Gas Under Pressure

Read a gas model, then use it to predict and graph changes.

CHE.7.b "Express the relationship among pressure, volume, temperature, and the number of moles of a gas quantitatively, conceptually, and graphically."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline each phrase that names variables kept fixed, circle each numerical or proportional change in a variable, and number the two graph shapes described in the passage.

What the Syringe Reveals

(1) A sealed syringe traps a sample of gas under a movable plunger. A sensor reads its pressure while the plunger sets its volume. Gas behavior depends on pressure P, volume V, temperature T, and amount n, measured in moles. The equation PV = nRT connects them, where R is a constant and T must be measured in kelvins.

(2) Keep the syringe at 300 K without letting gas escape. The table shows readings as the plunger moves. Each pressure times its volume equals 240 kPa L. With temperature and moles fixed, doubling volume halves pressure. With volume on the horizontal axis and pressure on the vertical axis, the graph curves downward.

SYRINGE READINGS AT 300 K

Volume (L)	Pressure (kPa)
2	120
4	60
6	40
8	30

(3) Other changes shift the reading too. At fixed volume and moles, heating the gas from 300 K to 450 K multiplies its pressure by 1.5. A pressure-versus-kelvin-temperature graph is a straight rising line. At fixed temperature and volume, doubling the number of moles doubles pressure. If pressure and temperature stay fixed instead, doubling moles doubles volume.

2 ANSWER WITH EVIDENCE

Use the passage

1. At 3 L, what pressure would you predict for the gas in the table? Show how you used the pressure-volume relationship.

2. If you graph the table's readings, where would you plot the points for 2 L and 4 L? Describe the shape of the graph as volume increases.

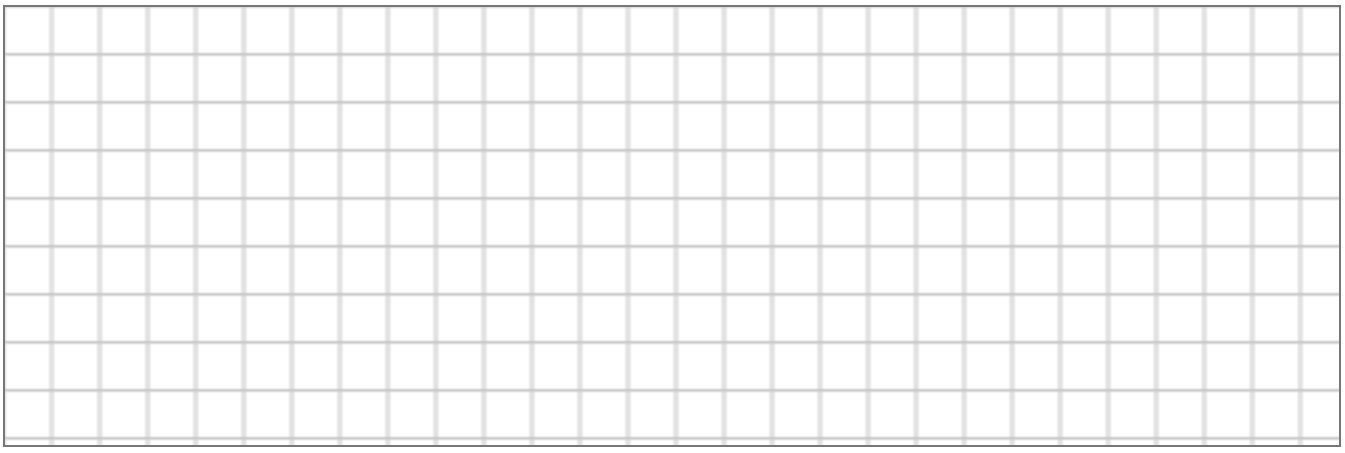
3. The gas in the table has a pressure of 60 kPa at 4 L and 300 K. If its temperature rises to 450 K while volume and moles stay fixed, what is its new pressure?

4. If the number of moles doubles while pressure and temperature stay fixed, what happens to volume? What shape would a volume-versus-moles graph have?

3 YOUR TURN

Your own words

A different gas has a pressure of 90 kPa at 2 L. At fixed temperature and moles, plot its pressure at 2 L, 3 L, and 6 L on the grid, label both axes, and draw a smooth curve through the points. Write one sentence explaining the curve's shape.



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PART 1 · READ AND MARK

Underline each phrase that names variables kept fixed, circle each numerical or proportional change in a variable, and number the two graph shapes described in the passage. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	At 3 L, what pressure would you predict for the gas in the table? Show how you used the pressure-volume relationship.	**80 kPa. The table shows PV = 240 kPa L, so P = 240 ÷ 3 = 80 kPa.**
2	If you graph the table's readings, where would you plot the points for 2 L and 4 L? Describe the shape of the graph as volume increases.	**Plot (2 L, 120 kPa) and (4 L, 60 kPa). Pressure decreases as volume increases, forming a downward-curving line.**
3	The gas in the table has a pressure of 60 kPa at 4 L and 300 K. If its temperature rises to 450 K while volume and moles stay fixed, what is its new pressure?	**90 kPa, because 450 ÷ 300 = 1.5 and 60 × 1.5 = 90.**
4	If the number of moles doubles while pressure and temperature stay fixed, what happens to volume? What shape would a volume-versus-moles graph have?	**Volume doubles. A volume-versus-moles graph is a straight rising line.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

Horizontal axis: volume (L). Vertical axis: pressure (kPa). Plot (2, 90), (3, 60), and (6, 30), then draw a smooth downward-curving line through them. The curve falls as volume increases because pressure and volume have a constant product of 180 kPa L.

Accept equivalent calculations and descriptions of an inverse pressure-volume relationship. For the graph, check axis labels, all three plotted points, a downward curve, and an explanation that temperature and moles stay fixed.