Chemistry 20

Unit B: Gases and the gas laws

Combining volumes and gas technologies

Hydrogen and oxygen volume ratio

- When hydrogen gas and oxygen gas form water vapour at one temperature and one pressure, their volumes follow the coefficients.
- The reaction $2\ H_2 + O_2 \longrightarrow 2\ H_2O(g)$ therefore uses volumes in the ratio 2:1:2.

Volume ratios in devices

- Multiply a known gas volume by a coefficient ratio to find the other gas volumes at the same temperature and pressure.
- Breathing, diffusion, weather, balloons, tanks, air bags, turbines, and engines each show a gas property in use.

Key terms

law of combining volumes

At the same temperature and pressure, the volumes of gases in a reaction are in the same ratio as their coefficients. (2:1:2)

density

Mass divided by volume. Heated air in an open balloon has a lower density than the cooler air outside. (g/L)

diffusion

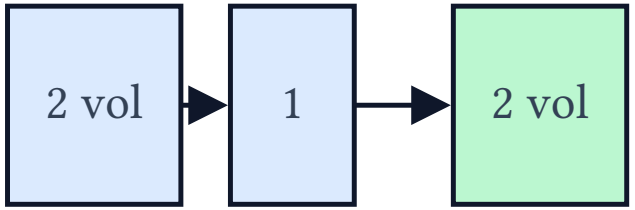
The net spread of gas particles from a region of higher concentration toward a region of lower concentration.

Coefficients are the volume recipe for gases

- The law of combining volumes applies only to substances that are gases at the shared temperature and pressure.
- A coefficient of 2 means twice the volume of a coefficient of 1.

Coefficients = gas volumes

$2\ H_2(g) + O_2(g) \longrightarrow 2\ H_2O(g)$



Same T and P; gases only
Coeff 2 = twice volume of 1

Volumes for 6.00 L of hydrogen

- Hydrogen's coefficient is 2, oxygen's coefficient is 1, and water vapour's coefficient is 2.
- The gases react completely at one temperature and one pressure.

Scaling ammonia from 9.00 L of hydrogen

- The equation $N_2 + 3\ H_2 \longrightarrow 2\ NH_3$ uses gas volumes in the ratio 1:3:2.
- Hydrogen is the known volume, 9.00 L, at the same temperature and pressure as the other gases.

Gases in devices

- Explain a hot-air balloon, an air bag, and a scuba tank with three different gas properties.
- Keep the balloon answer on density and the air-bag answer on a reaction that produces gas.