A LEVEL DESIGN ENGINEERING

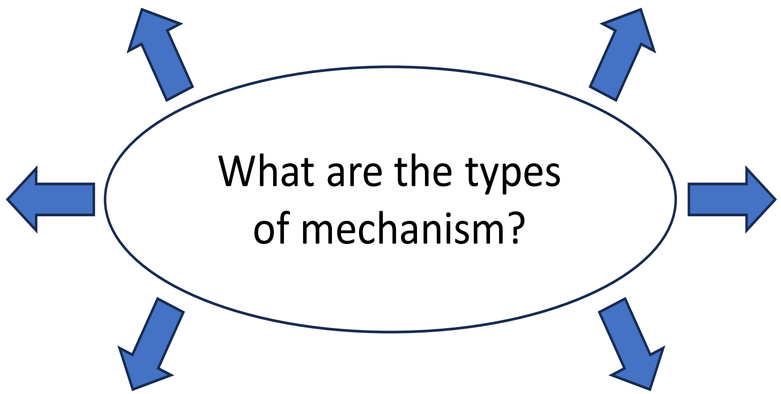
6.4 MECHANISMS PART 2

Design & Technology – Starter

PLEASE SIT DOWN IMMEDIATELY & WORK IN SILENCE

You have already explored mechanisms. But! What can you remember?

How many types of mechanism can you name?



Challenge: Can you suggest an application for each of the mechanisms you have listed?

Learning objectives

- ❑ What are mechanisms?
- ❑ What are the different types of mechanism?
- ❑ How are mechanisms used in products?
- ❑ What is the basic machine principle?
- ❑ What is mechanical advantage and gear ratio?

Key words:

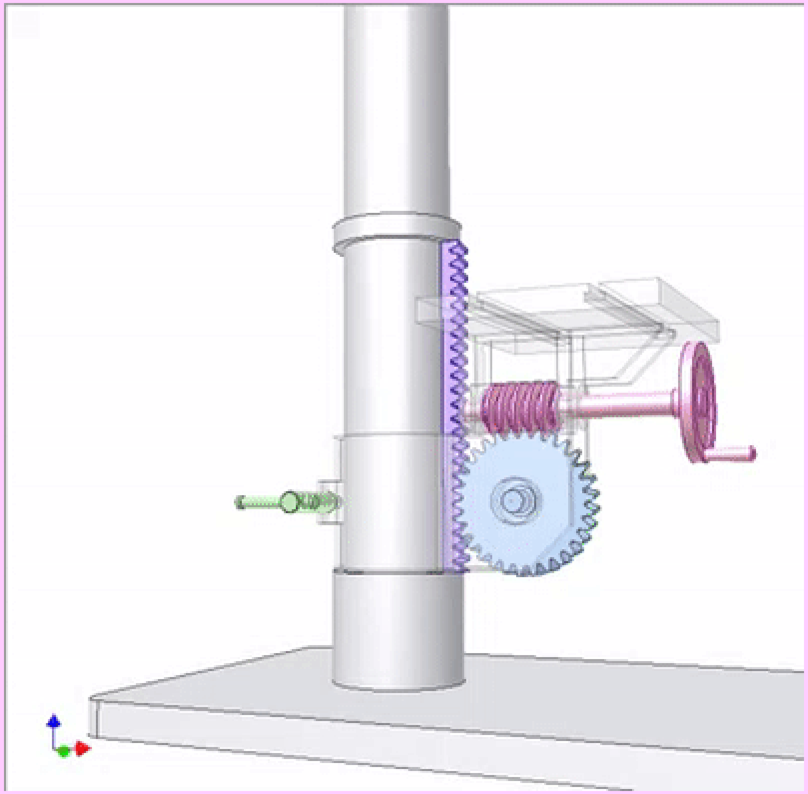
Mechanism, gear, cam, linkage, lever, chain and sprocket, belt and pulley, basic machine principle, mechanical advantage, velocity ratio

Explanation

What does a mechanism do?

Controls forces and motion

Transfers power without adding or subtracting from it.



Learning objectives:

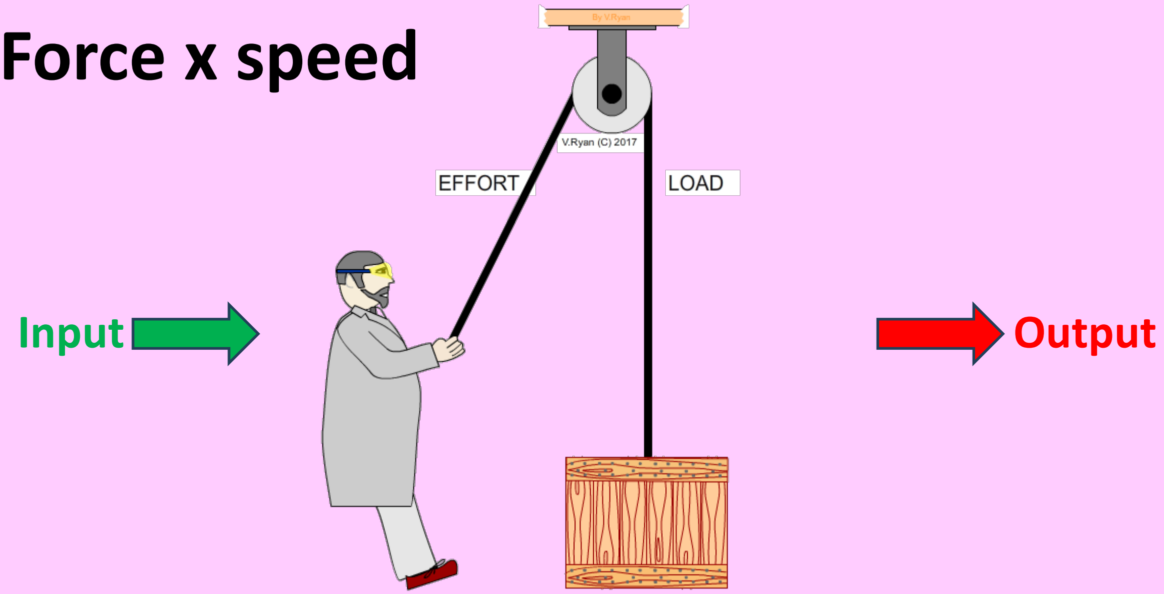
- ❑ What is a mechanism?
- ❑ What are the types of mechanism?
- ❑ How are mechanisms used in products?

Explanation

How do mechanisms transfer power?

Input power = Output power

Power = Force x speed



Input force x input speed = Output force x output speed

Learning objectives:

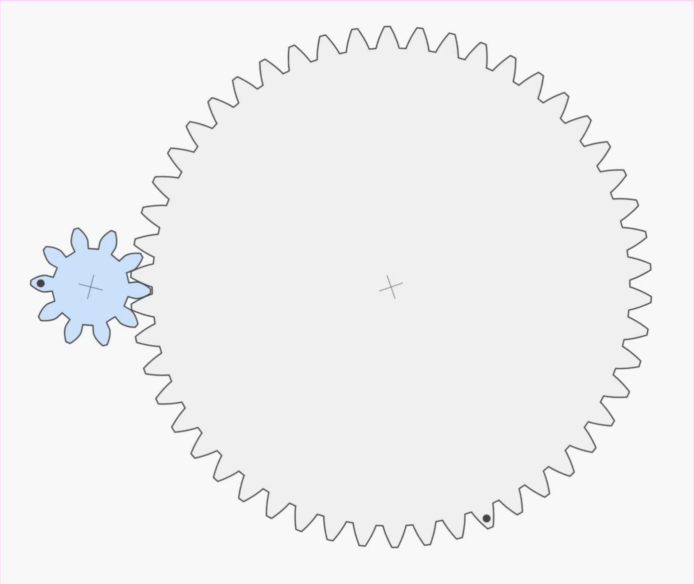
- ❑ What is a mechanism?
- ❑ What are the types of mechanism?
- ❑ How are mechanisms used in products?

How does a mechanism trade off force against movement?

Input → Output

High speed

Low force



Lower speed

Greater force

Learning objectives:

- ❑ What is a mechanism?
- ❑ What are the types of mechanism?
- ❑ How are mechanisms used in products?

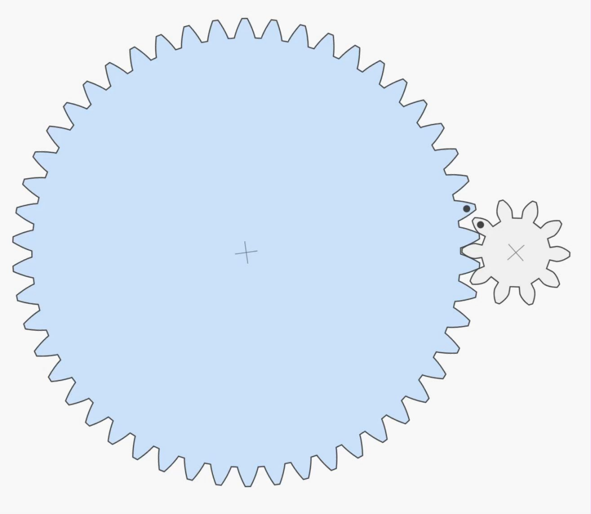
Explanation

How does a mechanism trade off force against movement?

Input → Output

Low speed

High force



High speed

Reduced force

Learning objectives:

- ❑ What is a mechanism?
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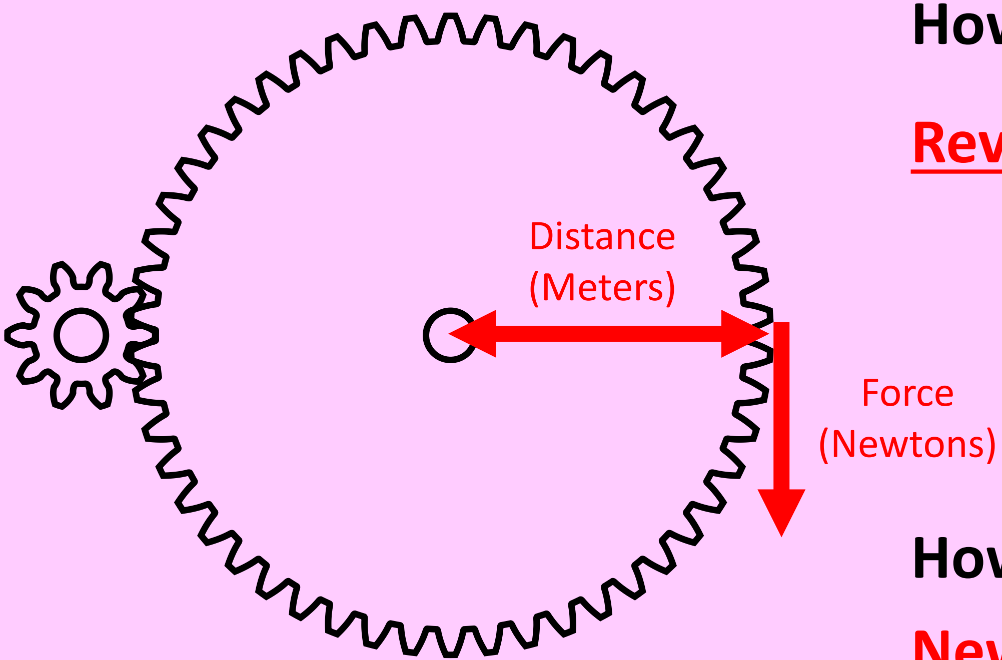
Explanation

What do we need to know when working with gears?



How do we measure speed?

Revolutions per minute (rpm)

How do we measure force?

Newtons (N)

Torque(Nm) = Force(N) x distance to pivot(m)

Learning objectives:

- ❑ What is a mechanism?
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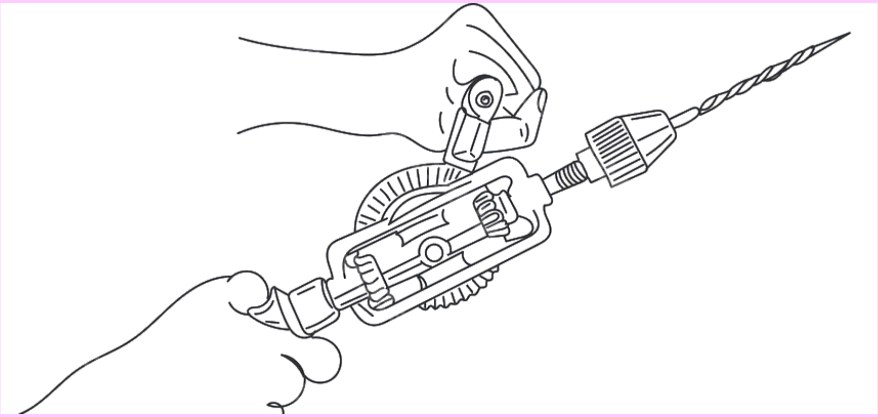
- ❑ How are mechanisms used in products?

Explanation

What is the basic machine principle ?

Input torque x input speed = Output torque x output speed



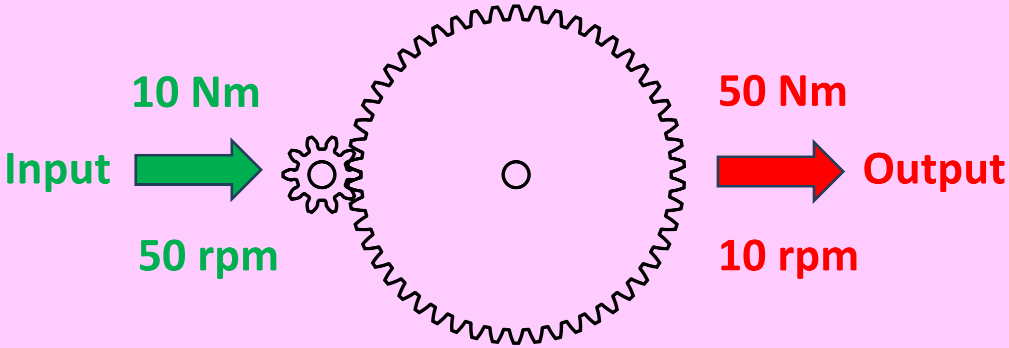
Learning objectives:

- ❑ What is a mechanism?
- ❑ What are the types of mechanism?
- ❑ How are mechanisms used in products?

Explanation

How does the basic machine principle apply to gears?

Input torque x input speed = Output torque x output speed



10Nm x 50rpm = 50Nm x 10rpm

Learning objectives:

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- ❑ What are the types of mechanism?
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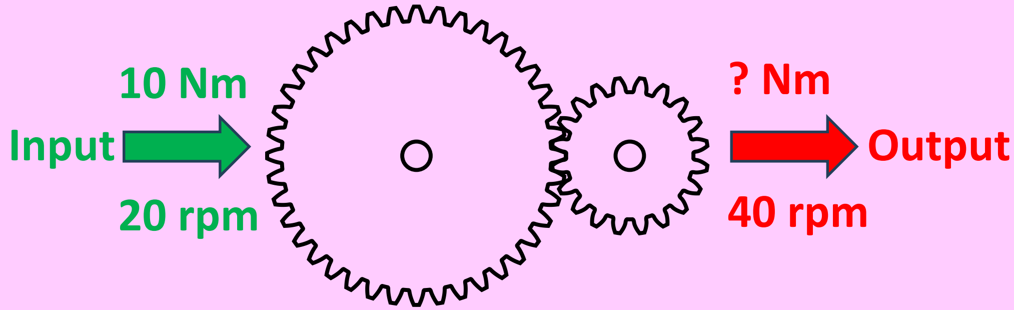
Explanation

How does the basic machine principle apply to gears?



10Nm x 20rpm = ? Nm x 40rpm

$$\frac{10\text{Nm} \times 20\text{rpm}}{40\text{rpm}} = ?\ \text{Nm}$$

Output torque = 5 Nm

Learning objectives:

- ❑ What is a mechanism?
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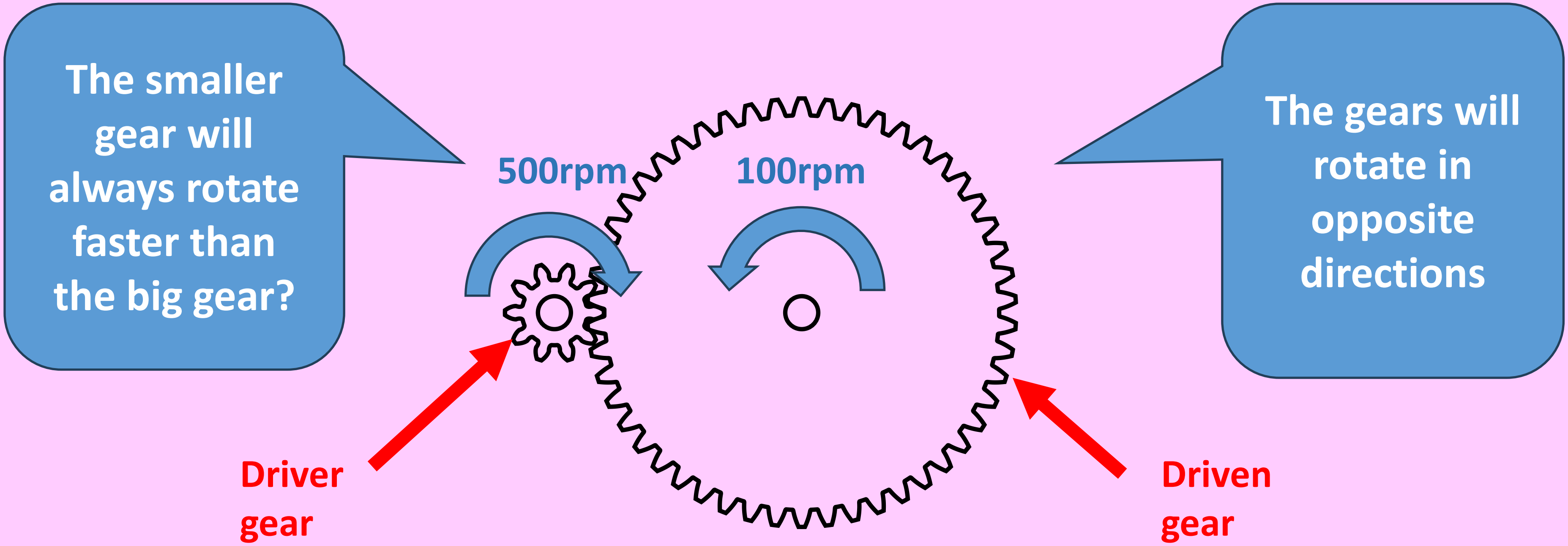
Explanation

What are the **basic rules** when working with gears?



Learning objectives:

- ❑ What is a mechanism?
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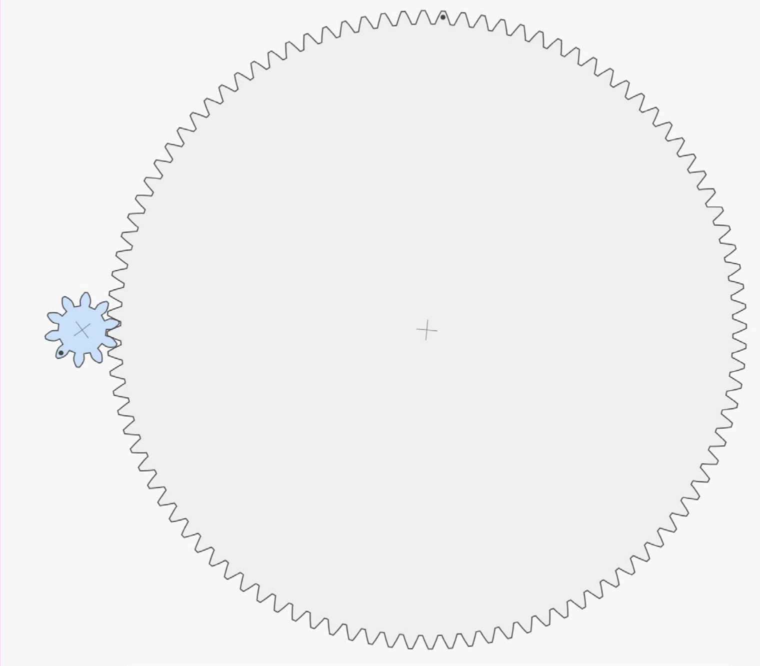
Explanation

What are the basic rules when working with gears?

The smaller gear will always rotate faster than the big gear?



The gears will rotate in opposite directions

Learning objectives:

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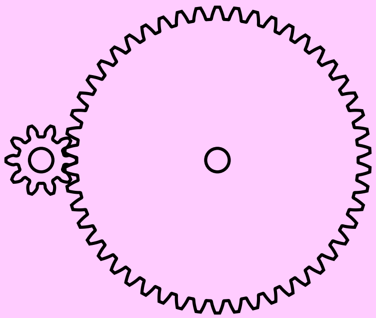
Explanation

What is the gear ratio?

The relationship of the teeth on two gears.

$$\boldsymbol{Gear\ ratio} = \frac{number\ of\ teeth\ on\ \boldsymbol{driven}\ gear}{number\ of\ teeth\ on\ \boldsymbol{driver}\ gear}$$

10 teeth (driver)



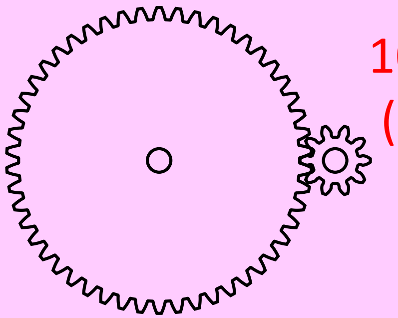
50 teeth (driven)

$$Gear\ ratio = \frac{50}{10}$$

$$Gear\ ratio = 5$$

$$Gear\ ratio = 5:1$$

50 teeth (driver)



10 teeth (driven)

$$Gear\ ratio = \frac{10}{50}$$

$$Gear\ ratio = 0.2$$

$$Gear\ ratio = 1:5$$

Learning objectives:

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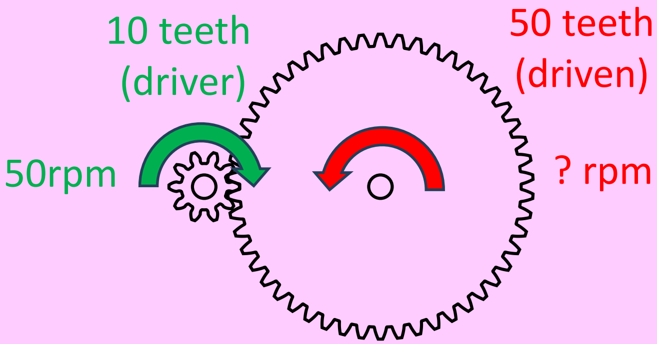
Explanation

Using the gear ratio to calculate speed?

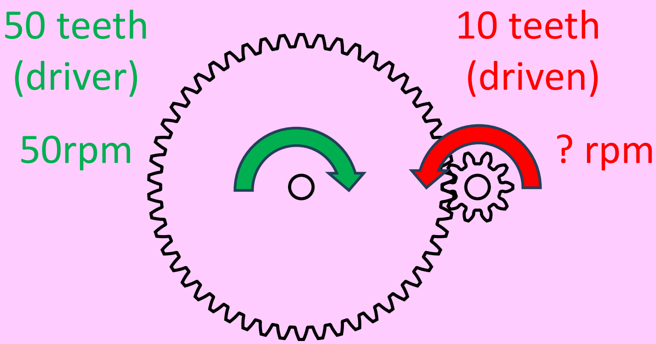


$$Gear\ ratio = 5$$

$$Output\ speed = \frac{input\ speed}{gear\ ratio}$$

$$Output\ speed = \frac{50}{5}$$

$$Output\ speed = 10\ rpm$$



$$Gear\ ratio = 0.2$$

$$Output\ speed = \frac{50}{0.2}$$

$$Output\ speed = 250\ rpm$$

Learning objectives:

- ❑ What is a mechanism?
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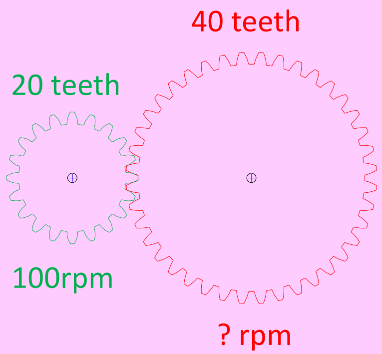
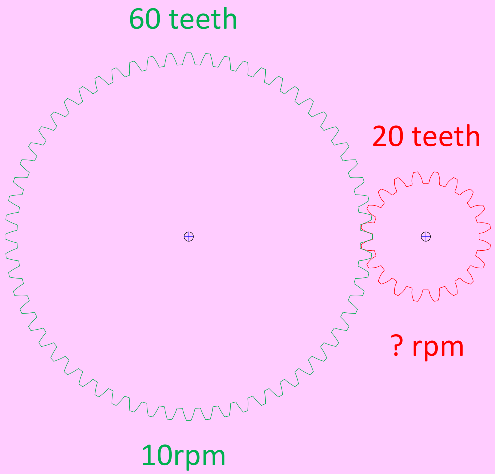
Explanation

Can you work out the missing speeds?

Driver

Driven





Learning objectives:

- ❑ What is a mechanism?
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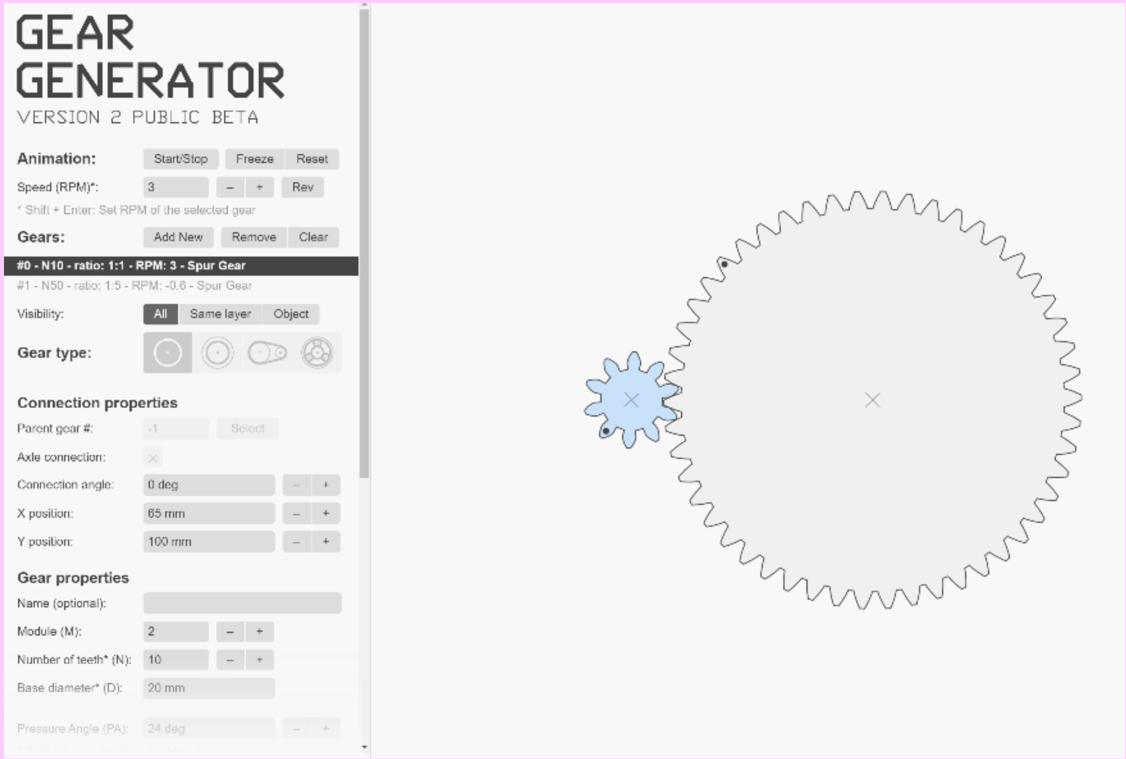
Explanation

How can we explore gear systems further?



Use the links below which will take you to the gear generator website…

https://geargenerator.com/
https://geargenerator.com/beta/

Learning objectives:

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