Rescue Gas Tests

Choose and use gas laws to predict changing conditions.

CHE.7.4 "Use mathematical computations to describe relationships comparing pressure, temperature, volume, and number of particles, including Boyle's law, Charles's law, Dalton's law, combined gas laws, and ideal gas laws."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB In each table row, underline what stays fixed or what gases share, and circle the value to find. Write the row letter beside the matching law in the passage to show which calculation you would use.

Testing Gas at a Rescue Station

1. At a mountain rescue station, a sealed gas syringe helps trainees predict what happens inside air-filled equipment. If temperature and particle number stay fixed, Boyle's law gives $P_1V_1 = P_2V_2$. At constant pressure and particle number, Charles's law gives $V_1/T_1 = V_2/T_2$. Both rules describe changes in state, not new gas being made.

2. A rescue cylinder contains several gases, so its gauge reads their combined pressure. Dalton's law adds the partial pressures: $P_{total} = P_a + P_b + \ldots$. If pressure, volume, and temperature all change while particle number stays fixed, use the combined gas law: $P_1V_1/T_1 = P_2V_2/T_2$. The table gives separate test conditions, not a single sequence.

3. When gas can be added or removed, count it in moles, a measure of particle number. The ideal gas law, PV = nRT, links all four variables. For pressure in kilopascals and volume in liters, use R = 8.31 kPa·L/(mol·K). Convert temperatures to kelvins before calculating; ratios of Celsius temperatures do not describe gas behavior.

FOUR SEPARATE GAS TESTS

Test	Starting values	New values or gas parts	Fixed condition or shared container
A	P = 90 kPa; V = 4.0 L	V = 2.0 L; find P	T and particle number
B	V = 3.0 L; T = 300 K	T = 400 K; find V	P and particle number
C	N_2: 45 kPa; O_2: 35 kPa	Ar: 20 kPa; find total P	All gases in one tank
D	P = 120 kPa; V = 2.0 L; T = 300 K	V = 3.0 L; T = 600 K; find P	Particle number

2 ANSWER WITH EVIDENCE

Use the passage

1. For test A, calculate the new pressure. Show which values you use.

2. For test B, calculate the new volume. Show which values you use.

3. For test C, calculate the total pressure in the tank. Show your addition.

4. For test D, calculate the new pressure. Show which values you use.

3 YOUR TURN

Your own words

Invent a new tank state with n from 0.5 to 2.0 mol, T from 250 to 350 K, and V from 10 to 25 L. Use the ideal gas law to calculate P in kPa, show your substitution, and state what happens to P if n doubles while T and V stay fixed.

Rescue Gas Tests

PART 1 · READ AND MARK

In each table row, underline what stays fixed or what gases share, and circle the value to find. Write the row letter beside the matching law in the passage to show which calculation you would use. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	For test A, calculate the new pressure. Show which values you use.	**P_2 = (90 kPa)(4.0 L)/(2.0 L) = 180 kPa.**
2	For test B, calculate the new volume. Show which values you use.	**V_2 = (3.0 L)(400 K)/(300 K) = 4.0 L.**
3	For test C, calculate the total pressure in the tank. Show your addition.	**P_{total} = 45 + 35 + 20 = 100 kPa.**
4	For test D, calculate the new pressure. Show which values you use.	**P_2 = (120 kPa)(2.0 L)(600 K)/[(300 K)(3.0 L)] = 160 kPa.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

For n = 1.0 mol, T = 300 K, and V = 20 L, P = nRT/V = (1.0 mol)(8.31 kPa·L/(mol·K))(300 K)/(20 L) = 124.65 kPa. If n doubles while T and V stay fixed, P doubles to 249.3 kPa.

Accept correctly calculated results with reasonable rounding. For Your Turn, check that all three chosen values are in range and that doubling n also doubles the calculated pressure.