

Particles in motion?

Introduction

Students produce carbon dioxide by reacting calcium carbonate with hydrochloric acid. They then check to see if diffusion occurs by both holding the test-tube of carbon dioxide over a test-tube of air and vice-versa

Equipment

Apparatus

- Eye protection
- Test tubes, x3
- Cork
- Delivery tube and bung

Chemicals

- Limewater 0.02 mol dm^{-3}
- Calcium carbonate
- Hydrochloric acid 0.5 mol dm^{-3}

Health, safety and technical notes

- Read our standard health and safety guidance here <https://rsc.li/3F7DnV7>
- Wear eye protection, if desired
- Hydrochloric acid is an eye irritant, see CLEAPSS Hazcard [HC057](https://rsc.li/3F6wKBt)

Notes

This experiment provides a good introduction, one suggestion is to show a demonstration of Brownian motion using a smoke cell after this experiment.

Solids, liquids and gases consist of minute particles. If this were not the case, they would not mix so easily.

This is not proof of a particulate theory, but the experiment does suggest that the particles in the gas must be in motion to spread through the air in the containers.

Answers

1. All the test-tubes contained carbon dioxide; the gases always diffuse and mix.
2. Carbon dioxide is denser than air.
3. Yes; both tubes should give cloudy limewater, suggesting the gases in the two tubes mixed. Some of the heavier carbon dioxide molecules moved upwards into the test-tube containing air.