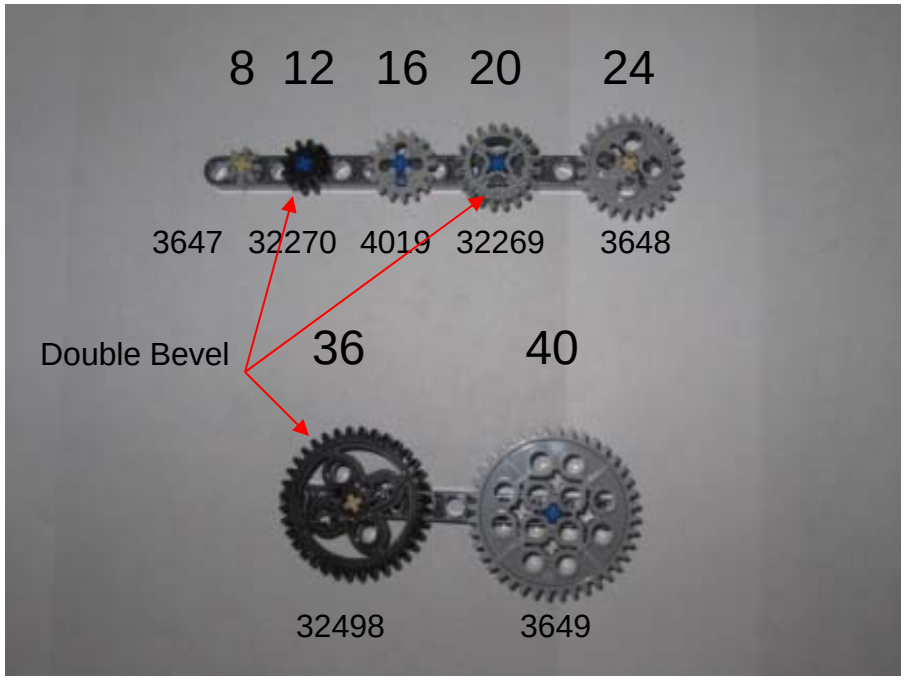
Mechanisms and Algorithms

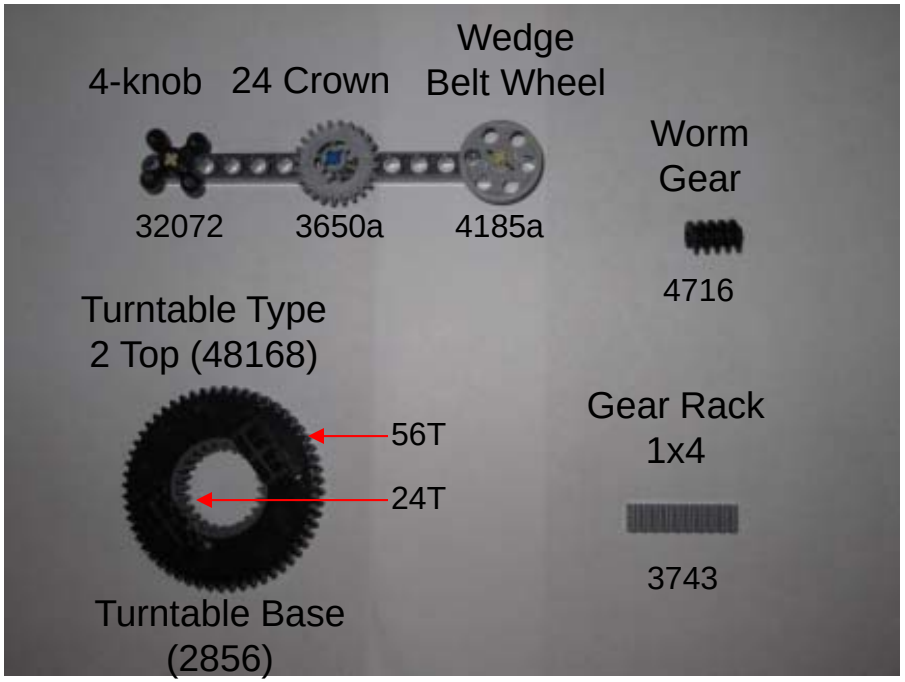
Lab: Lego Ratchets, Drives and Gearing

Lab Experiments

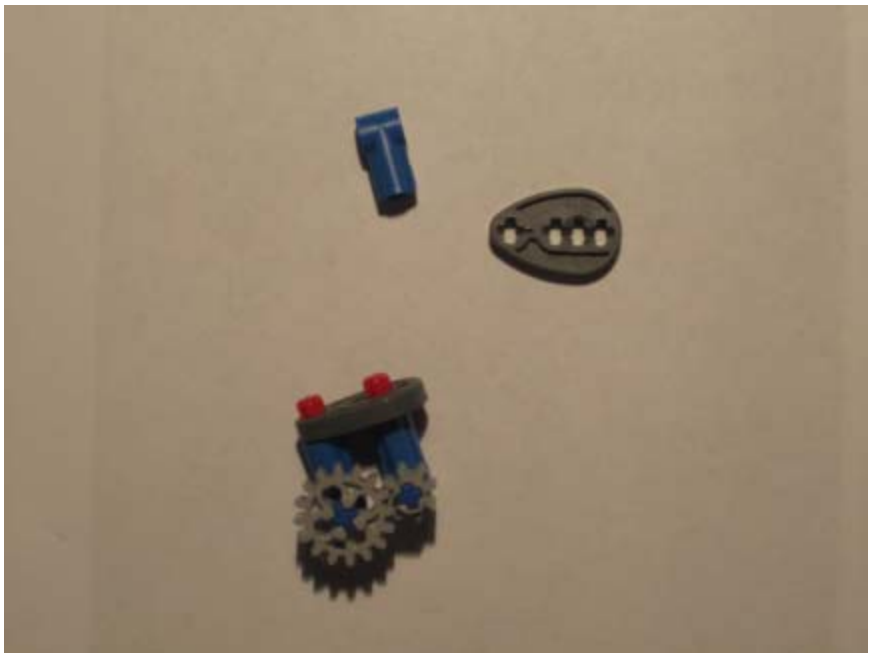
1. Introduction to Lego Gears (example connections)
2. Planetary Gears (outside and inside revolutions)
3. Bevel Gears
4. Worm Gears
5. Friction Drive
6. Rack-and-Pinion
7. Putting it all together: motorized example with worm gear and friction drive

Exercise 1: Lego Gears – Example Connections

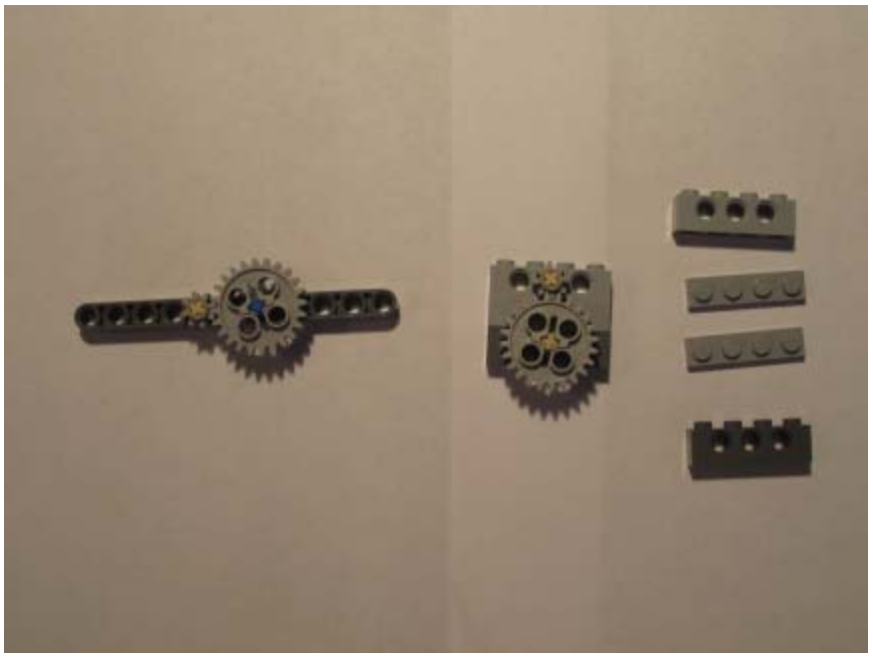




More Examples



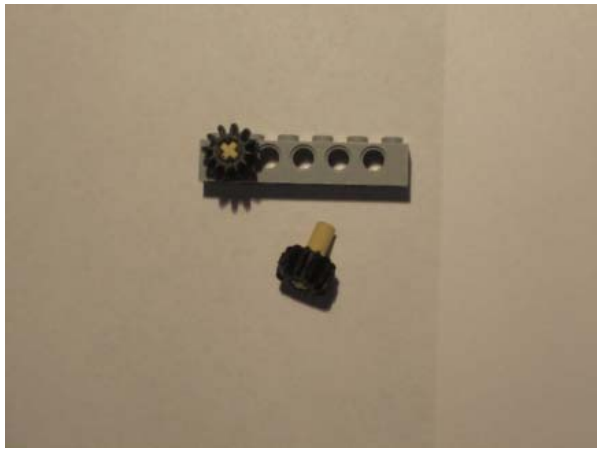
Construct with 8T and 16T gears

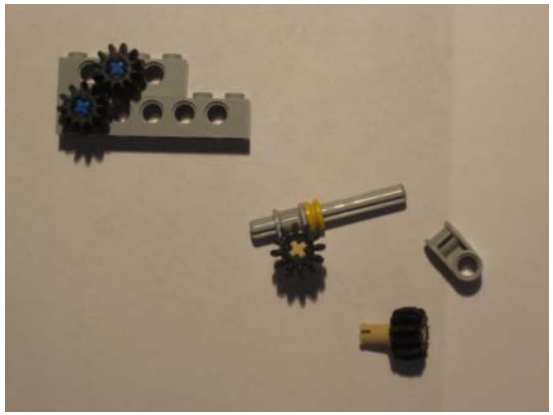


1:3 Gear Train with 8T and 24T gears

Exercises

1-1 Construct a 1:1 gear train using 8-tooth Lego Gears





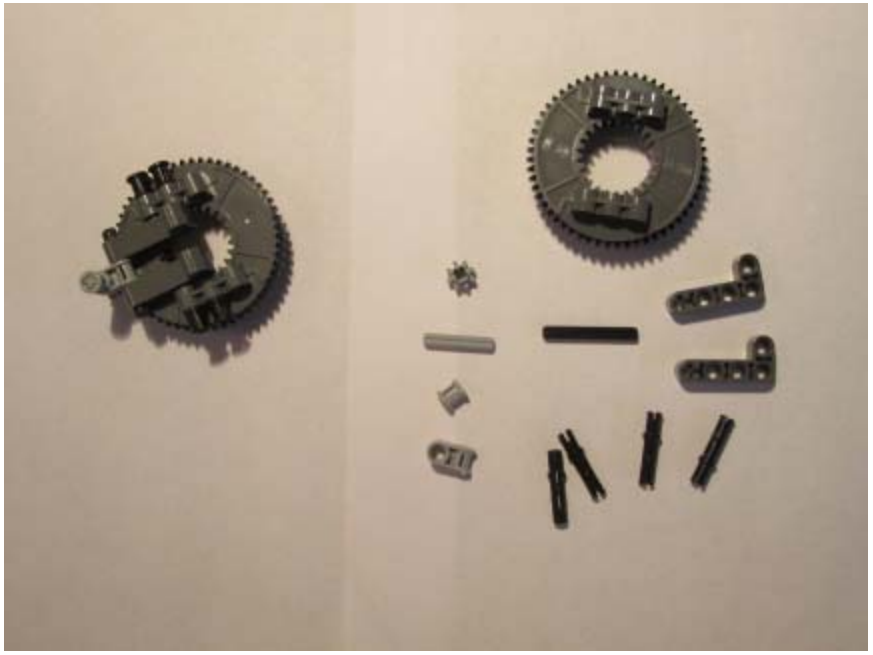
Solution

1-2 Use a pair of 24T gears and bricks to create a 1:1 gear train

1-3 Use a pair of 40T gears and bricks to create a 1:1 gear train

1-4 Use a 16T and 24T gear and axles to create a 2:3 gear train

Exercise 2: Planetary Gears

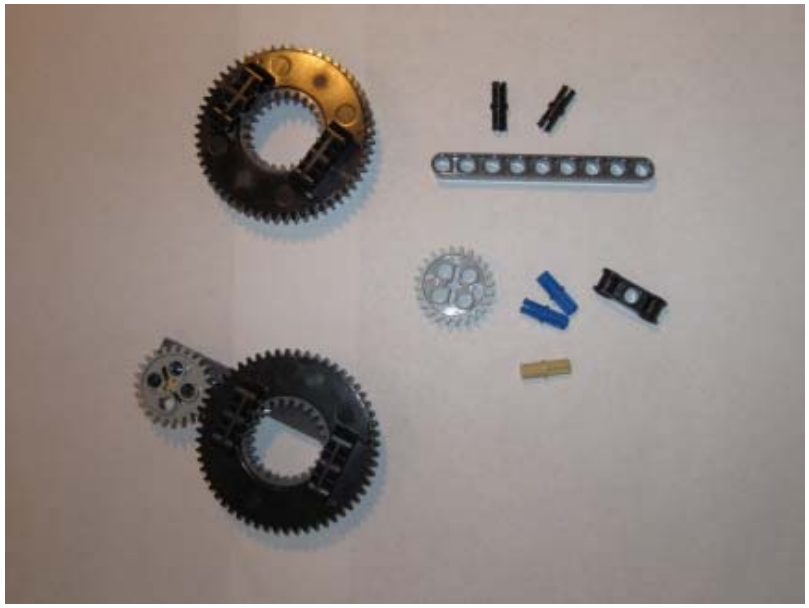


Lego Outside Gear Revolution 1:7 Ratio
Using 8T and 56T gears

Lego Inside Gear Revolution 1:3 Ratio
Using 8T and 24T gears

Exercises

2-1 Construct a 3:7 outside planetary gear train using 24T and 56T Lego Gears



Solution

2-2 Construct a 2:7 outside planetary gear train using 16T and 56T Lego Gears

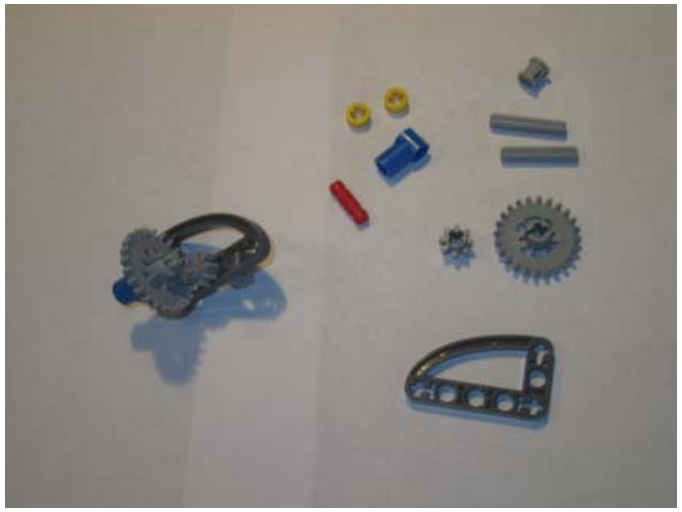
2-3 Construct a 2:3 inside planetary gear train using 24T and 16T Lego Gears

Exercise 3: Bevel Gears

1:1 Bevel with 12T pair

Solution

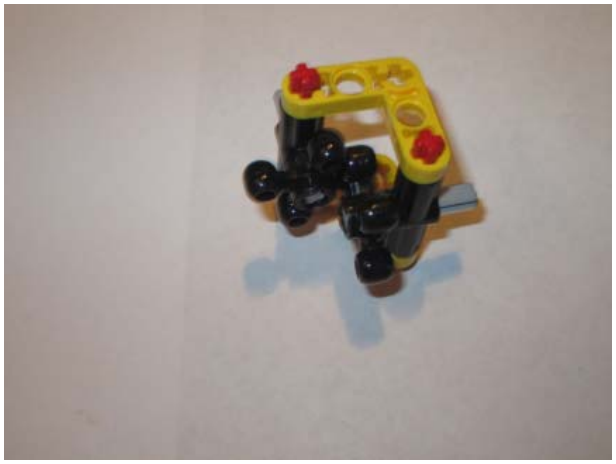
1:3 Pin Wheel with 24T Crown and 8T Gear



Solution

Exercises

3-1 Construct a 1:1 pin wheel using a pair of 4T knob gears

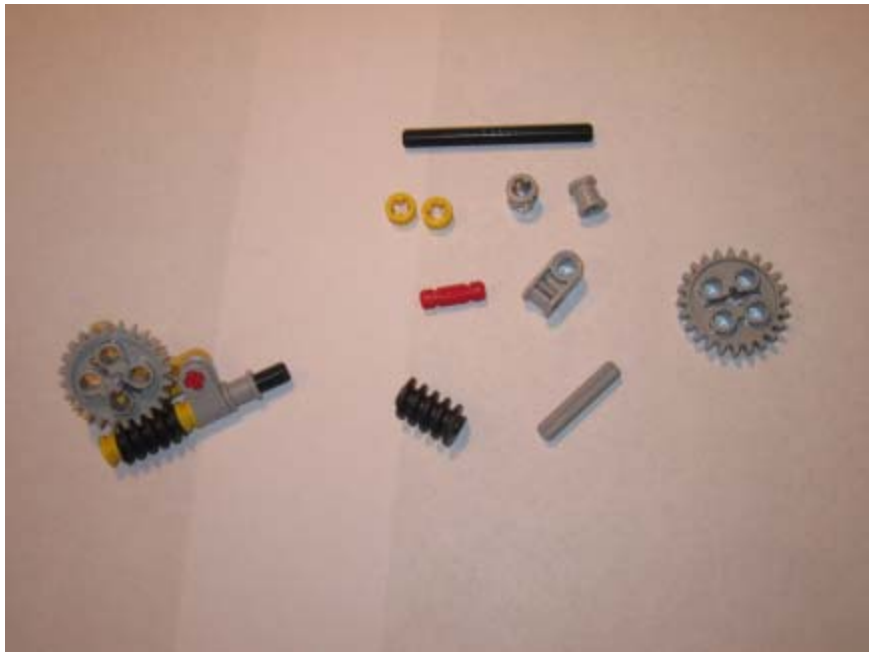


Solution

3-2 Construct a 1:1 pin wheel with a 24T crown gear and 24T gear

3-3 Construct a 3:5 bevel gear train

Exercise 4: Worm Gears



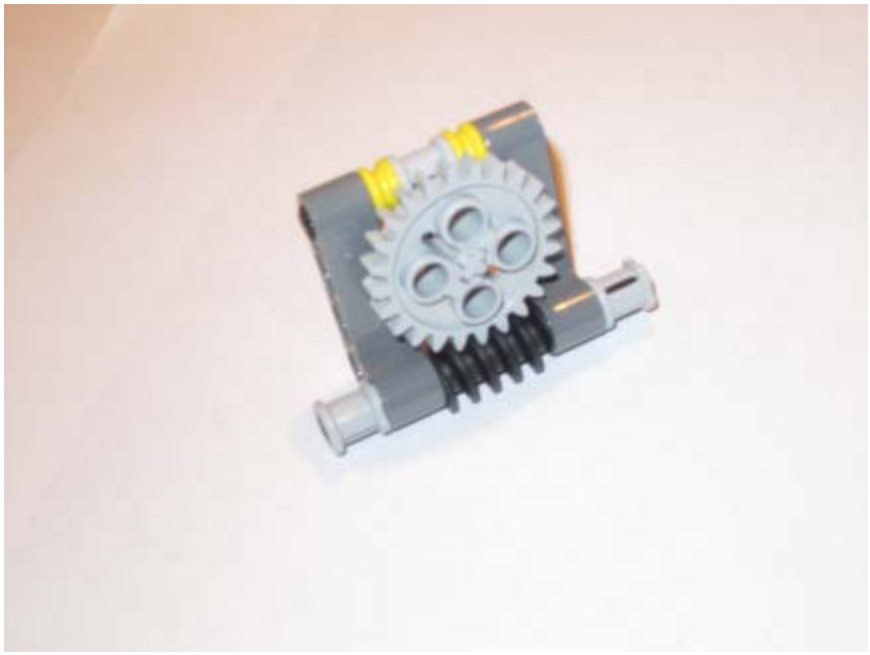
Solution

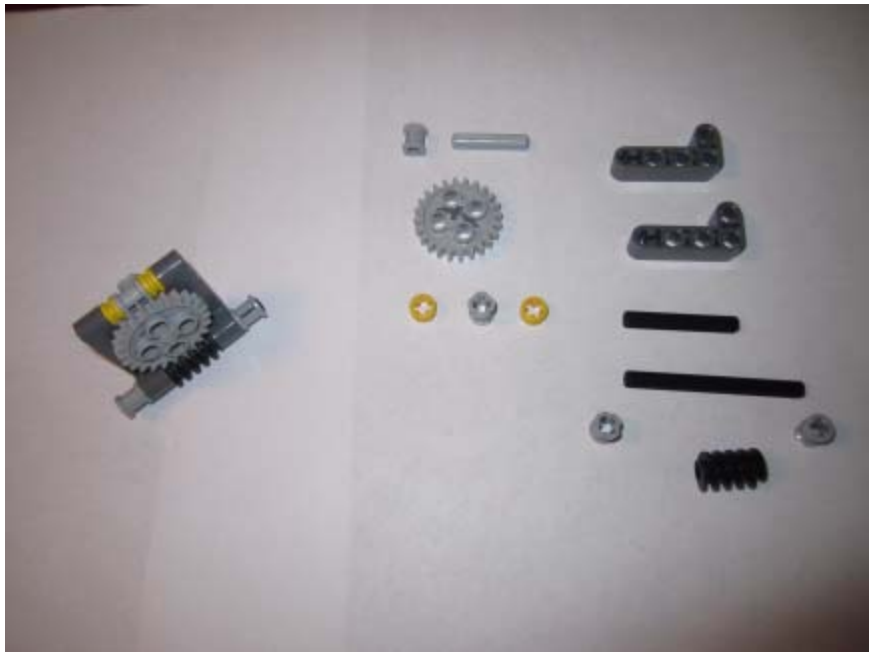
Q. Rotate the worm shaft. What do you observe?
Q. Rotate the toothed gear. What do you observe?

A. Refer to Lecture notes section on Worm Gears; can only rotate worm

Exercises

4-1 Construct the following worm gear train using 24T Lego Gear





Solution

4-2 Construct a 1:8 worm gear train using a Lego worm gear and 8T gear

4-3 Construct a 1:24 worm gear train using a Lego worm gear and 24T crown

4-4 Construct a 1:56 worm gear train using a Lego worm gear and 56T turntable

Exercise 5: Friction Drives

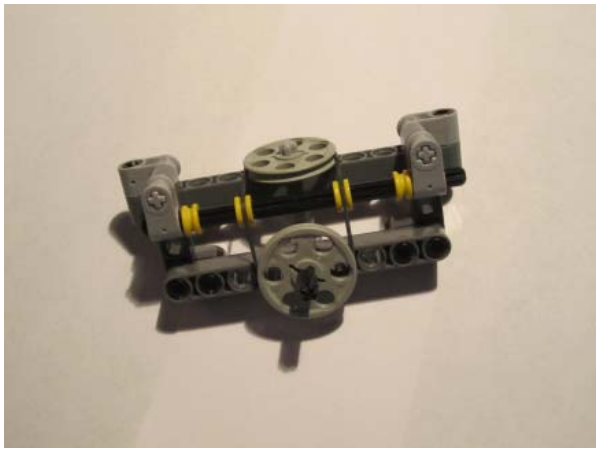
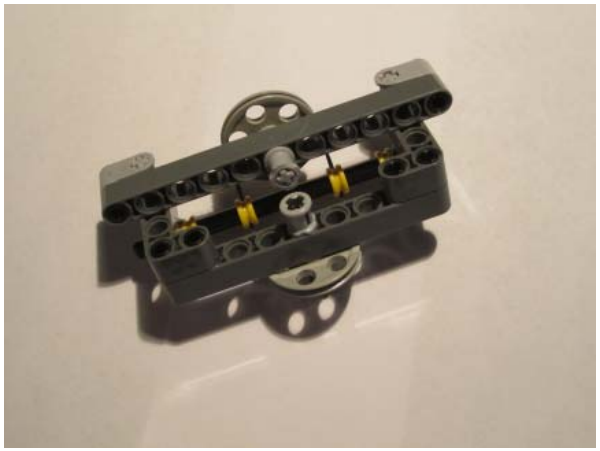
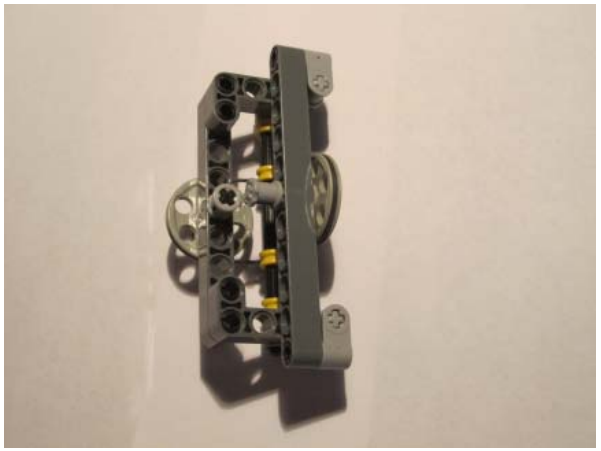
Construct these friction drives

Construct. NB: What is the input?

Solution

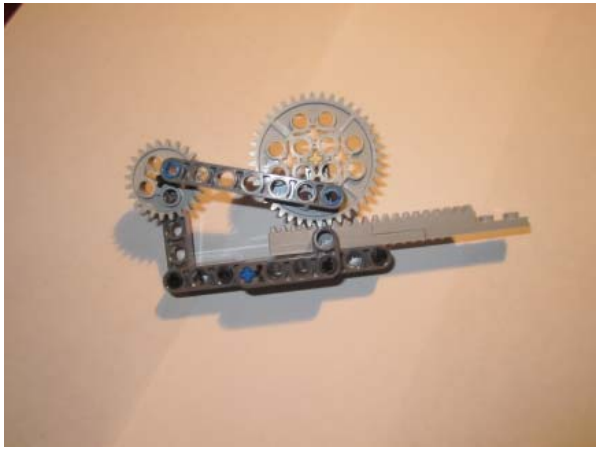
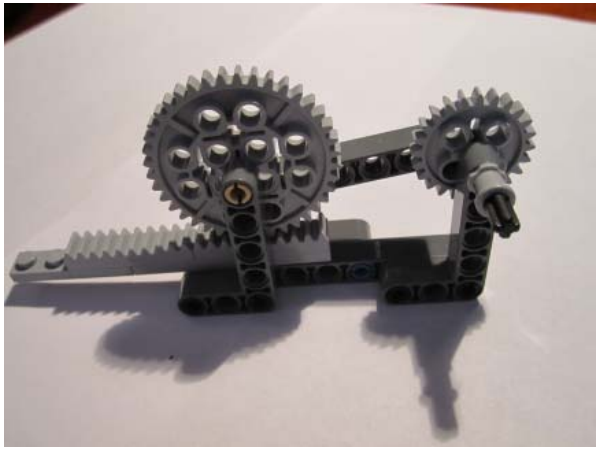
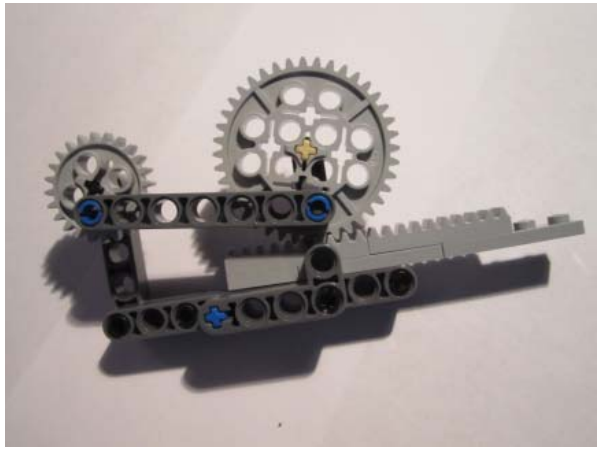
Exercises

5-1 Construct the following friction drive

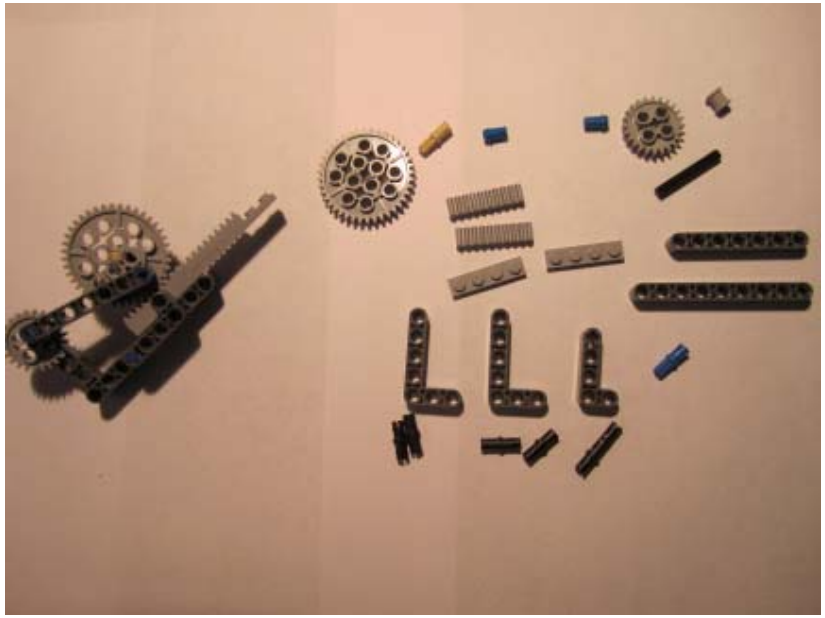
Solution

Exercise 6: Rack-and-Pinion

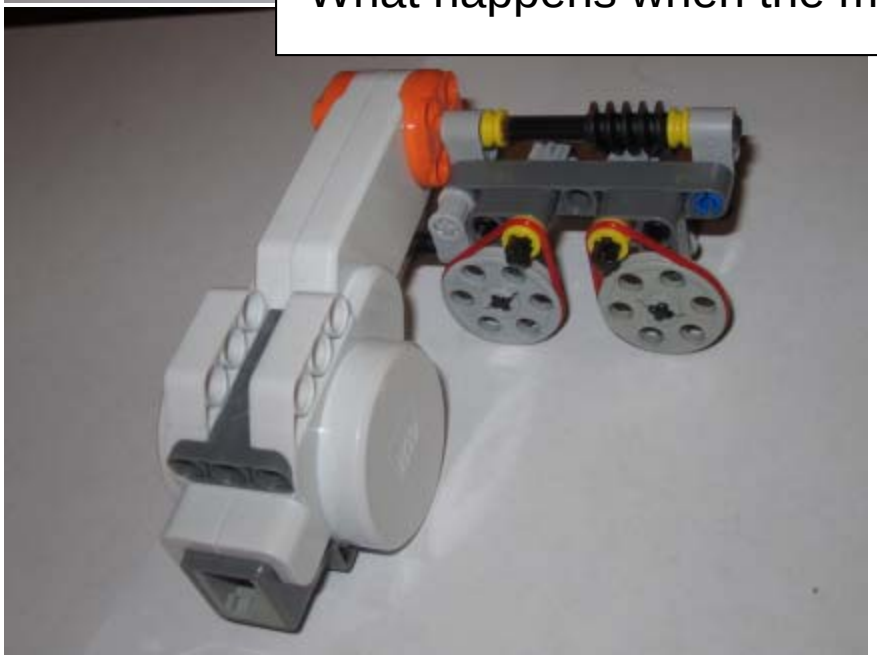
Construct this Rack-and-Pinion Drive. What's input? What's output?

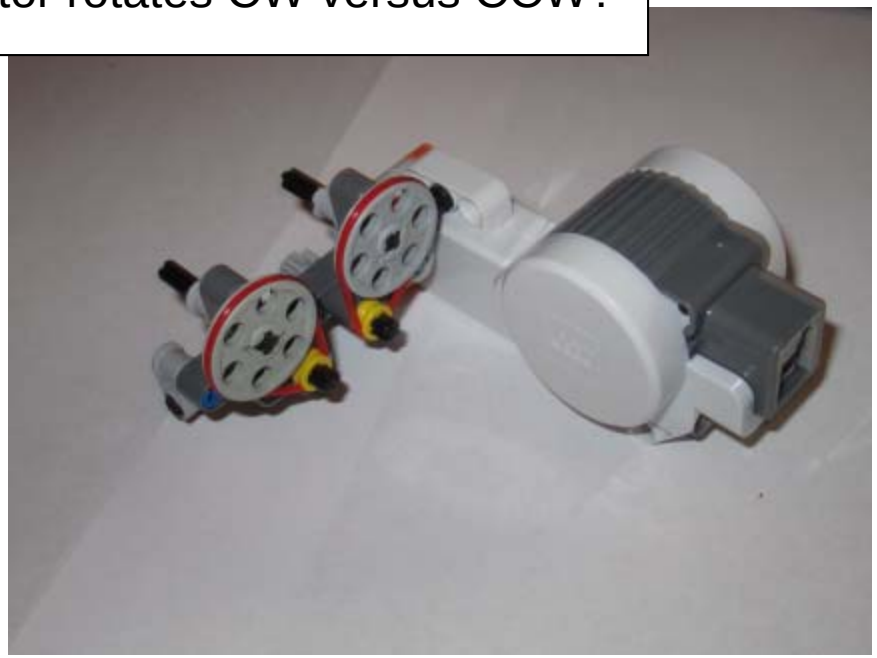
Solution



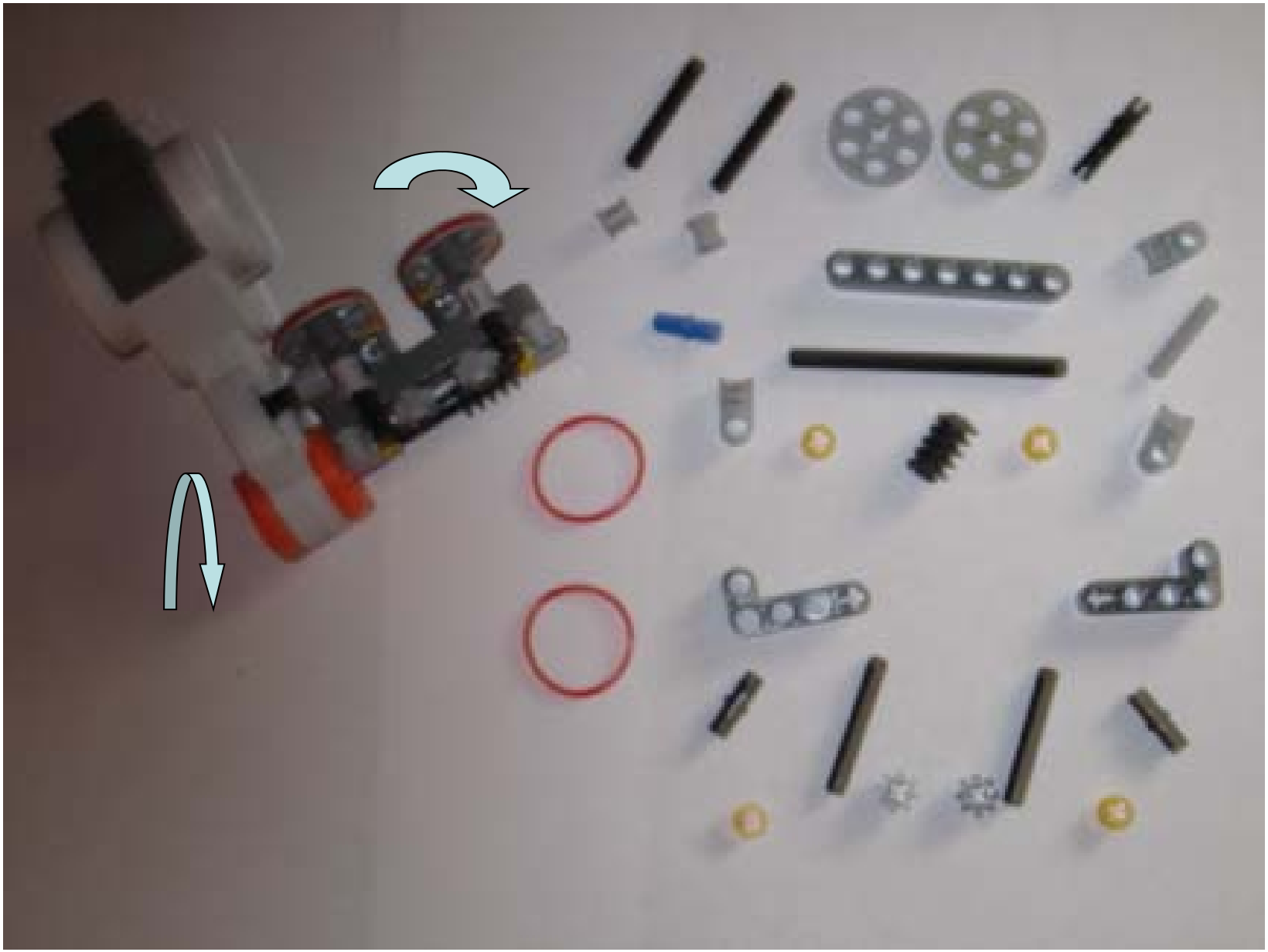
Exercise 7: Motorized Example

What happens when the motor rotates CW versus CCW?





Solution



Use NxC to program NXT motor to rotate CW and CCW