

Mixtures

Aim: To visually represent the particle arrangement of air.

1. Here is a list of the components (parts) of air. Next to each identify whether it is an element or compound. Then, in the final column, write a reason why.

	Element or Compound?	Reason
nitrogen (N ₂)		
carbon dioxide (CO ₂)		
argon (Ar)		
oxygen (O ₂)		
water (H ₂ O)		

2. Make sure you have sticky dots, or coloured pens to draw circles with. Each different colour will represent a different element. You must stick or draw circles to show the components of air trapped inside of a balloon, using the table above to help you. An example has been given for you:

Key:

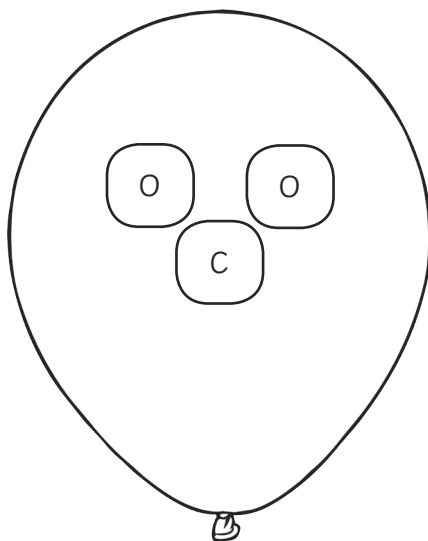
nitrogen

carbon

oxygen

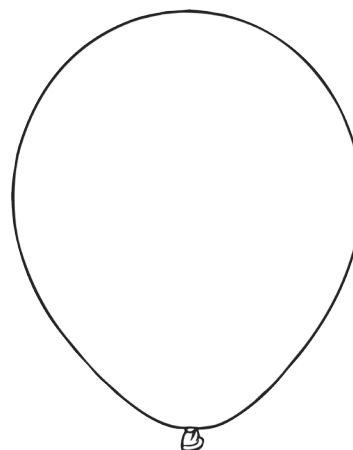
hydrogen

argon



3. How does the picture you've created give evidence that air is a mixture?

4. **Challenge:** If the balloon above had been filled with helium instead, how would your picture look different?

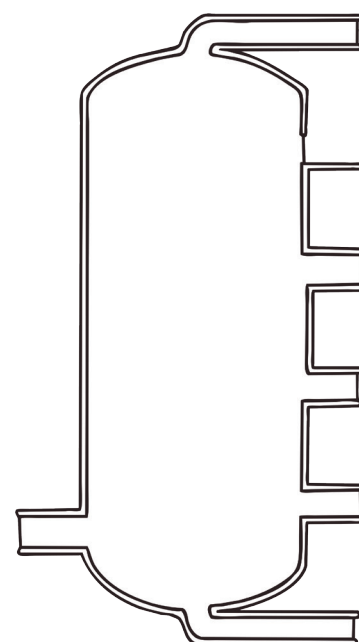


5. Some of the gases in air can be separated out using a process called fractional distillation where it is cooled to temperatures of minus 200°C!

a. What does the term 'fraction' mean to you?

b. What change of state would happen to the air at minus 200°C? **Clue:** The **boiling** point of oxygen is -185°C and nitrogen is -196°C.

c. Why might people want to separate oxygen, in particular, from air?



Learning Objectives:

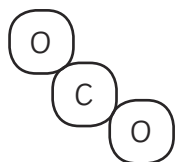
- I can identify elements and visually represent them.
- I can identify compounds and visually represent them.
- I can explain why air is a mixture using scientific terms.
- I can suggest what happens in fractional distillation and why it is carried out.

Mixtures Answers

1.

	Element or Compound?	Reason
nitrogen (N ₂)	element	Only one element present.
carbon dioxide (CO ₂)	compound	Two different elements bonded together.
argon (Ar)	element	Only one element present.
oxygen (O ₂)	element	Only one element present.
water (H ₂ O)	compound	Two different elements bonded together.

2. Students visual representations will differ based on resources and colours available, but here is an overall idea:



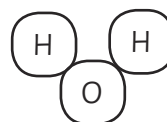
carbon dioxide



oxygen



nitrogen



water



argon

3. The picture shows that there are several different substances in air that are not chemically joined/bonded together. Each substance retains its own properties.

4. If the balloon had been filled with helium instead, the majority of the balloon would be filled with helium particles, which is an element and not a mixture. If the student has drawn their answer also in the balloon provided, there should be solely separate 'He' circles (helium is monatomic, not diatomic).

5.

a. Students answers may vary. Overall definitions of 'fraction' might include 'an amount or part of a whole' or 'a numerical quantity that is not a whole number'. For example $\frac{5}{8}$ ths or $\frac{1}{4}$.

b. At minus 200°C, oxygen and nitrogen should condense from gases into liquids.

c. People might want to separate oxygen in particular from air as it is used in burning fuels; in the manufacture of antifreeze; PVC; used in welding and cutting metals; oxygen therapy in hospitals, and treat sewage/purify water - amongst many other things! Also, emphasise that it only makes up 21% of the air, but we use it for many applications so we must separate it out.