

Boyles Law Work Done Gas

GCSE Physics · Written to the shared content for AQA, Edexcel and OCR

Name _____ Class _____ Date _____

1. Worked example

State the relationship between the pressure and volume of a fixed mass of gas at constant temperature, and what happens to the pressure if the volume is halved. (2 marks)

Step 1 · Relationship

Pressure $\times$ volume = constant (pressure is inversely proportional to volume).

Step 2 · Halving the volume

The pressure doubles.

Answer: $pV = \text{constant}$; pressure doubles

Check: Both conditions matter: fixed mass and constant temperature.

2. Now try one with the steps

Air in a syringe has a volume of 40 cm^3 at 100 kPa . The plunger is pushed in slowly until the volume is 25 cm^3 . Calculate the new pressure. (3 marks)

Step 1 · Equation

Step 2 · Substitute

Step 3 · Calculate

Answer:

3. Practice

Show your working. The marks tell you how much is expected.

1. State Boyle's law, including the conditions. [2]

2. The volume of a fixed mass of gas is halved at constant temperature. State what happens to its pressure. [1]

3. State what is meant by work done on a gas. [1]

4. Use the particle model to explain why compressing a gas at constant temperature increases its pressure. [3]

5. A gas at 100 kPa has a volume of 30 cm³. It is compressed to 15 cm³ at constant temperature. Calculate the new pressure in kPa. [2]

6. A gas occupies 2.0 m³ at 150 kPa. Calculate its volume at 300 kPa, at constant temperature. [2]

7. A gas at 80 kPa and 0.50 m³ expands to 0.80 m³ at constant temperature. Calculate the new pressure in kPa. [2]

8. A syringe holds 25 cm³ of gas at 120 kPa. Calculate the pressure when the volume is increased to 40 cm³ at constant temperature, in kPa. [2]

9. Describe the graph of pressure against $1 \div \text{volume}$ for a fixed mass of gas at constant temperature. [1]

10. An air bubble has a volume of 3.0 cm³ at a depth where the pressure is 200 kPa. Calculate its volume at the surface, where the pressure is 100 kPa, at constant temperature. [2]

11. Explain why the pressure of a gas decreases when its volume increases at constant temperature. [2]

12. Explain why a bicycle pump becomes warm when used quickly. [3]

13. Explain why a gas must be compressed slowly in an experiment to test Boyle's law. [2]

14. A weather balloon holds 5.0 m^3 of helium at 100 kPa . Calculate its volume where the pressure is 25 kPa , assuming the temperature does not change. [2]

4. Before you hand it in

"Halving the volume halves the pressure."

If one halves, the other doubles (pV stays the same).

Using Boyle's law when the temperature changes

Check the question says the temperature is constant (or the change is slow).

"The particles move faster when the gas is squashed slowly."

The pressure rises because collisions with the walls happen more often, not harder.

Mixing units: p_1 in kPa and p_2 in Pa

Keep pressures in the same unit and volumes in the same unit on both sides of $p_1V_1 = p_2V_2$.