Gears

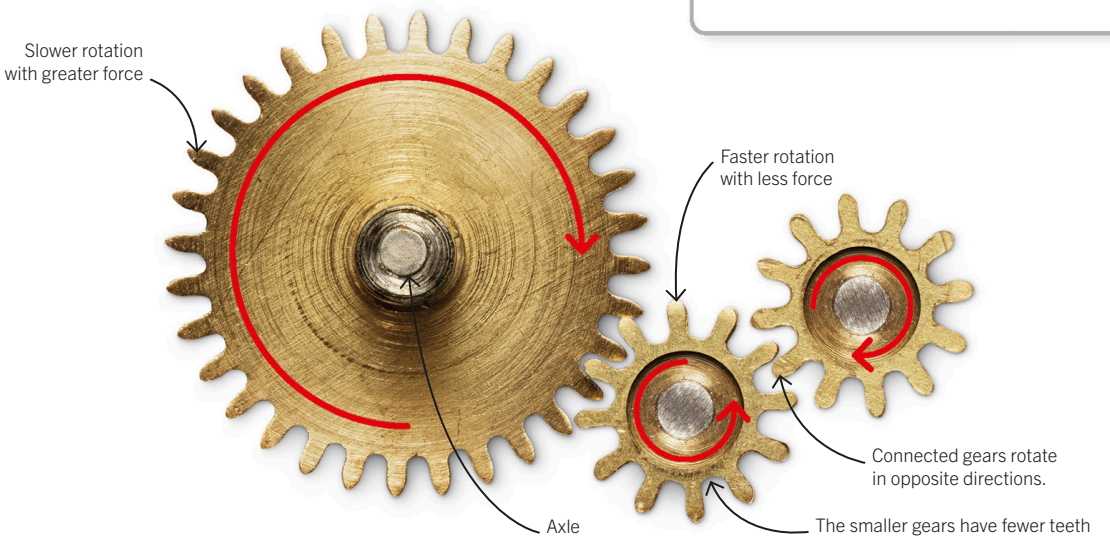
Gears are wheels with toothed edges that interlock to transmit rotational (turning) forces. Like levers, they can magnify or reduce the turning effects (moments) of forces.

How gears work

A gear transmits rotational force when its teeth mesh with those of another gear, causing it to turn as well. The forces acting at the teeth are the same for both gears, but the moments (the turning forces exerted on the axles) are different if connected gears have different numbers of teeth.

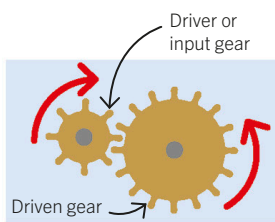
Key facts

- ✓ **A gear is a wheel with a toothed edge.**
- ✓ **Gears transmit rotational forces.**
- ✓ **When the driven gear is larger than the gear driving it, it rotates more slowly but with a greater moment (stronger turning force).**
- ✓ **When the driven gear is smaller than the gear driving it, it rotates more quickly but with a smaller moment (weaker turning force).**

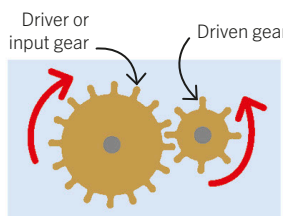


Using gears

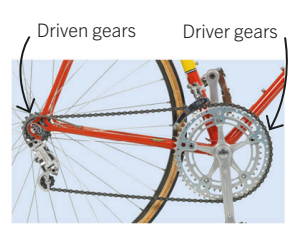
Gears can either magnify moments or increase the speed of rotation. Which they do depends on whether the driving gear is smaller or larger than the driven gear.



When the driven gear is larger than the gear driving it, the greater distance between the teeth and the axle means it produces a greater moment. This arrangement magnifies the input turning force.



When the driven gear is smaller than the driver gear, it produces a smaller moment on its axle but rotates faster. This arrangement increases speed.



The gears on a bike are connected by a chain. Choosing a small front gear and a large rear gear increases the moment—ideal for climbing a hill. Choosing a large front gear and small rear gear increases speed.