Tracing Gases Through a Tiny Opening

Base your answers on the information provided and your knowledge of chemistry. Use the 2025 Chemistry Reference Tables as needed.

Two sealed display vessels have the same volume and temperature. Each starts with 20 units of gas and a pressure of 100 kPa. P contains eight helium units and 12 argon units. Q contains 12 helium units and eight argon units. A unit counts the same number of particles for each gas.

1 Use the 2025 Reference Tables. Which gas has the lower atomic mass?

(1) Helium

(2) Argon

(3) Both have the same atomic mass

(4) Atomic mass changes with the vessel

A tiny opening lets gas particles leave for a brief interval. The opening is then sealed. In the model the fraction of helium that leaves is three times the fraction of argon that leaves. The temperature and vessel volume remain constant. A tracer measurement shows that one quarter of the argon leaves from each vessel.

2 Find the helium and argon units that remain in each vessel after the interval. [1]

Answer and work

3 A student expects the same final pressure because both vessels had the same starting pressure. Compare the final pressures using the particle counts. [1]

Answer and work

The display can add pure helium to Q without changing its volume or temperature.

4 Find how much helium to add so Q’s pressure matches P’s final pressure. Compare the amounts of argon in the two vessels after that addition. [1]

Answer and work