

Pressure in Gases Notes

Science Exams Sorted

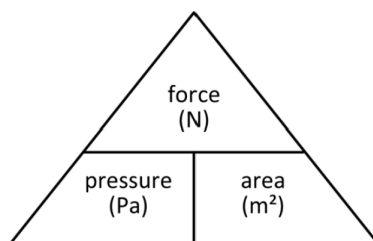


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Pressure: the force of the object divided by the area of the object.

Pressure = force ÷ area

$$P = F \div a$$



P = pressure (Pa)

F = Force (N)

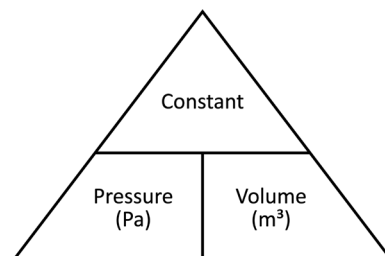
a = area (m²)

Pressure in gases

Pressure in gases: can be found using the following equation.

pressure × volume = constant

$$p \times V = \text{constant}$$



P = pressure (Pa)

V = metres cubed (m³)

Constant = a set value for that system.

Movement of particles in a Gas

Gas particles with low kinetic energy	Gas particles with moderate kinetic energy	Gas particles with high kinetic energy

The movement of particles in a gas is completely random. Imagine if we dropped 100 high bounce balls from a height. They would all bounce in different directions.

Really important note: when gas particles collide against a surface they exert a force at right angles to the walls. This will cause a pressure on that surface.

So, particles that have a higher kinetic energy will collide more with a surface, this will increase the pressure on the surface. This is even more noticeable when the gas is in a sealed container.

What will happen to the pressure inside the container when the volume is increased? If the temperature is kept the same then the pressure inside the container will decrease. Pressure and volume are inversely proportional.

Let's look at a few examples 😊

Example 1: An unknown gas has a volume of 1 m^3 and a pressure of 101 Pa .

Calculate the pressure that the gas exerts if it is **compressed** at a constant temperature to a volume of 0.25 m^3 .

Step 1: use the two known values (the volume and the pressure) to calculate the constant.

$$\text{constant} = \text{pressure} \times \text{volume}$$

$$\text{constant} = 101 \times 1$$

$$\text{constant} = 101$$

Step 2: use this constant and the new volume to calculate the pressure.

$$\text{Pressure} = \text{constant} \div \text{volume}$$

$$\text{Pressure} = 101 \div 0.25$$

$$\text{Pressure} = 404 \text{ Pa}$$

Example 2: The pressure of some helium in a helium balloon is $100\,000 \text{ Pa}$. The volume of the balloon is 0.035 m^3 .

The balloon is compressed at a constant temperature causing the volume to decrease to 0.020 m^3 .

No helium leaves the balloon. Calculate the new pressure in the balloon.

Step 1: use the two known values (the volume and the pressure) to calculate the constant.

$$\text{constant} = \text{pressure} \times \text{volume}$$

$$\text{constant} = 100\,000 \times 0.035$$

$$\text{constant} = 3500$$

Step 2: use this constant and the new volume to calculate the pressure.

$$p \times 0.020 = 3500$$

$$p = 3500 \div 0.020$$

$$p = 175\,000 \text{ (Pa)}$$

Exam note: calculation questions involving pressures in gases are typically worth between 3 and 4 marks. They can be worth 5 marks and above if there is another aspect to the problem such as calculating the resultant force for example. They are lovely questions to get 😊

Doing Work on a Gas

So far, our examples have assumed that the temperature of the gas stays exactly the same when it is compressed. But what happens in real life when we compress a gas really quickly? The example that is used for GCSE is a bike pump.

Step 1: Doing Work – when we push down on the plunger of a pump, we are applying a force to move it. This means we are doing work on the gas (key point to remember is that **work done** = **force** × **distance**).

Step 2: Transferring Energy – doing work transfers energy directly to the gas particles. This increases their internal energy (specifically, it increases their kinetic energy).

Step 3: Temperature Rises – because the particles now have more kinetic energy and are moving faster, the temperature of the gas increases.

Exam note: AQA really like to ask a 3-mark question explaining why a bicycle pump gets warm when you use it to pump up a tyre. Use the three steps above to get full marks in this type of question! 😊