

Exercise walk-through

1.2

Diffusion

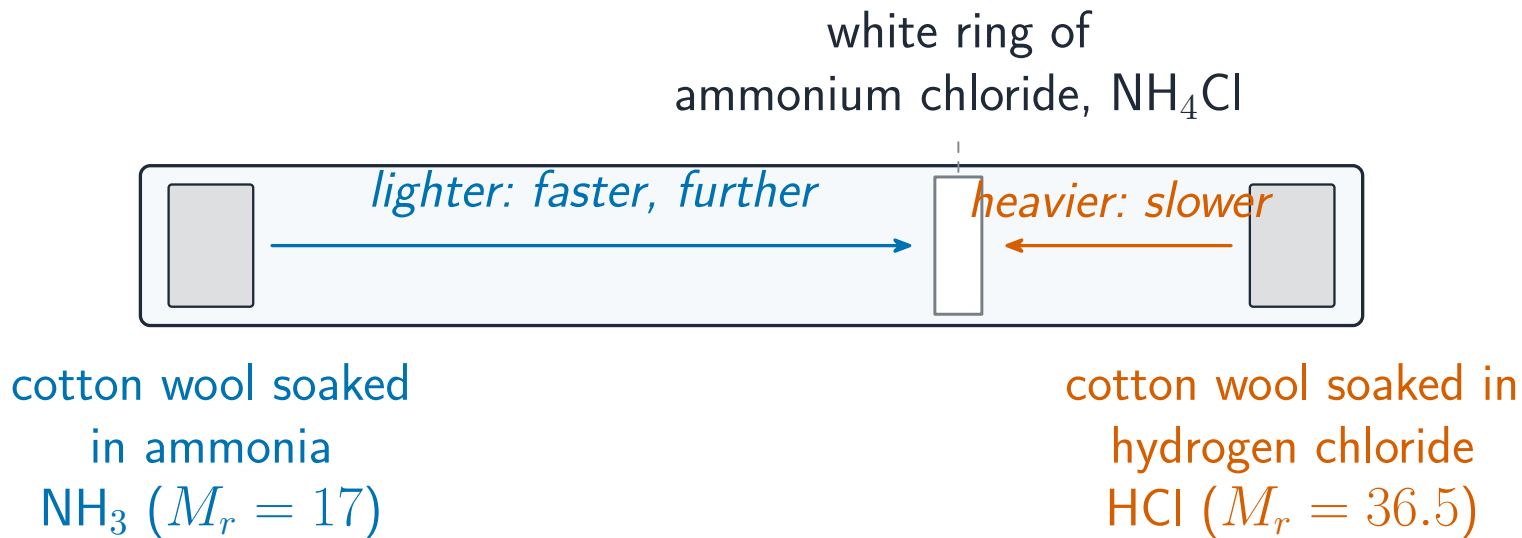
IGCSE Chemistry

Diffusion

Diffusion : net spreading from higher to lower **concentration** , caused by random particle motion.

At the same temperature, a gas with smaller M_r diffuses faster. Light NH_3 ($M_r = 17$) beats heavy HCl ($M_r = 36.5$), so the white ring forms nearer the HCl end.

Diffusion, in detail



At the same temperature, the gas with smaller M_r diffuses faster: NH_3 ($M_r = 17$) beats HCl ($M_r = 36.5$), so the white ring forms nearer the HCl end.

Is the white ring a change of state?

Your turn

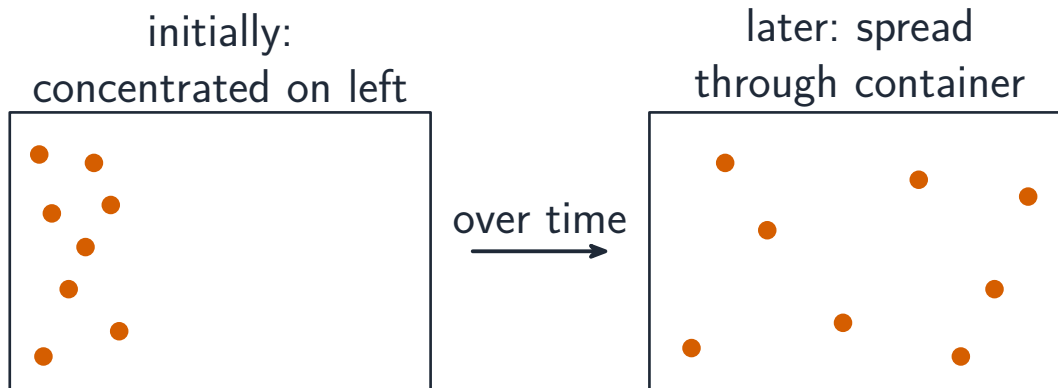
Ammonia gas and hydrogen chloride gas react to form solid ammonium chloride. Is this simply deposition? Explain.

- A. Compare the substances before and after.
- B. Contrast this with iodine vapour forming solid iodine.

A new substance means a chemical reaction

- 1 **Reaction** $NH_3(g) + HCl(g) \rightarrow NH_4Cl(s)$
- 2 **Distinction** The gases react to make a different substance. This is a chemical reaction, not just a change of state.
- 3 **Physical example** Iodine vapour forming solid iodine is gas $\rightarrow$ solid: deposition. It remains iodine.

Particles diffuse from high to low concentration



Particles move randomly in all directions.
Net spreading: higher to lower concentration.

Net spreading is from higher to lower concentration; random motion continues after mixing

Worked example – comparing diffusion

Ammonia ($M_r = 17$) and hydrogen chloride ($M_r = 36.5$) diffuse from opposite ends of a tube. Where does the white ring form?

- Diffusion is net spreading from higher to lower concentration, caused by random particle motion.
- At the same temperature the gases have the same average **kinetic energy**.
- NH_3 is **lighter**, so it moves **faster** than HCl .
- It travels further before they meet $\Rightarrow$ the ring forms **nearer the HCl end**.

Lighter particles diffuse faster **at the same temperature**. Say “lower $M_r \Rightarrow$ faster” – do not just say “it is a gas”.

Exercises 2.1·2.2

2.1 Define diffusion.

[1]

2.2 State why diffusion does not occur in solids.

[1]

Exercises 2.1·2.2

2.1 Define diffusion.

[1]

2.1

- particles spread because they move randomly
- **spreading from high concentration to low concentration**

2.2 State why diffusion does not occur in solids.

[1]

2.2

- particles in a solid **cannot move from place to place** (they only vibrate)

Exercise 3.1

3.1 Two gases diffuse along a tube. The one that travels faster has the:

[1]

☐

A larger relative molecular mass

B smaller relative molecular mass

C higher density

D larger molecules

Exercise 3.1

3.1 Two gases diffuse along a tube. The one that travels faster has the: [1]

☐

- A** larger relative molecular mass
- B** smaller relative molecular mass
- C** higher density
- D** larger molecules

3.1 B

- the gas with the **smaller** M_r diffuses faster
- compare relative molecular mass at the same temperature; molecular size alone is not a reliable rule

Exercise 3.2 (a)

3.2 In the experiment, ammonia ($M_r = 17$) and hydrogen chloride ($M_r = 36.5$) diffuse from opposite ends of a tube and form a white ring.

(a) State, with a reason, at which end the white ring forms nearer.

[2]

Exercise 3.2 (a)

3.2 In the experiment, ammonia ($M_r = 17$) and hydrogen chloride ($M_r = 36.5$) diffuse from opposite ends of a tube and form a white ring.

(a) State, with a reason, at which end the white ring forms nearer. [2]

(a)

- ammonia is lighter ($M_r = 17$ vs 36.5), so it **diffuses faster and travels further**
- the ring forms **nearer the hydrogen chloride end**

Exercise 3.2 (b)

3.2 In the experiment, ammonia ($M_r = 17$) and hydrogen chloride ($M_r = 36.5$) diffuse from opposite ends of a tube and form a white ring.

(b) Name the white solid formed.

[1]

Exercise 3.2 (b)

3.2 In the experiment, ammonia ($M_r = 17$) and hydrogen chloride ($M_r = 36.5$) diffuse from opposite ends of a tube and form a white ring.

(b) Name the white solid formed.

[1]

(b)

- the white solid is **ammonium chloride**, NH_4Cl

Exercise 3.3

3.3 Explain, in terms of particles, why you can smell perfume from across a room. [2]

Exercise 3.3

3.3 Explain, in terms of particles, why you can smell perfume from across a room. [2]

3.3

- perfume particles move **randomly in all directions**
- they **diffuse** and mix with the air until they reach your nose