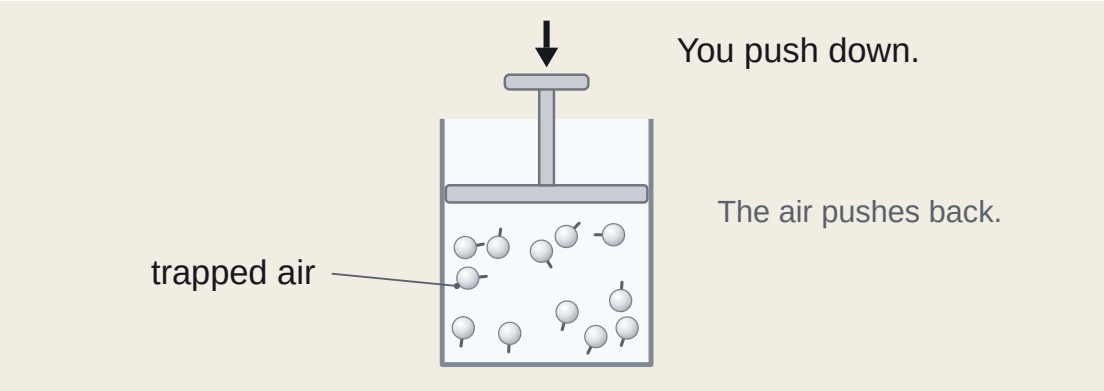
# B1 · What we measure about a gas; pressure and its units · Completed notes

Goals: Name the four things measured about a gas. Explain gas pressure as particles hitting a surface. Change a pressure between kilopascals, atmospheres and millimetres of mercury.

These are the completed notes. The blanks are filled in and each question is worked.

## Slide 1 of 6 · Gases you already use

Unit A was about how atoms bond. Unit B is about gases. You already know how a gas feels when you squeeze it.




### Key ideas

A trapped gas **pushes back** when you squeeze it.

In a gas the particles are **far apart**.

Gas particles never stop **moving**.

A gas spreads out to **fill** its container.

### Example

You squeeze a blown-up balloon. What pushes back on your hand?

1. The balloon is full of gas particles.
2. The gas inside pushes back. The rubber only holds the gas in.

### Try it

Why does a gas fill its whole container?

1. Gas particles are far apart and never stop moving.
2. They spread out until the walls stop them.

## Slide 2 of 6 · Four things we measure about a gas

On the last slide the gas in a syringe pushed back. To predict that push, a chemist measures four things about the gas.

| what we measure | symbol | unit |
|---|---|---|
| pressure | P | kPa |
| volume | V | L |
| temperature | T | °C, for now |
| amount of gas | n | mol |

### Key ideas

The push of a gas is its **pressure**, P.

The space a gas fills is its **volume**, V.

How hot a gas is, is its **temperature**, T.

The **amount** of gas, n, is counted in moles.

### Example

A tire looks flat on a cold morning. No air leaked out. Which of the four things changed?

1. The amount of air stayed the same, because nothing leaked.
2. The temperature dropped first.
3. Then the pressure dropped, so the tire looks flat.

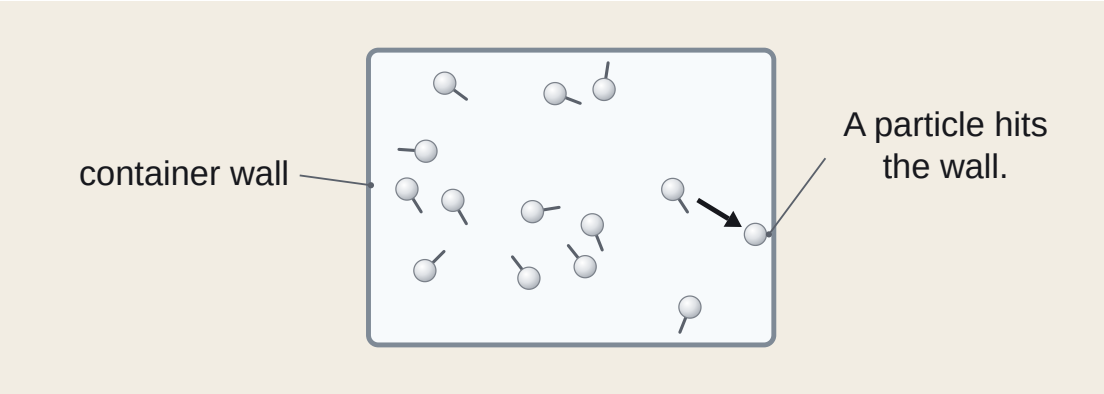
### Try it

Name the symbol and the unit for the amount of a gas.

1. The symbol is n.
2. The unit is the mole, mol.

## Slide 3 of 6 · What pressure is

The last slide named pressure as the push of a gas. This slide shows where that push comes from.




### Key ideas

Each moving particle sooner or later hits a **wall**.

Every hit gives the wall a tiny **push**.

All the tiny pushes together are the **pressure** of the gas.

More **hits** each second means more pressure.

### Example

What makes the pressure of a gas on the walls of its container?

1. Gas particles never stop moving, so they hit the walls.
2. Each hit is a tiny push.
3. All the pushes together are the pressure.

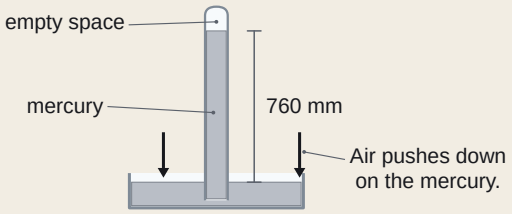
### Try it

You pump more air into a tire. Why does the pressure go up?

1. More particles are now inside the tire.
2. More particles hit the walls each second, so the pressure goes up.

## Slide 4 of 6 · Three units for pressure

The last slide said what pressure is. To measure it you need a unit. Chemists use three.




| unit | symbol | air at sea level |
|---|---|---|
| atmosphere | atm | 1 atm |
| kilopascal | kPa | 101.325 kPa |
| millimetre of mercury | mm Hg | 760 mm Hg |

**1 atm = 101.325 kPa = 760 mm Hg**

### Key ideas

The air pushes down on the **mercury** in the dish.

At sea level the air holds the mercury **760** mm high.

The pressure of the air at sea level is one **atmosphere**.

1 atm = **101.325** kPa = 760 mm Hg.

### Example

What holds the mercury up inside the tube?

1. The air pushes down on the mercury in the dish.
2. That push holds the mercury up inside the tube.

### Try it

Write the line that links the three units of pressure.

1. 1 atm = 101.325 kPa = 760 mm Hg.
2. All three values are the same pressure.

## Slide 5 of 6 · Changing from one pressure unit to another

The last slide gave three units and one line that links them. That line lets you change a pressure from one unit to another.

1 atm = 101.325 kPa = 760 mm Hg

$$0.750\ \text{atm} \times \frac{101.325\ \text{kPa}}{1\ \text{atm}} = \mathbf{76.0\ kPa}$$

The unit you want is on top.

### Key ideas

Write the two equal values as a **fraction**.

Put the unit you want on **top**.

The old units **cancel**.

### Example

Use 1 atm = 101.325 kPa = 760 mm Hg. Convert 1.10 atm to kilopascals. What is the pressure in kPa?

1. The unit wanted is kPa, so kPa goes on top.
2. 1.10 atm × 101.325 kPa / 1 atm = 111 kPa.
3. The atm units cancel.

### Try it

Use 1 atm = 101.325 kPa = 760 mm Hg. Convert 745 mm Hg to kilopascals. What is the pressure in kPa?

1. The unit wanted is kPa, so kPa goes on top.
2. 745 mm Hg × 101.325 kPa / 760 mm Hg = 99.3 kPa.

## Slide 6 of 6 · Method: how to change a pressure from one unit to another

You just changed two pressures to new units. Each time you did the same four things. Here they are as steps.

1. **Write** the pressure you are given.
2. **Choose** the two equal values you need.
3. **Put** the unit you want on top.
4. **Multiply** and round.




**Check: the old unit cancels, and the new unit is left.**

Used again in: lessons B3, B5 and B8

### Key ideas

Step 1: **write** the pressure you are given.

Step 2: **choose** the two equal values you need.

Step 3: put the unit you want on **top**.

Step 4: **multiply** and round.

### Example

Use 1 atm = 101.325 kPa = 760 mm Hg. Use the four steps to convert 0.500 atm to millimetres of mercury.

1. Step 1: the pressure given is 0.500 atm.
2. Step 2: 1 atm = 760 mm Hg.
3. Step 3: mm Hg goes on top.
4. Step 4: 0.500 atm × 760 mm Hg / 1 atm = 380 mm Hg.

### Try it

Use 1 atm = 101.325 kPa = 760 mm Hg. Use the four steps to convert 90.0 kPa to atmospheres.

1. Step 1: the pressure given is 90.0 kPa.
2. Step 2: 1 atm = 101.325 kPa.
3. Step 3: atm goes on top.
4. Step 4: 90.0 kPa × 1 atm / 101.325 kPa = 0.888 atm.