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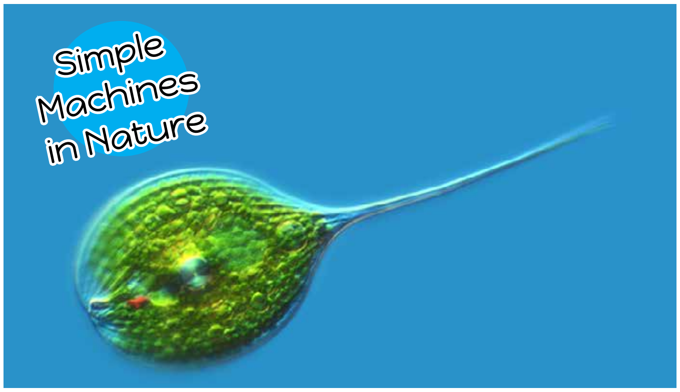

HCTF Education

Simple Machines in Nature

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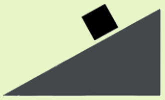
Inclined plane

When birds are learning to fly they run and flap up steep inclines, which uses much less energy than if they flew at those same angles.



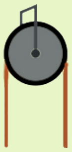
Wedge

Beavers use their teeth like a wedge to chew trees for food, to build a shelter (lodge), and to alter ecosystems (build a dam).

Lever

Some birds use their beaks like a lever to pry open seeds or dig under rocks, sand, or soil to look for food.

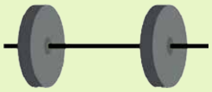
Pulley



The knee joint works like a pulley, where the kneecap is like the pulley's wheel and tendon of the quadriceps muscle (the big muscle in the front of the upper leg) is like the pulley's rope. The kneecap changes the angle and line of pull, giving more power to stand up, jump, and kick.

Wheel & Axle

The whip-like flagellum of bacteria rotates completely around like a wheel and axle, creating a twisting force and moving the bacteria forwards as it spins.



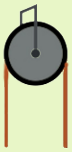
Screw

Some sharks, skates, and rays have a screw-shaped organ, called a spiral valve, in their intestines. The coiled shape increases surface area without taking up much room and it slows down digestions so that more nutrients are absorbed.

Wedges & Levers

The legs of a grizzly bear are used like shovels (levers) and their long claws are like wedges. Together they work powerfully and efficiently to dig into the soil to look for food or build a winter shelter.

Pulley



Some spiders hoist prey using a pulley-like system made from silk. This system allows them to efficiently snag oversized prey like lizards.

Simple Machines in Nature

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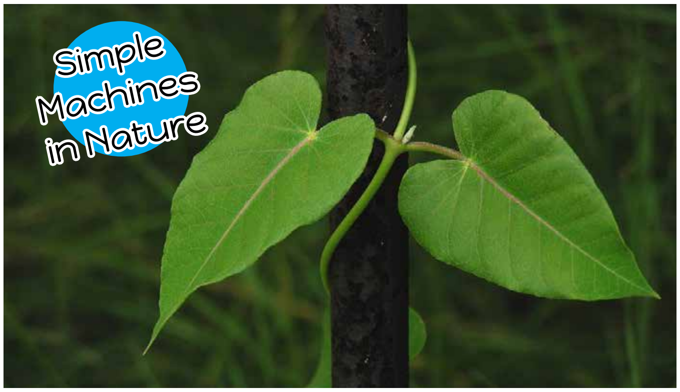

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Screw

Scientists studying electron micrographs of the Papuan weevil's knee joint found miniature screws and nuts, which the insect uses to lock its knees for stability when it lands.

Wedge

A woodpecker uses its sharp, strong beak like wedge. It hammers down hard to concentrate all its power in a tiny spot, which helps it break through the tough bark and wood of a tree.

Lever

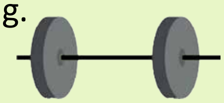
Some insects' wings and animal limbs have joints that work like a door hinge, opening and closing in one plane. This provides stability and strength in complex movements.

Screw

Snails have a toothy tongue called a radula, which is used in feeding. The radula scrapes in a circular motion, allowing the snail to drill through the hard shells of barnacles and shellfish.

Wheel

Some plants have round seeds. The seeds are efficiently dispersed away from the parent plant using gravity and by rolling away like a wheel, reducing friction and drag.



Inclined plane

The sloping sides of an anthill act like ramps, making it easier for ants to carry soil and food to the top. This design reduces the force needed to move an object to a certain height while increasing the distance the ants must travel.

Inclined plane

Vine stems and tendrils grow up supports like moving up a ramp. Instead of one hard vertical climb, they make many small, easy pushes. This uses less work per step, making it easier and efficient for them to reach high places.

Wedge

Wedges are common in nature and include any structure that can pierce or separate materials. Teeth are wedges, used for biting and pulling apart food.