# Beach Sand

**Q:** Some beaches have very white sand while others do not. Why is this?

**A:** The sand is made of different minerals.

White sand beaches (such as those near Perth, the Bahamas, and many other places) are composed of bits of shell and corals which were brought from the ocean shelf to the shore by waves. These shells and corals are made of pure calcite which is nearly always white.

Beaches whose sand is not white (say a yellowy-brown colour) are formed by quartz sand -the raw material for glass- and a few other minor minerals which were eroded from the land and brought to the shore by rivers.

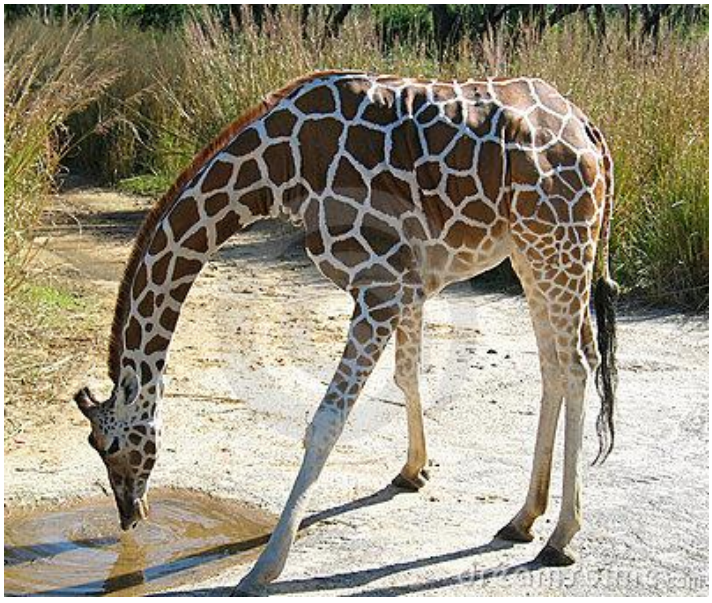
Pure quartz is clear, but there are commonly impurities and coatings on the grains, and with the other minor minerals the sand looks yellowy-brown.

# Blood to the Brain

Your heart works against gravity to pump blood to your brain. If you do a handstand - thereby putting yourself upside down- gravity works *with* the heart to carry blood to the brain. This results in an increase in blood pressure in the brain which can make you feel a little 'funny' and even cause a black-out.

Why doesn't a giraffe, with its extremely long neck, black-out when it bends over to take a drink of water? *...see under pic for the answer.*

It's because a giraffe has an extra-large, very strong heart –needed to pump blood up its long neck to its brain against the force of gravity. When a giraffe's head is lowered, in spite of the tremendous increase in pressure from the large strong heart pumping blood forcefully to the brain, together with gravitational forces, the animal does not black-out because it has evolved certain adaptations; these include extremely elastic blood vessels, special valves in their neck veins and a network of tiny veins to compensate for the sudden increase in blood pressure.



*Not all animals have these kinds of adaptations. A rabbit for example will die if held head upwards, since it simply can't pump blood to its brain in that unnatural posture.*

**Talk about or Write about**

1. This article talks about two of our most important organs, the brain and the heart. You know that the brain relies on the heart to provide it with blood but the heart needs the brain just as much. How might it be that the heart relies upon the brain in order to function?
2. Some people have a condition called *high blood pressure* while there are others whose blood pressure is low. From what you read above do you think you could guess possible causes for both these medical ailments?
3. Giraffes have evolved special adaptations to enable them to keep their head lowered. Rabbits, though, haven't acquired the ability to keep their head raised...why have they not?

# How to tell if an Egg has been Boiled

**Question**: How you might you tell whether an egg is boiled or not without breaking the shell, or using any equipment other than a flat surface?

**Answer:** Place your egg on a flat surface and spin it. A cooked egg will revolve much faster and continue turning longer than a raw one. Indeed it is difficult to make the raw egg turn. The difference between these two behaviours is, not surprisingly, because the boiled egg is solid and the raw egg contains liquid. It is easy to spin a rigid body like the boiled egg, because it turns as a whole. Nearly all of the force you apply to the cooked egg contributes to the rotation of the egg. The raw egg, however, has liquid contents. The liquid centre of the egg, attempting to stay at rest, resists rotation and acts as a brake on the rotation of the egg. Thus the energy you give to the egg is lost in overcoming friction between the liquid contents and the shell, rather than contributing to the rotation of the egg as a whole.

# Famous Scientist: Archimedes

Archimedes was born in Syracuse, the largest Greek settlement in Sicily, in 287BC.
He was a physicist and mechanical engineer but was best known in the ancient world as an inventor.

Archimedes proved the law of the lever and invented the compound pulley. With these machines, it is possible to move a great weight with a small force. Archimedes reportedly once boasted to Hiero, King of Syracuse: "Give me a place to stand on, and I will move the entire earth." He was referring to the way levers and pulleys can help people move objects many times their own size. The king challenged him to prove his boast. Archimedes is said to have used a system of pulleys to move a ship fully loaded with passengers and freight.

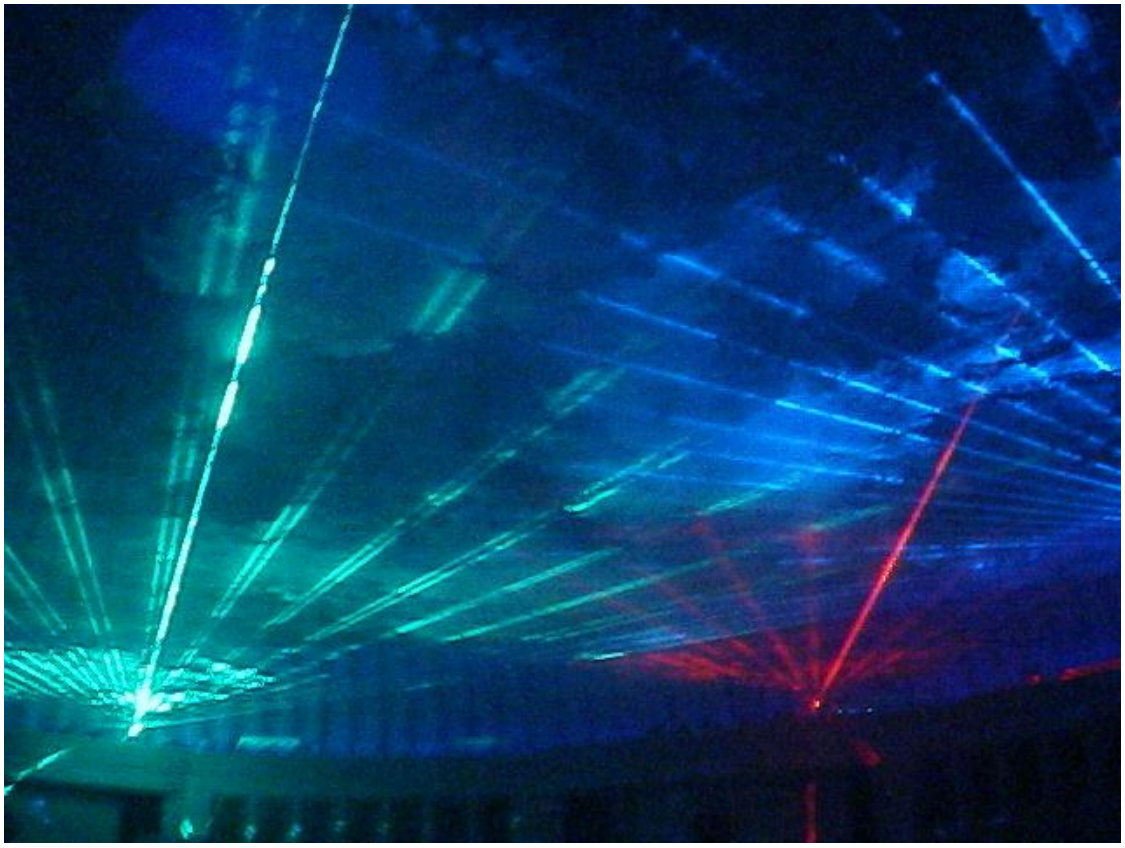
In his investigations of force and motion, Archimedes discovered that every object has a *centre of gravity*. This is a single point at which the force of gravity appears to act on the object.
Archimedes did much of his work for King Hiero. In one famous story, the king suspected that a goldsmith had not made a new coin of pure gold, but had mixed in some less costly silver. The king asked Archimedes to find out if the goldsmith had cheated. Archimedes found the answer to this problem while taking a bath. Archimedes noticed that water spilled out of a bath as he placed his body into it. By measuring the amount of water his body displaced, he could measure his body's volume. He concluded that any object placed in the bath would displace a volume of water equal to its own volume.
Archimedes compared the amount of water displaced by the coin to the amount of water displaced by an equal weight of pure gold. The coin displaced more water, and so it was not pure gold. The goldsmith had cheated.
Archimedes was so excited when he found the answer that he ran into the street without dressing, shouting "Eureka!"

**Talk about or Write about**

1. Would you say that the centre of gravity of planet earth is at earth's centre?

2. If an object is made of a heavy substance at one end and a light substance at the other end is its centre of gravity nearer the heavier end or the lighter end?
3. Give definitions for lever and pulley.
4. Archimedes found that the coin made of pure gold displaced a different amount of water from the coin that was made of a gold-silver mixture, even though the coins weighed the same. This is because the coins were of different density. What is density?
5. Providing they both sink, is it possible that a small, heavy object could displace as much water as a lighter object that is twice its volume?

# Laser



Gordon Gould was born in New York City in 1920. As a child, he idolized the great inventor Thomas Edison. Later, Gould himself would conceive and design one of the most significant inventions of the 20th century, the laser.

In 1957 Gould was working in the Physics Department at Columbia University, USA. One Saturday night, he was inspired "in a flash" with a revolutionary idea: '**L**ight **A**mplification by **S**timulated **E**mission of **R**adiation', or the 'laser'.
Gould reasoned that a light-wave amplifier would be much more powerful than a maser (which amplifies microwaves), since every photon of light has a hundred thousand times more energy than a photon of microwave energy.

By the end of that weekend, Gould had designed a device that he predicted could heat a substance to the temperature of the sun's surface in a millionth of a second.

By the time the first of his laser patents was issued in 1977 Gould's laser technology was already being used in countless practical applications, including welding, scanning and surgery.

**Talk about or Write about**

1. There are some people who are wary of using microwave ovens to heat food. Why do you suppose this is?
2. Why might it have been so long (20 years) from the time of Gould's idea to the time his first laser patent was issued?
3. Which of the following laser applications would you think will most benefit humanity: *welding, scanning, surgery*?
4. What similarities are there between microwaves and lasers?
5. What differences are there between microwaves and lasers?

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# Does the Moon affect life on Earth?

*If there were no moon, the tides would be only about 30% of what they are now ...and the tide cycle would perfectly match the daylight cycle (explanation below).*

Tides are the rises and falls of large bodies of water (oceans, seas, lakes and rivers); they are caused mainly by the gravitational interaction between the Earth and the moon (the sun has a smaller effect on tides). The oceans bulge out in the direction of the moon. Since the earth is rotating while this is happening another bulge occurs on the opposite side, since the Earth is also being pulled toward the moon (and away from the water) on the far side. So two tides occur each day.

Notice that the tidal cycles have nothing to do with the day-night cycles we experience. Tides are caused by the moon's pull; day-night cycles are caused by Earth's rotation on its axis - now *we* get the sun's light, soon *people in places west of ours* will get it (and we'll experience night).
Many of the most primitive animals live in tidal zones of the ocean, and depend upon the tide cycles being out of tune with the day-night cycles to survive; so if there were no moon, ocean life would be affected. Some animals would perish without a moon; newer life forms -able to adapt to the two cycles being more 'in sync'- may well evolve.

The moon enables nocturnality (nighttime activity, daytime sleep) which is important for both predators and prey. Without nocturnality our Earth at night would be a different place for many species (mammals, reptiles and birds among them); hunting, feeding and sleeping habits would be altered.

So yes, the moon certainly does affect life on Earth.

**Talk about or Write about**

1) The moon's pull on Earth's large bodies of water is greater than that of the sun. Given that the sun is much bigger (far greater mass) than the moon how can that be?
2) Our large expanses of water 'move toward' the moon. What stops solid materials (mountains, rocks etc) from also moving?
3) Many of the most primitive animals live in tidal zones of the ocean. What would you say is meant by *tidal zones*?
4) Which ocean creatures would you say are least affected by the moon?
5) What would you say 'in sync' means?
6) Which of a nocturnal animal's five senses do you think would be the most highly evolved?...explain. Which other senses may also be more highly evolved than ours?
7) Here is some real 'food for thought'! Would it be harder for diurnal animals (squirrels, songbirds...) to have to adapt to permanent night time living or harder for nocturnal animals (koala, possum...) to be forced to adapt to permanent daytime living?