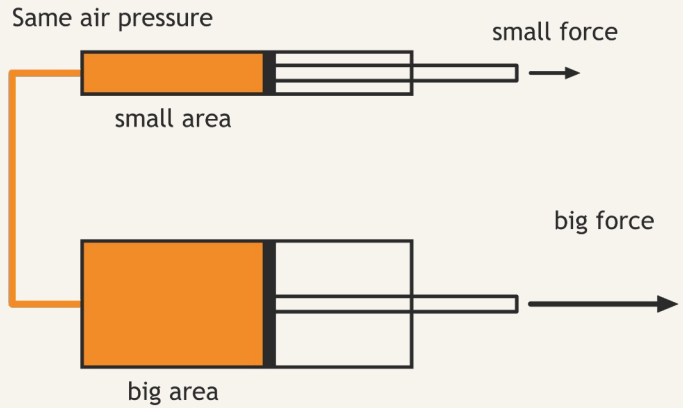
# Daily Review

| | | |
|---|---|---|
| 1 | **Name** the rod moving in. | The instroke |
| 2 | **State** what pushes a double-acting rod back. | Air |
| 3 | **State** check 1 when fault-finding. | Regulator at 0 |
| 4 | **State** our safe gauge reading. | 1 to 2 bar |
| 5 | **Find** the area of a 10 mm by 20 mm rectangle. | 200 $mm^2$ |

# Force, Pressure and Area

How big a force can the air make?




S3 Engineering Science

# By the end of this lesson…



1. I can **use** P = F/A to find a **pressure**
2. I can **find** a **force** or an **area** from P = F/A

# Why a Bigger Cylinder Pushes Harder

## Same pressure

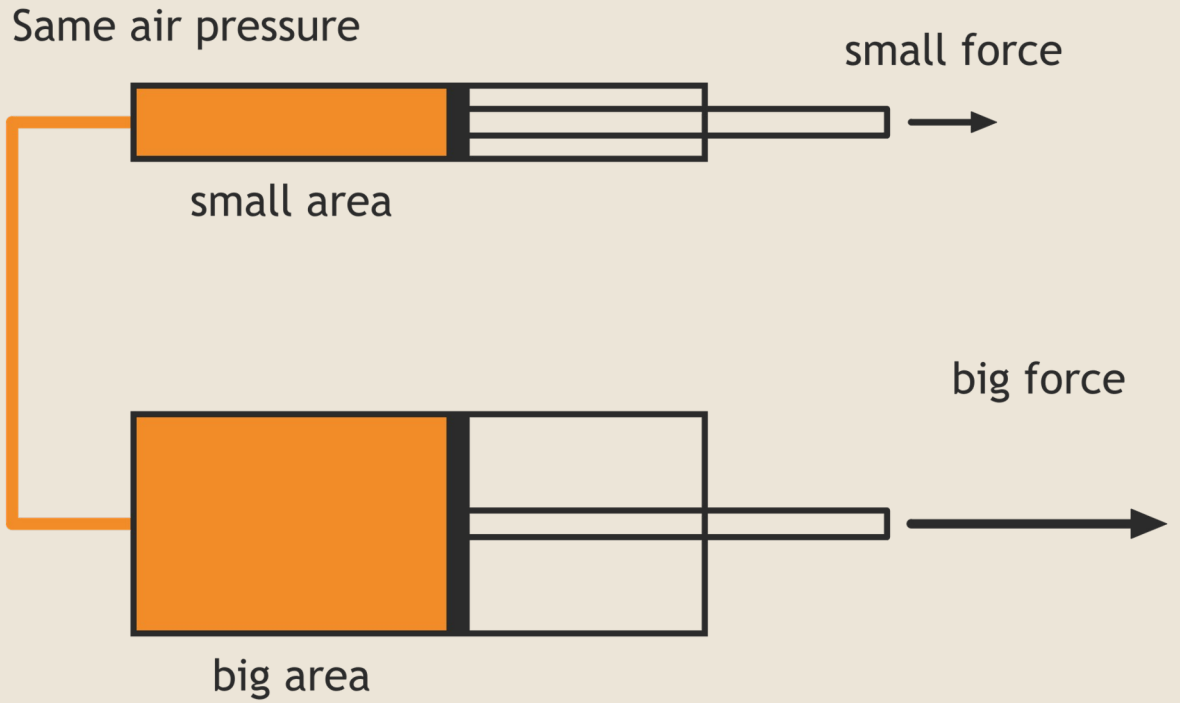
the same push on every **mm²** of piston

## Bigger area

more mm² for the air to **push** on

## So

a bigger **force**



# Pressure, Force and Area

$$P = F/A$$

P = pressure, in **N mm$^{-2}$**

F = force, in **N**

A = area, in **mm$^2$**

Our gauge: 1 bar = 0.1 N mm$^{-2}$



# Worked Example 1: Find the Pressure (2 marks)

A piston has an area of 250 $mm^2$. It outstrokes with a force of 40 N. Calculate the air pressure supplied.

$F = 40\ N$

$A = 250\ mm^2$

$P = ?$

$P = F/A$

$P = 40/250$

$P = 0.16\ N\ mm^{-2}$

# We Do: Find the Pressure (2 marks)

A piston has an area of 300 $mm^2$. It outstrokes with a force of 54 N. Calculate the air pressure supplied.

$F = 54\ N$

$A = 300\ mm^2$

$P = ?$

$P = F/A$

$P = 54/300$

$P = 0.18\ N\ mm^{-2}$

# Your Step: Find the Force (3 marks)

The air pressure is 0.30 N $mm^{-2}$ and the piston area is 200 $mm^2$. Calculate the outstroking force.

$P = 0.30\ \text{N mm}^{-2}$

$A = 200\ \text{mm}^2$

$F = ?$

$P = F/A$

$0.30 = F/200$

$F = 0.30 \times 200$

$F = 60\ \text{N}$

# Second Start

| | | |
|---|---|---|
| 1 | **State** the formula for pressure. | $P = F/A$ |
| 2 | **State** the unit of pressure. | $N\ mm^{-2}$ |
| 3 | **State** the unit of area. | $mm^2$ |
| 4 | **Find** P: F = 40 N, A = 200 $mm^2$. | $0.2\ N\ mm^{-2}$ |
| 5 | **State** which pushes harder: big or small piston. | Big piston |

# Worked Example 2: Find the Area (3 marks)

Cylinder A is supplied with an air pressure of 0.40 N $mm^{-2}$ and outstrokes with a force of 180 N. Calculate the piston area.

$P = 0.40$ N $mm^{-2}$

$F = 180$ N

$A = ?$

$P = F/A$

$0.40 = 180/A$

$A = 180/0.40$

$A = 450$ $mm^2$

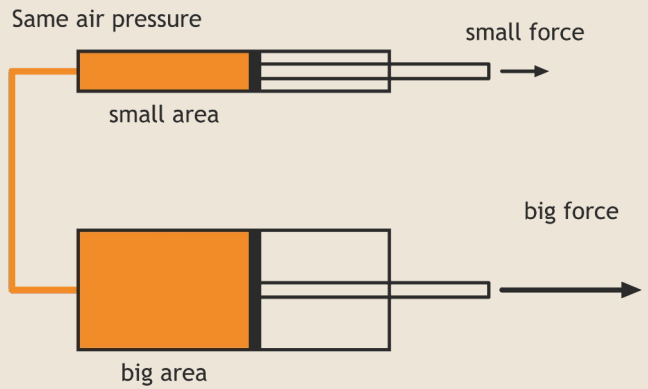
# Your Turn

## Show Me board

1 $F = 90$ N, $A = 300$ mm$^2$. **Find** P.

2 $P = 0.25$ N mm$^{-2}$, $A = 320$ mm$^2$. **Find** F.

3 $P = 0.50$ N mm$^{-2}$, $F = 210$ N. **Find** A.



# Answers: Your Turn

1 1 $P = 90 \div 300$

2 2 $F = 0.25 \times 320$

3 3 $A = 210 \div 0.50$

$0.30\ N\ mm^{-2}$

80 N

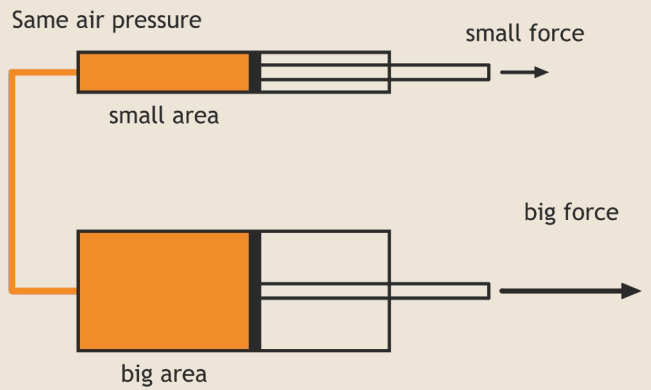
$420\ mm^2$

# Review Questions

# Booklet page 13

**Answer** Questions 1 to 5 on your own.

**Finished?** Try the Challenge.



# Answers: Review Questions

| Question | Answer |
| --- | --- |
| 1 | big; area |
| 2 | $P = 60 \div 300 = 0.2$ N mm$^{-2}$ |
| 3 | $F = 0.2 \times 400 = 80$ N |
| 4 | $A = 100 \div 0.25 = 400$ mm$^2$ |
| 5 | N mm$^{-2}$; N; mm$^2$ |
| Challenge | $P = 65 \div 420$ (1) $= 0.15$ N mm$^{-2}$ (1) |

# Look back — by the end of this lesson…



1. I can **use** P = F/A to find a **pressure**
2. I can **find** a **force** or an **area** from P = F/A

# Credits

**Drawings:** Sources: cylinder and piston drawings by R Stewart.

**Worked example layout:** © Qualifications Scotland (SQA). Worked examples set out as the N5 Engineering Science marking instructions set out 2021 Question 12(c), 2022 Question 15(c) and 2025 Question 8(d); numbers are new.

**Challenge: 2026 Q14(b):** © Qualifications Scotland (SQA). N5 Engineering Science 2026, Question 14(b).

R Stewart - October 2026