Chemistry Gas Laws Practice

Use this key to check answers and read the explanations.

1. Which temperature scale belongs in the ideal gas equation PV = nRT?
   A. Kelvin
   B. Celsius
   C. Fahrenheit
   D. Any temperature scale
   Correct answer: A. Kelvin
   Gas laws use an absolute temperature. In chemistry, the kelvin scale counts from absolute zero.

2. An ideal gas in a sealed syringe is compressed slowly while its temperature stays the same. How does its pressure change?
   A. It remains the same
   B. It decreases
   C. It increases
   D. It falls to zero
   Correct answer: C. It increases
   With fixed temperature and amount of gas, Boyle’s law gives an inverse relationship between pressure and volume.

3. Which pair of quantities varies directly according to Charles’s law for a fixed amount of gas?
   A. Pressure and volume
   B. Volume and kelvin temperature
   C. Pressure and number of moles
   D. Volume and molar mass
   Correct answer: B. Volume and kelvin temperature
   Charles’s law states that V/T is constant when gas pressure and amount stay fixed and T is measured in kelvins.

4. Two containers hold ideal gases at equal pressure and temperature. One contains three times as many moles as the other. What is its volume compared with the other container’s?
   A. Nine times as large
   B. The same size
   C. One-third as large
   D. Three times as large
   Correct answer: D. Three times as large
   At fixed pressure and temperature, V = nRT/P. Tripling the amount of gas triples the volume.

5. In PV = nRT, what does n represent?

A. Number of liters of gas
B. Amount of gas in moles
C. Mass of gas in grams
D. Number of kinds of gas in the container

Correct answer: B. Amount of gas in moles
The variable n represents the amount of substance. That amount is expressed in moles.

6. An ideal gas occupies 2.40 L at 150 kPa. If its volume increases to 3.60 L at constant temperature, what is the new pressure?

A. 100 kPa
B. 225 kPa
C. 90 kPa
D. 150 kPa

Correct answer: A. 100 kPa
For a fixed amount at constant temperature, $P_1V_1 = P_2V_2$. Calculate 150 × 2.40 ÷ 3.60 = 100 kPa.

7. A flexible container holds 1.80 L of gas at 300 K. At fixed pressure, what volume does the same gas occupy at 350 K?

A. 3.15 L
B. 1.54 L
C. 1.85 L
D. 2.10 L

Correct answer: D. 2.10 L
Calculate $V_2 = V_1T_2/T_1 = 1.80 \times 350 \div 300 = 2.10$ L.

8. An ideal gas in a sealed rigid vessel starts at 84 kPa and 280 K. What is its pressure at 350 K?

A. 84 kPa
B. 67 kPa
C. 105 kPa
D. 154 kPa

Correct answer: C. 105 kPa
The volume and amount stay fixed, so pressure scales with absolute temperature. Calculate 84 × 350 ÷ 280 = 105 kPa.

9. A gas-law calculation gives a temperature of 313.15 K. What is this in degrees Celsius?

A. 40.00 °C
B. 586.30 °C
C. 313.15 °C
D. −40.00 °C

Correct answer: A. 40.00 °C
Subtract 273.15 from the temperature in kelvins to get 40.00 °C.

10. A vessel contains helium, neon, and argon. At the same temperature, their partial pressures are 24 kPa, 31 kPa, and 16 kPa. What is the total pressure?

A. 23.7 kPa
B. 55 kPa
C. 40 kPa
D. 71 kPa

Correct answer: D. 71 kPa
Dalton’s law adds the partial pressures of the gases. The sum is 24 + 31 + 16 = 71 kPa.

11. An ideal gas occupies 2.40 L at 100 kPa and 300 K. For the same amount of gas, what volume results at 120 kPa and 360 K?

A. 2.88 L
B. 2.00 L
C. 2.40 L
D. 3.46 L

Correct answer: C. 2.40 L
Volume is proportional to T/P for a fixed amount. Temperature and pressure both rise by a factor of 1.20, leaving volume unchanged.

12. An ideal gas is at 249.4 kPa and 300 K. Using R = 8.314 L·kPa/(mol·K), what is n/V to three significant figures?

A. 1.00 mol/L
B. 0.100 mol/L
C. 10.0 mol/L
D. 0.0100 mol/L

Correct answer: B. 0.100 mol/L
Rearrange PV = nRT to n/V = P/(RT). The ratio 249.4 ÷ (8.314 × 300) is approximately 0.100 mol/L.

13. A gas is collected over water. The mixture pressure is 102.0 kPa and the water vapor pressure is 2.8 kPa. What is the dry gas’s partial pressure?

A. 36.4 kPa
B. 104.8 kPa
C. 102.0 kPa
D. 99.2 kPa

Correct answer: D. 99.2 kPa
Water vapor contributes to total pressure. Subtract 2.8 kPa from 102.0 kPa to isolate the dry gas’s pressure.

14. Ideal gases X and Y have molar masses of 16 and 64 g/mol. At equal temperature and pressure, how fast does X effuse through the same small opening compared with Y?

A. Twice as fast
B. Four times as fast
C. Half as fast
D. At the same rate

Correct answer: A. Twice as fast
Graham’s law gives a rate ratio of $\sqrt{(M_Y/M_X)} = \sqrt{(64/16)} = 2$. X has the lower molar mass.

15. Under which conditions do particle volume and intermolecular attractions generally cause the greatest departures from ideal gas predictions?

A. High temperature and very low density
B. Low pressure and high temperature
C. High pressure and low temperature
D. Low pressure with very large spacing between particles

Correct answer: C. High pressure and low temperature
At high pressure, particles are close enough for their own volume to matter. At low temperature, attractions have a larger effect relative to thermal motion.