

5.2 Purity

In this topic you will:

- explain what is meant by purity
- calculate percentage purity
- describe how it is difficult to get a pure product.

Getting started

Answer the three questions on your own and then check with a partner. Be ready to share your answers with the class.

- 1 What does it mean if a substance is pure?
- 2 Which of these items are pure substances?
sodium chloride; oxygen; sea water; gold; orange juice;
copper oxide; silver nitrate; soil; black ink; potassium.
- 3 Of the items in question 2, which are elements, mixtures and compounds?

Key words

carat
suggest
translucent

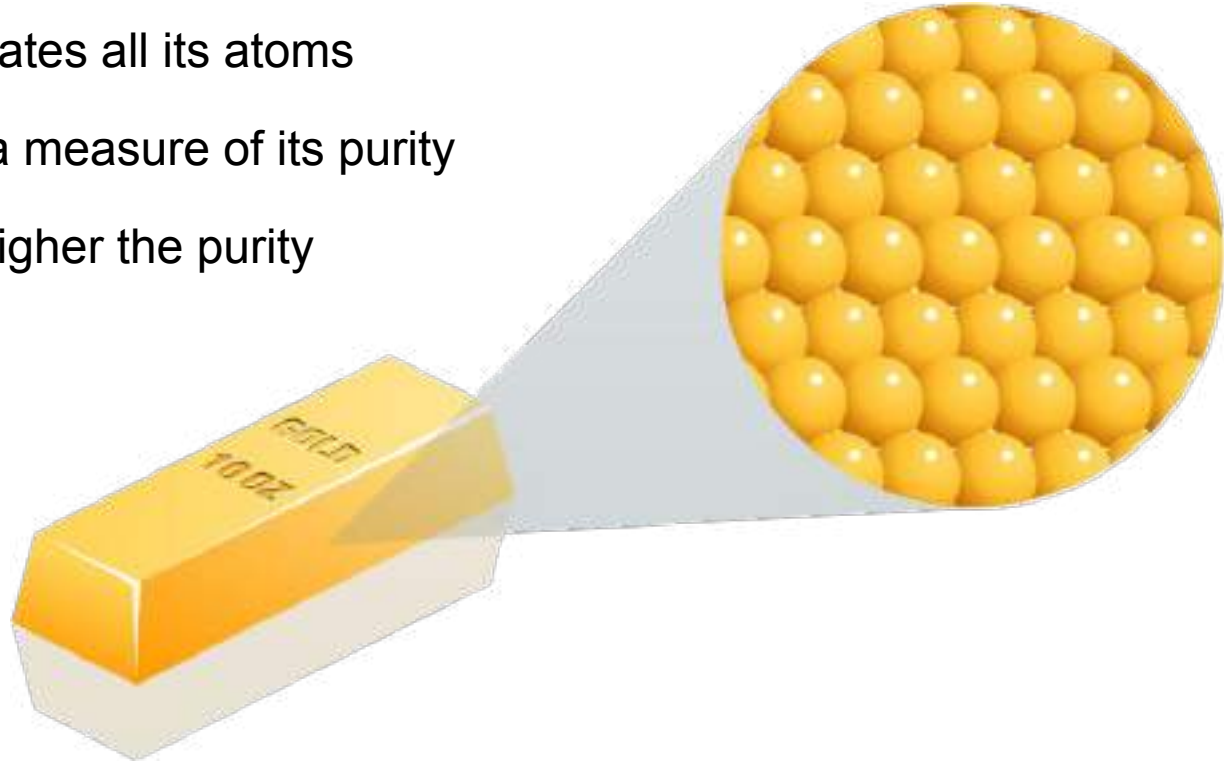
In a **pure element**, all the atoms are the same and of just one type

Ex- pure **gold** made of gold atoms only

Buying 24 **carat** gold - indicates all its atoms

are only made of gold, it is a measure of its purity

More gold atoms it has → higher the purity



18 **carat** gold - 18 parts out of 24 are gold

$$\frac{18}{24} \times 100 = 75\%$$

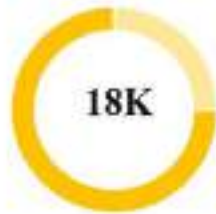
Rest 6 parts - silver or copper

18 carat gold is 75% pure



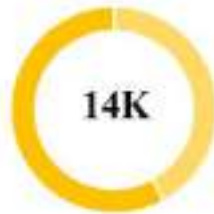
PURE GOLD

*Rarely used in
jewellery*



75% GOLD

*Excellent balance
between strength &
purity*



58% GOLD

*Very good quality
& reasonably priced*



42% GOLD

Good Value

Colour changes from yellow gold to slightly coppery

Silver is normally marked 925 (number of parts per thousand)

It has 925 atoms out of 1000 that are silver; rest 75 are other metal atoms

So its purity is 92.5%

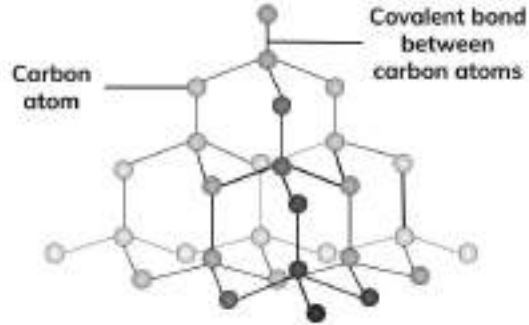
$$\frac{925}{1000} \times 100 = 92.5\%$$

Which ring is more pure?

- a. Silver marked 925
- b. Silver marked 900



Diamond - made from carbon atoms arranged in a certain pattern



Pure diamond - colourless, translucent, lets light pass through

Impure diamond - carbon atoms mixed with other elements

Ex- few carbon atoms per million mixed with N - yellow

Ex- few carbon atoms per million mixed with B - blue

Ex- one carbon atom per 1000 carbon atoms replaced by Ni or H - green (rare)



Questions

- 1 What percentage of 9 carat gold is gold?
- 2 What percentage of silver is in silver marked 900?
- 3 Which element mixed with carbon in diamonds makes them blue?
- 4 Which elements may cause a diamond to be green?

Sea water

What is sea water made up of?

How can you obtain salt from sea water?

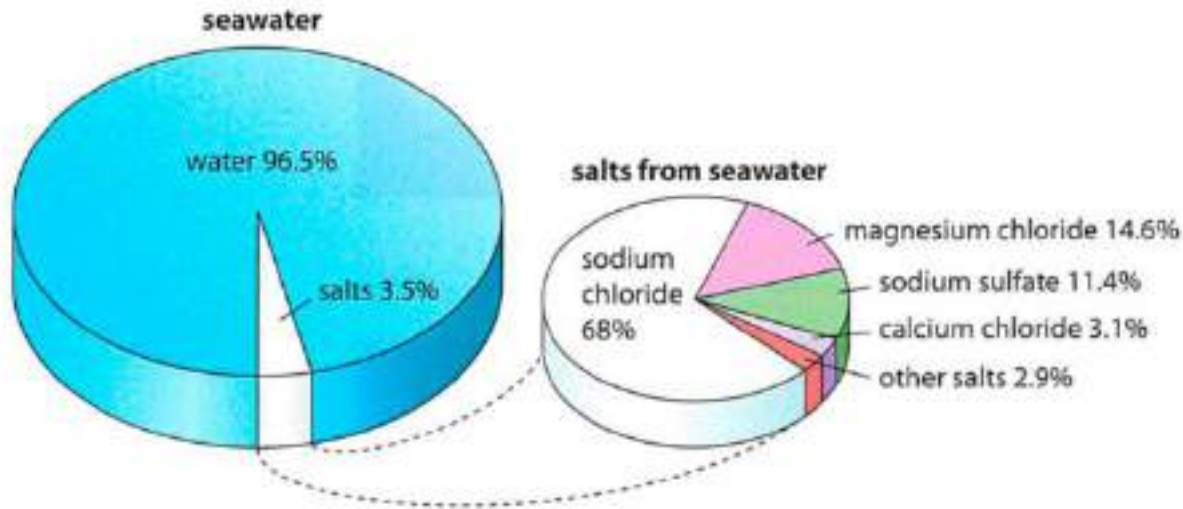


You can obtain salt from sea water by evaporation

- let sea water fill flat in shallow areas called beds
- allow water to evaporate from the Sun's heat

Sea water

In 1000g of sea water, 35g is made up of salts



The salt that is obtained from this seawater is only 68% sodium chloride.
The mass of sodium chloride in 1000 g seawater is:

$$\frac{68}{100} \times 35 = 23.8 \text{ g}$$

Question:
What mass of magnesium chloride is found in the seawater sample?

Finding the mass of salts in seawater

You will need:

- evaporating basin
- tongs
- Bunsen burner
- tripod
- pipe-clay triangle
- safety glasses
- top pan balance
- seawater sample

Method

- 1 Read through the method and think very carefully about any risks there may be when you carry out this task. Write a risk assessment.
- 2 Place an evaporating basin on a top pan balance and record its mass.
- 3 Add some seawater and find the mass of the seawater.
- 4 Heat the seawater until it begins to spit. Remove from the heat and allow the rest of the water to evaporate.
- 5 When there is no longer any water remaining and the basin is cool, find the mass of the salts.

Questions

- 1 What mass of salts did you obtain from the seawater?
- 2 What percentage of the seawater is this?
- 3 About 68% of the salt in seawater is sodium chloride. Estimate the mass of sodium chloride in your sample.
- 4 Is this about what you expected? If not, why not?
- 5 What difficulties did you have carrying out this investigation? How did you try to overcome them?
- 6 What safety measures did you have in place whilst carrying out this investigation?



Pure products

For scientists, important to obtain a pure product

In chemical reactions to make medicines, impurities can stop the medicine from working or could harm the patient

Some reactions have only one product, others have more than one product

So, products need to be separated and purified

Remaining products can also be used up in other reactions

magnesium + oxygen \rightarrow magnesium oxide

In other reactions, there may be more than one product. For example:

silver nitrate + sodium chloride \rightarrow sodium nitrate + silver chloride

sulfuric acid + sodium hydroxide \rightarrow sodium sulfate + water

barium chloride + sodium sulfate \rightarrow barium sulfate + sodium chloride

lead nitrate + potassium iodide \rightarrow potassium nitrate + lead iodide

copper carbonate + hydrochloric acid \rightarrow copper chloride + water + carbon dioxide