

Name _____

Class _____

Date _____

By the end of this worksheet I can...

- ☐ explain what stress is and why area matters
- ☐ calculate stress using $\sigma = F \div A$
- ☐ calculate the area of a circular section
- ☐ rearrange the formula to find a load or a diameter

I DO**Key ideas and worked example** Read this first

When a force acts on a member it creates **stress**. Too much stress makes a part bend, buckle or break. The same load causes more stress in a thin member than a thick one, because its cross-sectional area is smaller.

$\sigma = F \div A$

Stress = force $\div$ cross-sectional area

- Force F in newtons (N)
- Area A in mm²
- Stress σ in N/mm²

RememberKeep the units matched: N with mm² gives N/mm²; N with m² gives N/m². For a round bar, $A = \pi r^2$.

A rectangular bar with a 180 mm $\times$ 120 mm cross-section carries a tensile load of 500 N.

Example Calculate the stress in the bar.**Worked answer** set out every step like this

$$A = 180 \times 120 = 21\,600 \text{ mm}^2$$

$$\sigma = F \div A = 500 \div 21\,600$$

$$\sigma = 0.023 \text{ N/mm}^2$$

WE DO**Guided practice** Follow the steps to help you

A wire 4.0 mm in diameter carries a force of 300 N.

1 Calculate the stress in the wire. (3 marks)**Steps**

1. Radius = $4.0 \div 2 = 2.0 \text{ mm}$
2. $A = \pi \times 2.0^2 = \dots$
3. $\sigma = 300 \div A$

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

2 The stress in a steel wire carrying 8.0 kN must not exceed 200 N/mm². Calculate the minimum diameter of wire needed. (4 marks)

3 A roof-support column has a cross-section of 0.73 m². The maximum working stress is 4.0 MN/m². Calculate the maximum compressive load. (3 marks)

4 A North Sea oil platform has three legs, each 15.0 m in diameter, sharing a 120 MN load equally. Calculate the stress in each leg. (4 marks)

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.
