Your notes

GCSE Design and Technology: revision notes

Mechanical devices

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Types of movement

- Linear: movement in a straight line, such as a paper trimmer.
- Rotary: movement in a circle, such as a wheel.
- Reciprocating: backwards and forwards in a straight line, such as a sewing machine needle.
- Oscillating: swinging backwards and forwards in an arc, such as a pendulum.

Levers and linkages

- First order levers have the fulcrum between the effort and load (a see-saw); second order have the load in the middle (a wheelbarrow); third order have the effort in the middle (tweezers).
- Mechanical advantage = load ÷ effort. A mechanical advantage above 1 means less effort is needed.
- Linkages transfer force and change direction: a reverse motion linkage makes the output move the opposite way to the input; a **bell crank** changes the direction of motion through 90 degrees.

Rotary systems

- Cams and followers change **rotary motion** into **reciprocating motion**. The shape of the cam (such as circular/eccentric, pear or snail) decides how the follower moves.
- Gear trains: when a small driver gear turns a large driven gear, the output is slower but more powerful. **Gear ratio** = teeth on driven gear ÷ teeth on driver gear.
- **Rack and pinion** turns **rotary motion** into **linear motion**, such as in a car's steering.

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- Pulleys and belts transfer **rotary motion** between shafts; a belt can slip if overloaded, which protects the machine.

Worked example

- A driver gear with 10 teeth turns a driven gear with 40 teeth. The **gear ratio** is 40 ÷ 10 = 4 (4:1). If the driver turns at 200 rpm, the output speed is 200 ÷ 4 = 50 rpm.

Key terms

Linear motion	Movement in a straight line.
Rotary motion	Movement in a circle.
Reciprocating motion	Backwards and forwards movement in a straight line.
Oscillating motion	Swinging backwards and forwards in an arc.
Cam	A shaped part that turns rotary motion into reciprocating motion.
Gear ratio	Teeth on the driven gear divided by teeth on the driver gear.
Rack and pinion	A gear system that turns rotary motion into linear motion.
Bell crank	A linkage that changes the direction of motion through 90 degrees.

Quick questions

Cover the answers and test yourself: remembering is what makes it stick.

1. What type of motion does a pendulum show?
2. What type of motion does a sewing machine needle show?
3. What does a cam and follower do?
4. What does a rack and pinion do?
5. A driver gear has 12 teeth and the driven gear has 36 teeth. What is the gear ratio?
6. A driver turns at 300 rpm with a gear ratio of 3:1. What is the output speed?
7. What does a bell crank do?
8. What does a reverse motion linkage do?

Answers

1. Oscillating
2. Reciprocating
3. Turns rotary motion into reciprocating motion
4. Turns rotary motion into linear motion
5. 3:1
6. 100 rpm
7. Changes the direction of motion through 90 degrees

Your notes

8. Makes the output move the opposite way to the input

What to do next

Practise 11 questions on this topic

Try 5 exam questions, with mark schemes

Read the lesson, one step at a time

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