


第三单元：简单机械	Unit 3: Simple Machines
<p>主要观念：</p> <p>3.1 示范机械能如何经由力的运用或利用简单机械，在移动中造成改变。</p> <p>3.2 观察和形容一个物体在移动中受摩擦的影响而产生的改变。</p> <p>3.3 观察和形容一个物体移动的位置或方向如何被推力和拉力而改变。</p> <p>3.4 观察地心引力如何将物体拉向地球的中心。</p>	<p>Key Ideas:</p> <p>3.1 Demonstrate how mechanical energy may cause change in motion through the application of force or the use of simple machines.</p> <p>3.2 Observe and describe how the amount of change in the motion of an object is affected by friction.</p> <p>3.3 Observe and describe how the position or direction of motion of an object can be changed by pushing or pulling.</p> <p>3.4 Observe how the force of gravity pulls objects toward the center of the Earth.</p>
单元大纲	Unit Overview
<p>我们使用的是什么样的机械？我们可能不会想到一个削铅笔机，一辆脚踏车，或一个榔头是一种机械，但是它们全部都是机械。一个机械是可以让工作更容易的任何工具。</p> <p>当我们骑一辆脚踏车，脚部的肌肉提供让脚踏车快速移动的能量。由简单机械组合而成的脚踏车，让骑脚踏车的人用最少的能量而达到最大的功。</p> <p>简单机械就在我们的四周：学校，家里，和社区。它们改变一个力的力度，方向，或速度来让工作更容易。</p>	<p>What kinds of machine do we use? We may not think of a pencil sharpener, a bike, or a hammer as a machine, but they are. A machine is any tool that makes work easier to do.</p> <p>When we ride a bike, the muscles in the rider's legs provide the energy to move the bike quickly. The simple machines that make up the bike let the rider do the most work while using the least energy.</p> <p>Simple machines are all around us: in school, at home, and in the community. They make work easier by changing the strength, direction, or speed of a force.</p>

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3.1 主要观念 示范机械能如何经由力的运用或利用简单机械，在移动中造成改变。	Key Idea 3.1 Demonstrate how mechanical energy may cause change in motion through the application of force or the use of simple machines.
科学用语： 1. 力 2. 功 3. 斜面 4. 坡道 5. 楔形物 6. 螺旋 7. 杠杆 8. 支点 9. 棒 10. 轮子 11. 轴 12. 滑轮（组）	Scientific Terms: 1. force 2. work 3. inclined plane 4. ramp 5. wedge 6. screw 7. lever 8. fulcrum 9. rod 10. wheel 11. axel 12. pulley
内容： 由一个或两个部位构成的工具称作简单机械。简单机械利用机械能来改变一个力的力度，方向，或速度。如果我们使用简单机械， 做功 ，例如起重，裁剪，撬开，钻紧，和移动物体，会比较容易。 斜面 一个平板是一个面。当这个板，或面，倾斜时，它可以帮助我们移动物体穿过一段距离。坡道是最常见的斜面。如果我们利用坡道滑上或滑下一个很重的盒子，移动这个盒子将会比较容易。  楔形物 当你用一个斜面的尖的边缘来将东西推开，这个斜面便是一个楔形物。一个凿子，用来将一片木头剖开，便是一个楔形物。斧头，钉子，和刀都是楔形物。	Content: Tools with only one or two parts are known as simple machines. Simple machines use mechanical energy to change the strength, direction, or speed of a force . Work , such as lifting, cutting, prying, tightening, and moving objects, is easier when we use simple machines. Inclined Plane A smooth board is a plane. When the board, or plane, is slanted, it can help us move objects across distances. A ramp is a common inclined plane. Moving a heavy box is easier if we slide the box up or down a ramp. Wedge When you use the pointed edges of an inclined plane to push things apart, the inclined plane is a wedge. A chisel, when used to split a piece of wood, is a wedge. An axe, a nail, and knife are wedges, too.

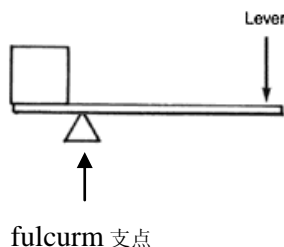
螺旋

一个螺丝钉是一个简单机械，能把东西固定在一起。许多罐子都有一个大的，扁形的螺旋体把盖子和罐子固定在一起。人们也利用螺丝钉把木头或金属片固定在一起。一个螺旋体实际上是一个围绕着一个棒子的斜面。每一个螺旋都帮助东西固定在一起。



杠杆

一个把东西撬开或像手臂一样举起的工具叫做杠杆。如果我们想用一个螺丝起子把油漆桶的盖子撬开，我们把螺丝起子的一端放到盖子的底下。螺丝起子被支撑在油漆桶的边缘，或是**支点**。然后，我们在螺丝起子的另一端往下压。支点改变力的方向，造成螺丝起子在盖子的另一端往上推。一个铲子或游乐园里的跷跷板都是杠杆的例子。



轮轴

另一种简单机械是轮轴。轮子转动轴，造成移动。例如手推车，底下的轮子在轴上转动，手推车便移动。门把是另一个例子。把手是轮子。轴是穿越门的棒子。轴连接内外两个把手。当我们转动门把，我们转动轴。轴然后再移动门把的另外一部份，让门打开。

Screw

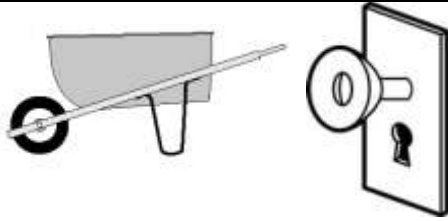
A screw is a simple machine that holds things together. Many jar lids have a large, flat screw that holds the lid to the jar. People also use screws to hold wood or metal pieces together. A screw is really an inclined plane wrapped around a rod. Every turn of a screw helps hold things together.

Lever

A tool that pries something loose or that lifts with an arm-like motion is a lever. If we use a screwdriver to pry open the lid of a paint can, we place one end of the screwdriver under the lid of the can. The screwdriver is held up by the edge of the can —or **fulcrum**. Then, we push down on the other end of the screwdriver. The fulcrum changes the direction of the force, causing the other end of the screwdriver to push up on the lid. A shovel or a playground seesaw can be another example of lever.

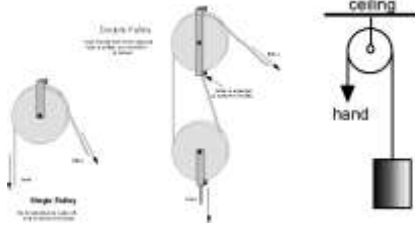
Wheel and Axle

Another kind of simple machine is the wheel and axle. The wheel turns the axle, which causes movement. An example of the wheel and axle is the wheelbarrow. The wheel below rotates on the axle and the wheelbarrow moves. A doorknob is another example. The knob is the wheel. The axle is the rod that goes through the door. The axle connects the two knobs. When we turn a doorknob, we turn the axle. The axle then moves another part within the doorknob that makes the door open.



滑轮（组）

轮子也可以转动绳子。这就是一个滑轮。一个滑轮，一根绳子包围著一个轮子。当这个轮子转动，绳子跟著移动。这个绳子可以用来拉高或降低物体。例如，旗杆上的旗子可以藉著滑轮升高或降低。有时候，几个滑轮组合在一起用来移动物体。人类用滑轮组来搬动重型的物体，例如船，钢琴，和保险箱。用越多的绳子来拉住装载物，施加在装载物上的力就越强。



Pulley

The wheel can also rotate a rope. This is a pulley. In a pulley, a rope wraps around a wheel. As the wheel rotates, the rope will move. The rope can be used to raise and lower objects. For example, a flag on a flagpole is raised and lowered by a pulley. Sometimes a number of pulleys are used to move objects. People use groups of pulleys to move heavy loads, such as boats, pianos, and safes. The more ropes used to hold the load, the stronger the force acting on the load.

复习：

1. 什么是简单机械？
2. 哪一种简单机械有一个支点？
3. 人们如何利用滑轮来工作？
4. 当你把你手掌心的球举起来，你像用一个杠杆一般的在用你的手臂。哪里是个支点？
5. 哪三种简单机械是根据斜面原理？

Review:

1. What are simple machines?
2. Which simple machine has a fulcrum?
3. How do people use pulleys to do work?
4. When you lift a ball in the palm of your hand, you use your arm as a lever. What is the fulcrum?
5. Which three simple machines are based on inclined planes?

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科学用语： 1. 摩擦力 2. 力 3. 摩擦 4. 平滑的 5. 粗糙的 6. 表面	Scientific Terms: 1. friction 2. force 3. rub 4. smooth 5. rough 6. surface
内容： 摩擦力 是一种让移动中的物体慢下来或停止的力量。当一个物体和另一个物体 摩擦 ，就会产生摩擦力。 平滑 面之间的摩擦力比 粗糙 面之间的摩擦力小。 拿一片铝箔和木头摩擦，并不会产生多少的摩擦力。拿一片砂纸和木头摩擦，就会产生摩擦力。当你拿著一片砂纸在木头上来来回回的摩擦著，你会感觉到砂纸和木头有微热的现象。物体表面互相摩擦，表面的粗糙度会缓慢动作并产生热。手推车的轮子让你更容易的拉动它。那是因为，轮轴这种简单机械会降低摩擦力并减少需要移动手推车所使用的力。 摩擦力帮助你每一天的工作。例如，你的鞋子和道路之间的摩擦力帮助你走路。如果没有摩擦力，你可能很容易滑倒和摔倒。摩擦力让你停止。摩擦力帮助轮胎在路上不会打滑。	Content: Friction is a force that slows down or stops moving objects. When an object rubs against another object, friction results. The friction between smooth surfaces is less than the friction between rough surfaces . Rubbing a piece of foil over wood does not cause much friction. Rubbing a piece of sandpaper over wood does cause friction. When you rub a piece of sandpaper back and forth across a piece of wood, the sandpaper and wood will feel warm when you touch them. The surfaces rub against each other; the roughness of the surfaces slows the movement and produce heat. The wheels on your wheelbarrow make it easier to pull. That’s because the simple machine of wheels and axles reduces friction and reduces the amount of force needed to move the wheelbarrow. Friction helps you do things every day. The friction between your shoes and the sidewalk helps you walk. Without friction, you would slip and fall. Friction makes you stop. Friction helps keep tires from slipping on the road.
复习： 1. 什么造成摩擦力？ 2. 摩擦力如何改变一个物体的动力？ 3. 你如何降低在两样物体之间互相摩擦的摩擦力？	Review: 1. What causes friction? 2. How does friction change an object’s motion? 3. How can you reduce the friction between two objects rubbing together?

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科学用语： 1. 推 2. 拉	Scientific Terms: 1. push 2. pull
内容： 想像你有一个空的小货车，你想要将它移动一小段距离。你也许要 推 或 拉 它。不论推或拉，你都要用力来移动这个小货车。力就是推或拉。例如小货车这个物体，只有在某些东西推它或拉它，它才会开始移动。 如果你只给这个货车一点点地推力，它大概只会移动一点点。如果你和其他三个朋友一起用力推，这个货车可能会移动的很远距离。那是因为用力的多寡决定物体移动的距离。如果你在这个货车里装满了砖头，你的货车将会比较重，而你也需要用更多的力来移动它。 推一个货车上坡比推它下坡，需要更多的力。山坡就好像一个斜面的简单机械，它会改变物体的动作。同时，我们必需用更多的力来抗拒地心引力把货车拉往地球。	Content: Imagine you have an empty wagon that you want to move a short distance. You might push the wagon or you might pull it. Either way, you would use force to move the wagon. A force is a push or a pull. An object, such as the wagon, starts to move only when something pushes it or pulls on it. If you give the wagon just a little push, it would most likely move only a little bit. If you and three friends give it a big push, the wagon would travel further. That is because the amount of force used determines how far the object moves. If you filled the wagon with bricks, your wagon would be heavier and you would need more force to move it. Pushing a wagon uphill would take more force than pushing the wagon downhill. The hill acts like a simple machine called an inclined plane, which changes the motion of the object. At the same time, we have to use more force against the gravity that pulls the wagon back to Earth.
复习： 1. 如果你推或拉一个小物体，会发生什么？ 2. 在冰上，推一个载了两个人雪橇比推载了一个人雪橇需要更多或更少的力？解释为什么。	Review: 1. What will happen if you push or pull a small object? 2. Explain whether it will take more or less force to push a sled over ice with two persons than one person on it.

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3.4 主要观念 观察地心引力如何将物体拉向地球的中心。	Key Idea 3.4 Observe how the force of gravity pulls objects toward the center of the Earth.
科学用语： 1. 地心引力 2. 轨道	Scientific Terms: 1. gravity 2. orbit
内容： 如果你把东西往空中丢，为什么它们都会掉下来？答案是 地心引力 。在十七世纪的时候，牛顿就有个疑问为什么月亮会绕著地球转。他也好奇为什么苹果会从苹果树掉下来。牛顿后来发现到的这个力就称作地心引力。地心引力是在两个物体之间互相吸引的力。它把苹果拉向地球，它也让月亮在 轨道 上绕着地球转。 月亮也有地心引力。因为月亮比地球小，它的地心引力也比地球小。因此，月亮不会像苹果一样掉到地球上。如果没有地心引力，月亮的移动路径将会是远离地球的一条直线。但是，月亮和地球的地心引力互相拉锯，因而形成月亮围绕着地球的一个圆弧型轨道。 地心引力可以穿过气体，液体，和固体。空气保持在地球的周围是因为地心引力。海水不会飞往太空是因为地心引力。石头和土壤保持在地球上是因为地心引力。你保持在地球上也是因为地心引力。如果你往上跳，地心引力会把你往地上拉下来。骑脚踏车上坡比下坡需要更多的力，因为地心引力不停的把你和脚踏车往下拉。没有地心引力的话，气体，液体，和固体都不会被拉向地球。它们可能都会飘浮在空中。	Content: Why do things come back down if you throw them up in the air? The answer is gravity . In the 17 th century, Isaac Newton wondered why the Moon orbits the Earth. He also wondered why apples fall from apple trees. What Newton discovered was the force called gravity. Gravity is a force of attraction between objects. It pulls apples toward the center of the Earth and it also keeps the Moon in orbit around the Earth. The Moon has gravity too. Because the Moon is smaller than the Earth, its gravity is less than Earth's. Therefore, the Moon doesn't fall to Earth like an apple. If there were no gravity, the motion of the Moon would be a straight path away from the Earth. The pull of gravity of both the Earth and the Moon causes the path of the Moon to curve in an orbit around Earth. Gravity works through gases, liquids, and solids. Air stays around the Earth because of gravity. Oceans do not fly off into space because of gravity. Rocks and soil stay on Earth because of gravity. You stay on Earth because of gravity too. If you jump up, the gravity will pull you down to the ground. Riding a bicycle uphill would take more force than riding downhill because the gravity keeps pulling you and your bicycle down. Without gravity, gases, liquids, and solids would not be pulled to the center of Earth. They all would probably be floating in the air.
复习： 1. 什么是地心引力？	Review: 1. What is gravity?

<p>2. 如果没有地心引力，月亮的移动将会如何不同？</p> <p>3. 如果地球没有地心引力会发生什么状况？</p>	<p>2. How would the motion of the Moon be different if there were no gravity?</p> <p>3. What would happen if there were no gravity on Earth?</p>
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解答	Answer Key
<p>3.1</p> <ol style="list-style-type: none"> 1. 简单机械是有很少或没有活动的零件的工具，让工作更容易。 2. 杠杆有支点。 3. 人类用滑轮（组）来移动物体往上，往下，或往旁边。 4. 手肘是支点。 5. 楔形物，斜面，和螺旋。 	<p>3.1</p> <ol style="list-style-type: none"> 1. Simple machines are tools with few or no moving parts that make work easier. 2. The lever has a fulcrum. 3. People use pulleys to move objects up, down or sideways. 4. The elbow is the fulcrum. 5. Wedges, inclined planes, and screws are three simple machines based on the inclined plane.
<p>3.2</p> <ol style="list-style-type: none"> 1. 摩擦两个物体。 2. 表面的粗糙度会缓慢物体的行动。 3. 在物体上加轮子。轮子会让我们更容易拉。那是因为轮轴这种简单机械会降低摩擦力，减低移动物体所需要的力。 	<p>3.2</p> <ol style="list-style-type: none"> 1. Rubbing two objects against one another causes friction. 2. The roughness of the surfaces slows down the movement of the object. 3. Add wheels to the object. Wheels will make it easier to pull. That's because the simple machine of wheels and axles reduces friction and reduces the amount of force needed to move the object.
<p>3.3</p> <ol style="list-style-type: none"> 1. 物体会移动。 2. 两个人会增加雪橇的重量。移动一个比较重的物体需要比较大的力。 	<p>3.3</p> <ol style="list-style-type: none"> 1. The object will move. 2. Adding another person to the sled makes it weigh more. It will take more force to move a heavier object.
<p>3.4</p> <ol style="list-style-type: none"> 1. 地心引力是在两个物体之间的吸引力。 2. 它的运行路径将会是一条直线，而不是围绕地球的圆弧路径。 3. 所有的东西将会飘浮在空中。 	<p>3.4</p> <ol style="list-style-type: none"> 1. Gravity is the force of attraction between two objects. 2. Its path would be a straight line away from the Earth instead of a curved path around Earth. 3. Everything would float up in the air.