

Name _____

Class _____

Date _____

By the end of this worksheet I can...

- ☐ calculate the total velocity ratio of a compound gear train
- ☐ calculate output and input speeds
- ☐ find a missing number of teeth
- ☐ design simple and compound trains in Yenka

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

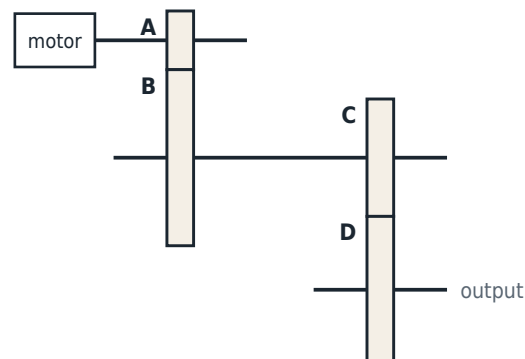
Velocity ratio = teeth on driven gear ÷ teeth on driver gear = input speed ÷ output speed

- 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.

A motor drives a compound gear train at $1000 \text{ revs min}^{-1}$. $A = 20$, $B = 60$, $C = 40$ and $D = 50$ teeth.

Example Calculate the velocity ratio and the output speed.

**Worked answer** set out every step like this

$$\text{VR}_1 = B \div A = 60 \div 20 = 3$$

$$\text{VR}_2 = D \div C = 50 \div 40 = 1.25$$

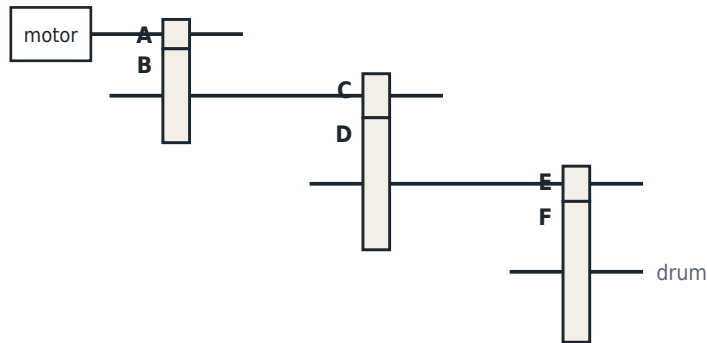
$$\text{Total VR} = 3 \times 1.25 = 3.75$$

$$\text{Output speed} = 1000 \div 3.75 = 267 \text{ revs min}^{-1}$$

YOU DO

On your own Show your working. Check your answers afterwards.

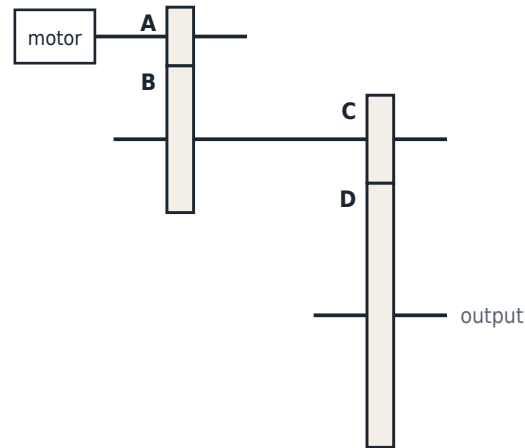
1 A motorised winch: $B = 32$, $C = 15$, $D = 45$, $E = 12$ and $F = 48$ teeth. The motor runs at $1200 \text{ revs min}^{-1}$ and the drum must turn at 25 revs min^{-1} .



a) Calculate the velocity ratio needed.

b) Calculate the number of teeth gear A must have. (3 marks)

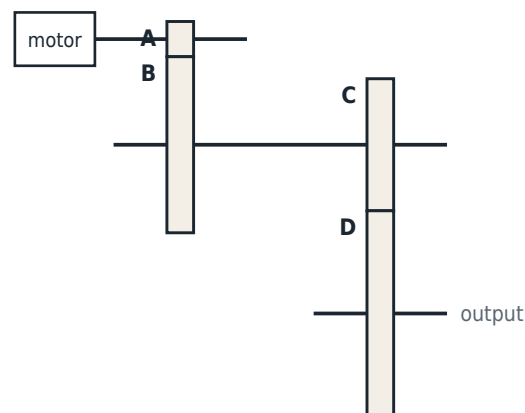
2 A compound gear train is driven at $750 \text{ revs min}^{-1}$. $A = 20$, $B = 50$, $C = 30$ and $D = 90$ teeth.



a) Calculate the velocity ratio.

b) Calculate the output shaft speed.

3 A theatre curtain is moved by a gear system. The motor turns gear A (12 teeth) at $2250 \text{ revs min}^{-1}$. B has 60 teeth and C has 45 teeth. The output gear D must turn at $150 \text{ revs min}^{-1}$.



a) State the type of gear system.

b) Calculate the velocity ratio of the system.

c) Calculate the ratio of gear B to gear A.

d) Calculate the number of teeth on gear D.

e) State one advantage of plastic gears over steel gears.

4 A winch is being designed for the front of an off-road vehicle. Use Yenka with a constant-speed motor.

a) Design a simple gear train where the output turns 5 times slower than the input. Sketch it using the correct symbols.

b) Design a compound gear train where the output turns 20 times slower than the input. Sketch it using the correct symbols.

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.
