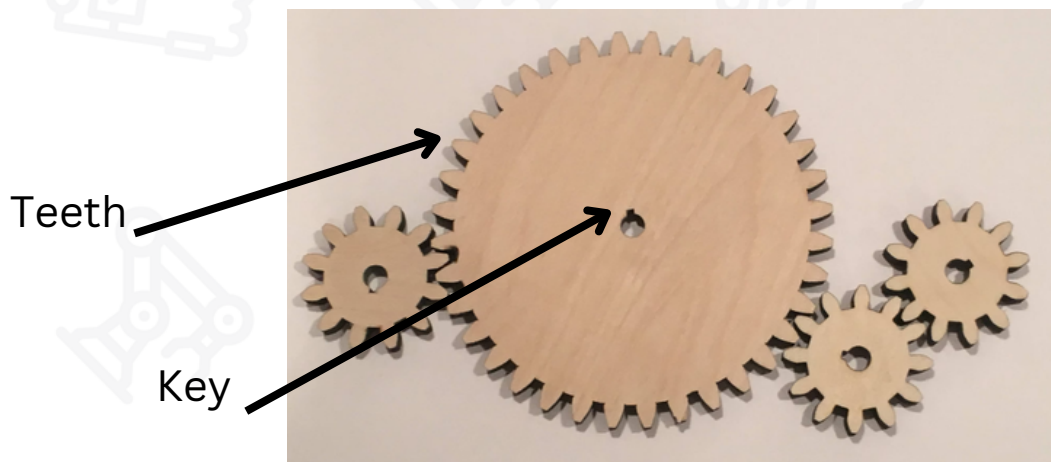


# Gears and Motion

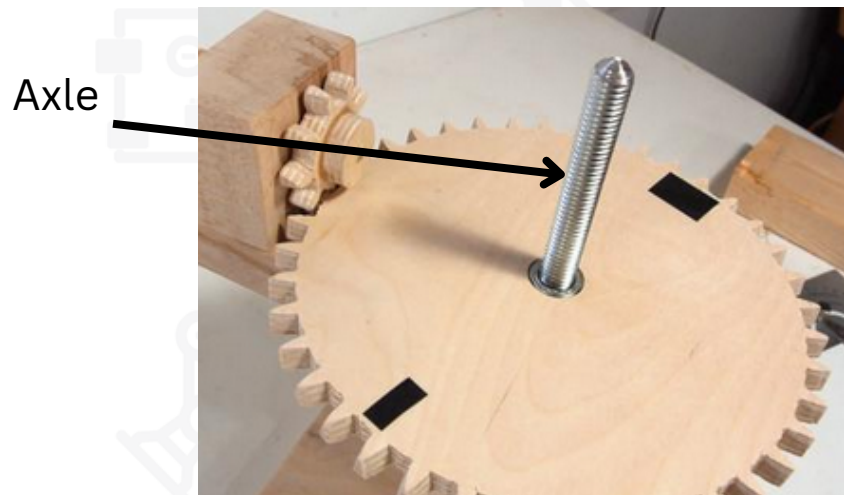
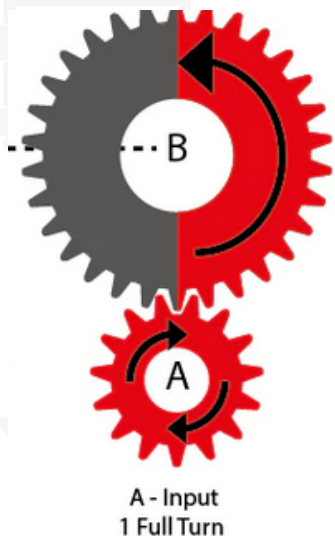
## What are gears used for?

- Gears have a variety of uses that can be demonstrated by organizing gears into different configurations.
- A very common use for gears is to exchange **torque** for **speed** and vice versa.
- Another would be to transfer mechanical motion between different positions and orientations, for example an engine piston in your car.



## What is a gear ratio?

- A gear ratio is a numerical representation of the size difference of **meshing gears**.
- For example, with 2 gears where one has twice the circumference as the other (assuming the teeth are the same size then also twice the teeth) the ratio would be 2:1. This means turning the bigger gear one full rotation would turn the smaller gear 2 full rotations and vice versa.



## Task 1: basic gear ratios

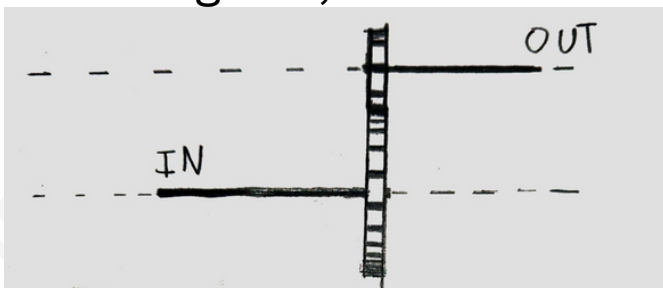
- Using your **pegboard** connect a large gear to a central hole, and then connect a small gear to a place around the large gear so that they will **mesh** properly.
- These gears have been designed to have 54, 36 and 18 teeth for large, medium and small sizes.
- Try and figure out the gear ratio between the combination you just created and test it by spinning the larger gear and seeing how many rotations the smaller one makes per full large gear rotation.
- Once you have done this, try the same with different gear combinations: medium with large, medium with small, etc...

## Task 2: Planetary gears and thier ratios

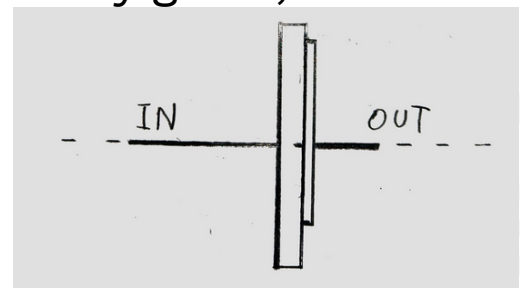
- Now you have learnt the basics of gears and thier ratios we can move onto a more complex mechanism, the planetary gear.
- These consist of a sun gear, outer ring gear and multiple planet gears, hence the name "planetary".
- the planet gears are usually connected through a single bracket allowing them to be attached to an axle at the center of rotation.
- Keeping the outer ring in place allows the planets to move with a high gear ratio compared to the center sun gear whilst keeping the axle **co-linear**.



Normal gears, not Co-linear



Planetary gears, co-linear



Your task is to assemble a planetary gear on the pegboard

## Task 3: Creating without instructions

- In this exercise you will not be given any instructions on how to make what you will be making.
- Instead you'll look at a fully assembled device to understand how it works, infer how it was constructed and then replicate it yourself.
- The goal of this exercise is to improve your problem-solving skills and ability to think of solutions with as little guidance as possible.
- Some steps may involve superglue, it is up to you to decide if it is necessary or not.

*This is super glue (cyanoacrylate) it is very sticky and very fast at setting. Try not to get on yourself or your skin, if you do, **don't** touch it, simply go to the toilet to keep the skin under warm soapy water for a while. Also **Don't** sniff or get any in your eyes.*



*if you make a mistake with super-glue do not worry, the parts can be easily replaced, just try to allow your creation to be somewhat dissassembled afterwards.*