

4. A balloon is filled with equal volumes (which means equal moles, because of Avogadro's principle) of helium and oxygen. If half of the gas in the balloon is allowed to escape, what is the ratio of helium to oxygen molecules still in the balloon?

Hint: pretend you started with two moles of gas in the balloon, one mole of helium and one mole of oxygen. The ratio of speeds will be equal to the ratio (and therefore the mole fraction) of gases that escape. Once you know how much of each gas escapes, you can figure out how much of each gas is left.

5. Phosgene, COCl_2 with a molar mass of $98.9 \frac{\text{g}}{\text{mol}}$, is a poison gas that was used in chemical warfare during World War I. Suppose a gas grenade landed a soldier's trench, 3.0 meters away from a soldier, and exploded silently. The soldier smelled the H_2S gas (molar mass $34.1 \frac{\text{g}}{\text{mol}}$) from the explosion 5.0 seconds after the explosion. How much time did the soldier have after smelling the H_2S gas to put on his gas mask before the phosgene gas reached him?

Hint: find the ratio of the speeds of the two gases using Graham's Law, and multiply the ratio times 5.0 seconds to find how long the phosgene would take to get to the soldier's location.