement and rough surfaces.

Your joints can make a variety of sounds: popping, cracking, grinding, and snapping. The joints that "crack" are the knuckles, knees, ankles, back, and neck. There are different reasons why these joints "sound off".

- **Escaping gases:** Scientists explain that synovial fluid present in your joints acts as a lubricant. The fluid contains the gases oxygen, nitrogen, and carbon dioxide. When you pop or crack a joint, you stretch the joint capsule. Gas is rapidly released, which forms bubbles. In order to crack the same knuckle again, you have to wait until the gases return to the synovial fluid.
- **Movement of joints, tendons and ligaments:** When a joint moves, the tendon's position changes and moves slightly out of place. You may hear a snapping sound as the tendon returns to its original position. In addition, your ligaments may tighten as you move your joints. This commonly occurs in your knee or ankle, and can make a cracking sound.
- **Rough surfaces:** Arthritic joints make sounds caused by the loss of smooth cartilage and the roughness of the joint surface.

Is joint cracking harmful? If you are feeling pain when your joints pop, than you should seek a health care professional. In terms of knuckle cracking, some studies show that knuckle cracking does not cause serious harm. Other studies show that repetitive knuckle cracking can do some damage to the soft tissue of the joint. It may also lead to a weak grip and a swelling hand.



### Question:

Why do fingers and toes wrinkle in the bathtub?

### Answer:

The outermost layer of the skin swells when it absorbs water. It is tightly attached to the skin underneath, so it compensates for the increased area by wrinkling.

There are various theories of why fingers and toes wrinkle in water. Most biologists suggest that the tough outer layer of skin made up of dead keratin cells is responsible. Keratin is a protein found in hair, nails, and the outermost layer of our skin.

Our skin is made up of three layers:

- The subcutaneous tissue is the deepest layer. It contains fats and connective tissue along with large blood vessels and nerves.
- The dermis is the middle layer. It contains the blood vessels, nerves, hair roots, and sweat glands.
- The epidermis is the topmost layer. It helps to prevent evaporation of water from the body and to protect the internal layers from harm.

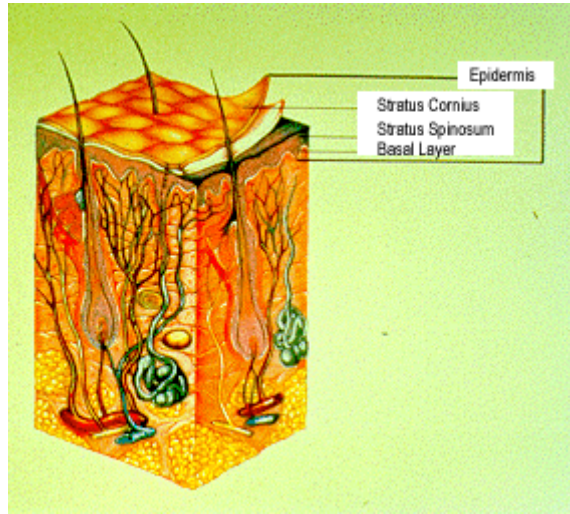
The epidermis is made up of four layers:

- the stratum corneum
- granular layer
- squamous cell layer
- and basal cell layer

The stratum corneum is the outer layer of our skin - the part that we can see and feel. This is the layer with the dead keratin cells.

While a person is in the pool or a bathtub for a long time, the dead keratin cells absorb water. This absorption causes the surface area of the skin to swell, but the outer layer is tightly attached to the living tissue. So, to compensate for the increased surface area, our skin wrinkles.

So why does this happen to hands and feet and not to other parts of the body? Because the hands and feet have the thickest layer of dead keratin cells. Our hands and feet are subjected to a lot of wear and tear. Imagine if the palm of our hands had skin as thin as that on our backs. No fun playing basketball with skin that thin!



*Question:*

What is the largest flower in the world?

*Answer:*

The *Rafflesia arnoldii*.

The flower with the world's largest bloom is the *Rafflesia arnoldii*. This rare flower is found in the rainforests of Indonesia. It can grow to be 3 feet across and weigh up to 15 pounds! It is a parasitic plant, with no visible leaves, roots, or stem. It attaches itself to a host plant to obtain water and nutrients. When in bloom, the *Rafflesia* emits a repulsive odor, similar to that of rotting meat. This odor attracts insects that pollinate the plant.

Another enormous flower found in Indonesia is the *Amorphophallus titanum*, or Titan arum. It is also known as the "corpse flower" for its unpleasant odor. Like the *Rafflesia*, the Titan emits the smell of rotting flesh to attract pollinators. Technically, the Titan arum is not a single flower. It is a cluster of many tiny flowers, called an inflorescence. The Titan arum has the largest unbranched inflorescence of all flowering plants. The plant can reach heights of 7 to 12 feet and weigh as much as 170 pounds!





### Question:

How high can a nine-banded armadillo jump?

### Answer:

Three to four feet into the air.

Of the twenty species of armadillo that exist throughout the Americas, the nine-banded armadillo (*dasypus novemcinctus*) is the only one found in the United States. When startled, the nine-banded armadillo can jump straight upward about three to four feet into the air. This reflex may help scare off predators in the wild. Unfortunately, many armadillos are killed when they jump into the underside of moving vehicles.

Amazing Armadillo Facts...



Armadillos can cross bodies of water in two ways. They can:

1. inflate their stomachs and intestines with air and float across the water, or,
2. sink down and use their sharp claws to walk across the bottom.

They can hold their breath for six minutes or more!

The nine-banded armadillo always gives birth to same gender quadruplets from a single egg.

The Latin name for the nine-banded armadillo is *Dasypus novemcinctus*. The word *Dasypus* is derived from the Latin word for rabbit,. *Novem* means nine and *cinctus* means band. Literally, it translates to "nine-banded rabbit." It is said that armadillos without their shells resemble rabbits.



### Question:

Why do bats live in caves?  
Why don't they fly into objects at night?

### Answer:

Most bats are nocturnal.

Most bats are nocturnal. They fly and forage for their food (bugs) at night. This means that they need safe places to sleep during the day. Caves provide the kind of protected shelter in which bats can thrive. Hanging from the ceiling of a cave, bats are out of reach of most of their enemies. Some of the most successful species of bats live in large cave colonies. Some of these colonies have millions of members, even up to 20 million! Carlsbad Caverns in New Mexico once had 7-8 million, but now has about 1 million.

So, why don't bats fly into things at night? They use echolocation to locate food and avoid obstacles. They have the ability to create and hear noises that humans cannot hear. The sound waves bounce off of objects and back to the bat, which can then judge the size and distance of the object. These subsonic noises vary in length and pulse frequency, and are unique to the individual. Each bat recognizes its own pulse reflections, or "voice," and uses it to avoid objects and to identify food.

Most bat colonies leave their caves more or less together, in large groups after dark. Before leaving they fly around inside, preparing for departure. Flying around with thousands of other bats inside a cave creates a chaotic amount of noise! The bats simply ignore their personal navigation systems inside the caves. The echolocators are on, but the bats aren't listening.

If you suddenly appeared in their cave among the flying bats, they would crash into you. The famous bat expert, Dr. Donald R. Griffin, called this phenomenon the "Andrea Doria effect." The Andrea Doria sank when it crashed into another ship out in the middle of the Atlantic ocean.

When bats are paying attention to their sonar signals, they can navigate without crashing into things. They can identify and capture food while it is moving. The echolocation system is designed to locate very small insects. Most of them are less than a centimeter in diameter. Compared to a bug, a human being is a very large, slow moving sound-reflecting surface. Outside of the cave, the chance of a bat hitting a person is very slim!

There are also bats that fly and hunt for food during the day. They sleep outdoors at night in trees, under bridges and other locations. Unlike nocturnal bats, they have well-developed eyes and poorly developed echolocation.



**Question:**

Which is the largest bear on earth?

**Answer:**

The polar bear.

It is a close call, but the polar bear is generally considered the largest bear on Earth. A close second is the brown bear, specifically the Kodiak bear. The Kodiak is a subspecies of the brown bear native to Alaska.

The consensus among experts is that the polar bear is the largest, but some believe the Kodiak bear to be larger. Part of the dissension comes from the vagueness of the word "largest." The answer really depends on how "largest" is defined - Heaviest? Longest? Largest ever recorded?

The following data, taken from Gary Brown's *Great Bear Almanac* (New York, 1993), compares the average measurements of the polar and brown bear.

	<b>Polar Bear</b>	<b>Brown Bear</b>
<b>Average Weight of Mature Male</b>	900-1,500 pounds	500-900 pounds
<b>Heaviest Recorded</b>	2,210 pounds	2,500+ pounds
<b>Average Length of Mature Male</b>	8-8.4 feet	>7-10 feet

Source: *The Great Bear Almanac* by Gary Brown



*Question:*

How much water does a camel's hump hold?

*Answer:*

None.

A camel's hump does not hold water at all - it actually stores fat. The camel uses it as nourishment when food is scarce. If a camel uses the fat inside the hump, the hump will become limp and droop down. With proper food and rest the hump will return to normal.

The hump is not used for water storage, but camels can go for long periods of time without water. They drink large amounts of water - up to 20 gallons at a time. This water is stored in the animal's bloodstream.



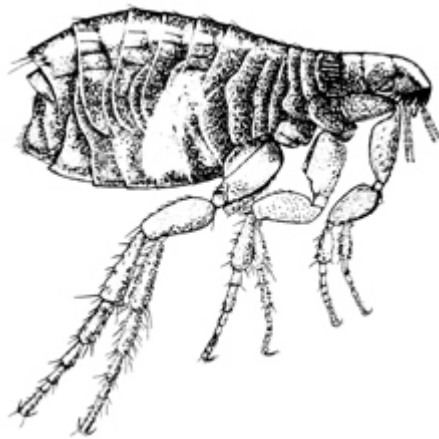
*Question:*

How long is the life span of a flea?

*Answer:*

30-90 Days (Average).

A flea might live a year and a half under ideal conditions. These include the right temperature, food supply, and humidity. Generally speaking, though, an adult flea only lives for 2 or 3 months. Without a host for food, a flea's life might be as short as a few days. But with ample food supply, the adult flea will often live up to 100 days.



### Question:

Why do geese fly in a V?

### Answer:

Energy conservation and visual assurance.

Why do geese fly in a V? Because it would be too hard to fly in an S! Just kidding. Scientists have determined that the V-shaped formation that geese use when migrating serves two important purposes:

First, it conserves their energy. Each bird flies slightly above the bird in front of him, resulting in a reduction of wind resistance. The birds take turns being in the front, falling back when they get tired. In this way, the geese can fly for a long time before they must stop for rest.

The second benefit to the V formation is that it is easy to keep track of every bird in the group. Fighter pilots often use this formation for the same reason.



### Question:

Is a polar bear's fur transparent?

### Answer:

Yes! Most sources indicate that the long, coarse guard hairs, which protect the plush thick undercoat, are hollow and transparent. The thinner hairs of the undercoat are not hollow, but they, like the guard hairs, are colorless.

The hair of a polar bear looks white because the air spaces in each hair scatter light of all colors. The color white becomes visible to our eyes when an object reflects back all of the visible wavelengths of light, rather than absorbing some of the wavelengths.

At one time it was suggested that the polar bear hairs might have some of the properties of optical fibers. Apparently this is not the case. See the following Web sites for information and additional links:

Debunking the Myth of Polar Bear Hair - Article 1390 from the Alaska Science Forum

<http://www.gi.alaska.edu/ScienceForum/ASF13/1390.html>

Complete Polar Bear Fact and Story Web site

[http://www.geocities.com/mikepolarbear/big\\_guess.html](http://www.geocities.com/mikepolarbear/big_guess.html)

Scientists in the late 1970's discovered another interesting tidbit about polar bears. A number of polar bears in zoos from around the world were turning green! These scientists discovered that the algae responsible for making the bears green were not on the SURFACE of the hairs, as originally supposed, but were INSIDE the hairs (Lewin & Robinson, 1979). The algae more than likely came from the pond waters in the bears' enclosures.



*Question:*

Can zebras be domesticated?

*Answer:*

No, zebras cannot be domesticated.

They are unpredictable and are known to attack people. To be domesticated, animals must meet certain criteria. For example, they must have a good disposition and should not panic under pressure. Zebras' unpredictable nature and tendency to attack preclude them from being good candidates for domestication. For more information about the criteria for domestication see : [The Australian Broadcasting Corporation's Animal Attraction Fact Sheet: Why were so few animals domesticable?](#)

While attempts at domestication have failed, some individuals have had success training and even hybridizing zebras! Common zebra hybrids: Zorse (horse + zebra) and Zonkey (donkey + zebra). Zebra hybridization has actually been in existence at least a century. One of the pioneers in the field was J.C. Ewart, author of *The Penycuik Experiments* in 1899.

