

Name _____

Class _____

Date _____

By the end of this worksheet I can...

- ☐ calculate velocity ratios for simple and compound trains
- ☐ calculate input and output speeds
- ☐ state directions of rotation
- ☐ give reasons for choosing plastic gears

I DO**Key ideas and worked example** Read this first**VR = driven ÷ driver (teeth)**

Velocity ratio = teeth on driven gear ÷ teeth on driver gear = input speed ÷ output speed

- Output speed = input speed ÷ VR
- Speeds in revs min^{-1}

- In a **compound** gear train two gears are fixed on the same shaft and turn at the same speed.
- **Total VR = VR₁ × VR₂**, where $\text{VR}_1 = B \div A$ and $\text{VR}_2 = D \div C$.
- Compound trains give a large speed change in a small space.
- Simple train: VR = driven ÷ driver. Meshing gears turn in opposite directions.

A winch uses a compound gear train: $A = 12$, $B = 48$, $C = 18$, $D = 54$ teeth. The drum on D turns at 50 revs min^{-1} .

Example Calculate the velocity ratio and the motor speed needed.

Worked answer set out every step like this

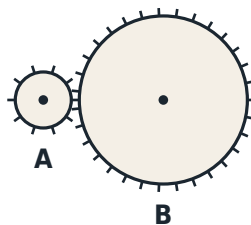
$$\text{VR} = (48 \div 12) \times (54 \div 18) = 4 \times 3 = 12$$

$$\text{Input speed} = \text{output speed} \times \text{VR}$$

$$\text{Motor speed} = 50 \times 12 = 600 \text{ revs min}^{-1}$$

YOU DO**On your own** Show your working. Check your answers afterwards.

- 1 A simple gear train: driver A = 15 teeth, driven B = 45 teeth. A rotates at $900 \text{ revs min}^{-1}$.



- a) Calculate the velocity ratio.

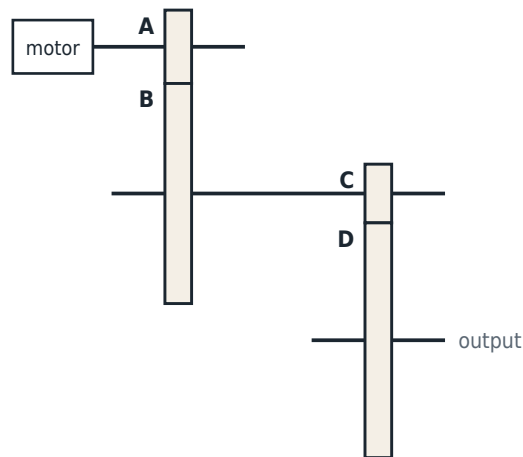
- b) Calculate the speed of B.

2 A conveyor uses a simple gear train: $A = 20$ teeth drives $B = 60$ teeth at $720 \text{ revs min}^{-1}$.

a) Calculate the velocity ratio.

b) Calculate the output speed.

3 A compound gear train: $A = 25$, $B = 75$, $C = 20$, $D = 80$ teeth. A turns at $1000 \text{ revs min}^{-1}$.



a) Calculate the velocity ratio.

b) Calculate the output speed of D.

4 A simple gear train: a 10-tooth driver turns a 40-tooth driven gear at $600 \text{ revs min}^{-1}$.

a) Calculate the velocity ratio.

b) Calculate the output speed.

c) State the direction of the output compared with the driver.

5 A small lathe uses a compound gear train: $A = 16$, $B = 64$, $C = 24$, $D = 72$ teeth. A turns at $1500 \text{ revs min}^{-1}$.

a) Calculate the velocity ratio.

b) Calculate the output shaft speed.

6 A simple gear train is designed to increase speed: $A = 30$ teeth, $B = 10$ teeth. A turns at $300 \text{ revs min}^{-1}$.

a) Calculate the velocity ratio.

b) Calculate the speed of B .

7 A compound gear train: $A = 18$, $B = 72$, $C = 24$, $D = 60$ teeth. The input turns at $1200 \text{ revs min}^{-1}$.

a) Calculate the velocity ratio.

b) Calculate the output speed.

8 A model vehicle uses a 12-tooth driver and a 36-tooth driven gear. The driver turns at $1800 \text{ revs min}^{-1}$.

a) Calculate the velocity ratio.

b) Calculate the speed of the driven gear.

c) State one reason for using plastic gears in the model.

9 A hoist uses a compound gear train: $A = 14$, $B = 70$, $C = 20$, $D = 80$ teeth. The drum on D turns at 20 revs min^{-1} .

a) Calculate the overall velocity ratio.

b) Calculate the motor speed needed.

Check and reflect

Mark your answers with the answer sheet. Which “I can” statement above still needs work? Look back at the notes for that topic on the site.
