

Gas laws and particle motion

AP Chemistry · Test answers (mark scheme)

Marking points follow each answer. Give method marks for correct substitution and answer marks for correct values with units, allowing small rounding differences. In explanations, accept equivalent wording that names the particle behaviour.

Level: AP Chemistry · **Curriculum:** AP Chem Unit 3

Question 1 Gas law basics (2 marks)

$$P_1V_1 = P_2V_2, \text{ so } V_2 = 150 \times 8.0 / 400 = \mathbf{3.0 \text{ L.}}$$

Marking: 1 correct equation, 1 answer with unit.

Question 2 Ideal gas law (3 marks)

$$T = 300.15 \text{ K. } n = PV/RT = 200 \times 2.50 / (8.314 \times 300.15) = \mathbf{0.200 \text{ mol.}}$$

Marking: 1 conversion to kelvin, 1 substitution, 1 answer.

Question 3 Speed distribution (4 marks)

- Q.**
- The peak of Q is at a higher speed because the average kinetic energy is higher; the curve is lower and wider, since the same number of molecules is spread over more speeds.
- The area doubles.

Marking: 1 + 2 + 1.

Question 4 Total pressure of a mixture (2 marks)

$$P = nRT/V = 0.500 \times 8.314 \times 300 / 5.00 = \mathbf{249 \text{ kPa.}}$$

Marking: 1 total amount, 1 pressure with unit.

Question 5 Partial pressure of helium (2 marks)

$$x(\text{He}) = 0.200/0.500 = 0.400; P(\text{He}) = 0.400 \times 249.4 = \mathbf{99.8 \text{ kPa.}}$$

Marking: 1 mole fraction, 1 answer.

Question 6 Why gases deviate (3 marks)

At high pressure particles are close, so their own volume is no longer negligible and the volume is larger than the ideal value. At low temperature particles move slowly and attractions pull them together, so the pressure is lower than the ideal value.

Marking: 1 particle volume, 1 attractions, 1 link to pressure or volume.

Question 7 Molar mass (2 marks)

$n = 100 \times 0.500 / (8.314 \times 300) = 0.02005 \text{ mol}$; $M = 0.800 / 0.02005 = \mathbf{39.9 \text{ g/mol}}$.

Marking: 1 amount, 1 molar mass.

Question 8 Gas over water (2 marks)

The collected gas is mixed with water vapour. The total pressure is the sum of the partial pressures, so **$P(\text{gas}) = P(\text{total}) - P(\text{water vapour})$** .

Marking: 1 mixture, 1 Dalton's law.