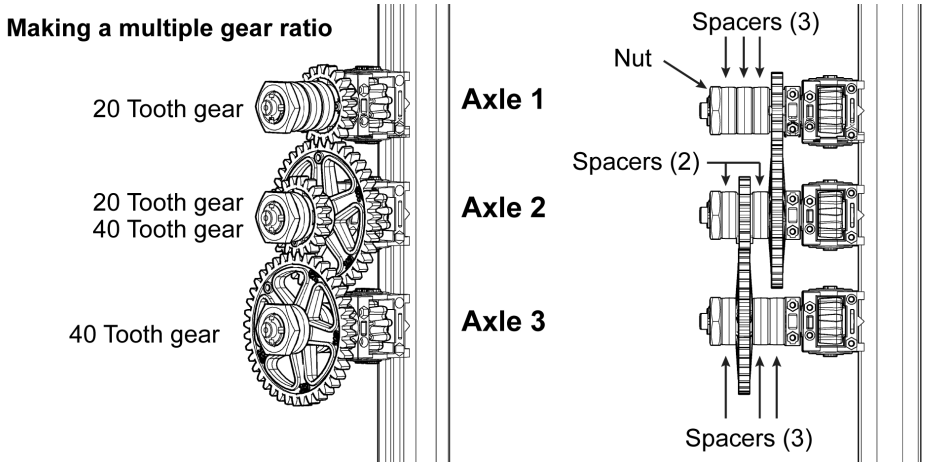
Investigation 12E: Designing Gear Machines

Essential question: How do you make a large gear ratio?
How are gear machines designed?

Your challenge is to design machines with the following ratios. NOTE: One of these ratios cannot be built with the gears in your set.



Design, build, and test the following machines.

Machine	Input turns	Output turns	NOTE: One of these four machines CANNOT be made with the gears you have. One of your challenges is to determine which machine cannot be built with your gears and propose an additional gear that would make that machine possible.
A	4	1	
B	6	1	
C	10	1	
D	9	4	
E	12	1	
F	18	1	

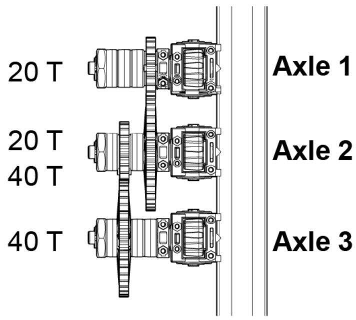
1. For each ratio that you can actually build fill in the numbers of teeth in the diagrams on the next page.

2. Write out the sequence of ratios that describes each machine and show that the ratios multiply together to give the overall ratio the design calls for.

3. What additional gear would you need in order to build the ratio you could not make?

4. Write out a series of ratios that would make this “un-built” machine if you had the missing gear.

Example



Use the charts to record your gear machine design.

The four columns match the four positions you can put a gear or a spacer.

Circle the pairs of gears that make each ratio.

Simplify and multiply the ratios to get the final ratio.

The example shows a machine with four gears.

	# teeth or “s”			
Axle 1	s	s	s	20
Axle 2	s	20	s	40
Axle 3	s	40	s	s
Axle 4				

Ratios

$$\frac{20}{40}\times\frac{20}{40}=\frac{1}{2}\times\frac{1}{2}=\frac{1}{4}$$

	# teeth or “s”			
Axle 1				
Axle 2				
Axle 3				
Axle 4				

Ratios

____

	# teeth or “s”			
Axle 1				
Axle 2				
Axle 3				
Axle 4				

Ratios

____

	# teeth or “s”			
Axle 1				
Axle 2				
Axle 3				
Axle 4				

Ratios

____

	# teeth or “s”			
Axle 1				
Axle 2				
Axle 3				
Axle 4				

Ratios

____

	# teeth or “s”			
Axle 1				
Axle 2				
Axle 3				
Axle 4				

Ratios

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