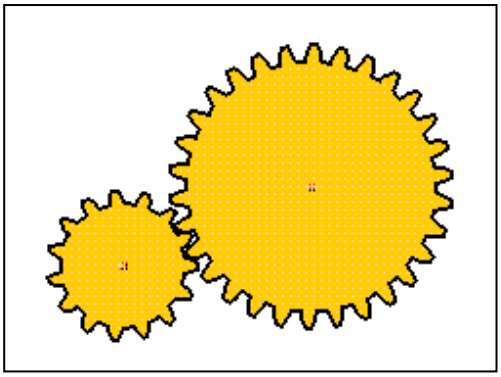

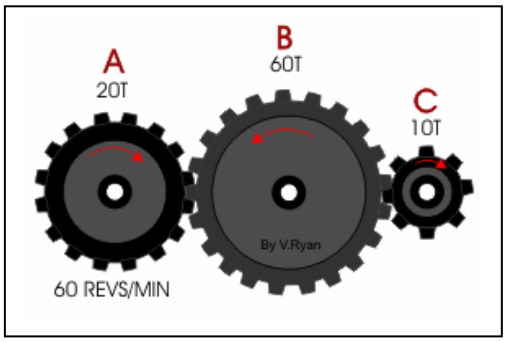

Gears are a common mechanical object used to change the rate of rotation of one shaft into a faster or slower rotation of a second shaft.

The top diagram shows two gears on two different shafts. The large gear has 30 teeth and the small gear has 15 teeth. As the small gear rolls along the circumference of the large gear, the shaft of the small gear completes 30/15 = 2 rotations for every 1 rotation of the large gear shaft. This is called a gear reduction, or gear ratio of 1:2.

The bottom diagram shows a more complicated gear 'chain' with 3 shafts. Gear A has 20 teeth, Gear B has 60 teeth and Gear C has 10 teeth. Gear A is turning at a rate of 60 revolutions per minute.

Problem 1 – When Gear A completes one revolution, how many revolutions does Gear B make?

Problem 2 – When Gear B makes one complete revolution, how many revolutions does Gear C make?

Problem 3 – What is the chain of reductions (example 1/2 x 1/3 x 4/6) that lets you calculate how many times Gear C rotates in revolutions per minute?

Problem 4 - An astronomer wants to build a 'clock drive' that will allow his telescope to keep up with the rotation of Earth so that stars will not move as he is looking at the sky with his telescope. To do this, the polar axis of the telescope mounting has to rotate exactly once each day, which lasts about 1437 minutes. He has a motor whose shaft rotates once every minute. The astronomer has the following gears with the indicated number of teeth: 1395, 309, 20 and 15. What combination will give him a speed reduction close to one shaft rotation every 1437 minutes?

Problem 1 – When Gear A completes one revolution, how many revolutions does Gear B make?

Answer: 20/60 = 1/3

Problem 2 – When Gear B makes one complete revolution, how many revolutions does Gear C make?

Answer: 60/10 = 6

Problem 3 – What is the chain of reductions (example 1/2 x 1/3 x 4/6) that lets you calculate how many times Gear C rotates in revolutions per minute?

Answer: 60 rev/min x (20/60) x (60/10) = 120 revolutions/minute

Problem 4 - An astronomer wants to build a 'clock drive' that will allow his telescope to keep up with the rotation of Earth so that stars will not move as he is looking at the sky with his telescope. To do this, the polar axis of the telescope mounting has to rotate exactly once each day, which lasts about 1437 minutes. He has a motor whose shaft rotates once every minute. The astronomer has the following gears with the indicated number of teeth: 1395, 309, 20 and 15. What combination will give him a speed reduction close to one shaft rotation every 1437 minutes?

Answer: The astronomer needs a gear reduction of **1:1437**

(309/15) x (1395/20) = (20.6)(69.75) = **1436.85 or 1437**.

So the gear reductions look like this:

1 revolution/minute x (15/309) x (20/1395) = 1 rpm x (1/1437) = 1 revolution/day.