



What is stuff made of? Exploring matter, atoms and elements

Learning objectives

- 1 Recall that matter is made from atoms
- 2 Compare the size of atoms with small objects that we can see and other objects which are too small to see with the naked eye
- 3 Describe that atoms are the smallest parts of an element and that they retain the properties of that element using observations from a demonstration
- 4 Make deductions about the nature of atoms from a series of observations

Introduction

Look around you. Everything you can see, touch or hold is made of matter. Matter is the name scientists give to anything that has mass and takes up space. Matter is made of tiny building blocks called atoms that make up everything in the universe.

Atoms are incredibly small. So small that you cannot see them with the naked eye. They combine in different ways to create all the materials around us.

It's a small world

1. Find out how small an atom is. Draw a line about 1 cm long in the box below. Guess the number of hydrogen atoms that could be placed side by side along it.



I think the number of hydrogen atoms is _____

The actual number of hydrogen atoms is _____

2. When your teacher has revealed the answer, complete the following questions.

(a) Compare your estimate with the actual number of hydrogen atoms. State whether it is larger or smaller.

(b) Explain what this tells you about the size of atoms.

(a) Write the objects in the table in order of size, from largest to smallest.

- Ribosome ~20–30 nm
- Red ant ~3 mm
- Skin cell ~30 μm
- Atom ~0.2 nm
- Red blood cell ~8 μm
- Pin head ~1–2 mm
- Pollen grain ~30–100 μm
- Human egg cell ~100 μm
- Bacterium ~2 μm
- Grain of sand ~0.5 mm
- Grain of table salt ~0.3 mm
- Water molecule ~0.3 nm
- Human hair (diameter) ~70 μm
- Dust mite ~0.3 mm (300 μm)
- DNA (width of double helix) ~2 nm
- Mitochondrion ~1 μm
- Virus ~100 nm
- Poppy seed

(b) Next to each object, write yes, no or barely visible to state whether you can see the object with the naked eye.

[illegible]



Your teacher will now show you a table giving the correct answers for task 3. Use the table to help you to answer the following questions.

4. Name the smallest thing your eyes can see. State the size of this.

5. Explain why our eyes cannot see some of the other small objects in the table.

6. Describe what all these small objects are made from.

7. Explain what this tells you about the sizes of atoms.

Atomic paperclips

Watch the demonstration and use your observations and your own knowledge to answer the following questions.

1. Name the smallest piece or 'particle' you could take from the paper clip pile.



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2. Explain whether or not one paper clip would still function as a paper clip.

Hint: Does it still hold paper?

3. Imagine breaking a paper clip in two. Think of a name for each part. Then name the parts of an atom.



4. Explain whether or not the broken paper clip is useable.

Hint: Can broken pieces do the same job? Use your answer to explain whether or not a broken-up atom is useable.

5. Name the smallest particle in the metal. Circle the correct answer.

particle atom metal piece

6. Explain why the metal sheet cannot be torn into the smallest possible particles using our hands.

7. Will the smallest particle in the metal still be made of the metal? Explain your answer.

Hint: What makes a metal be a metal?

8. Describe how we could see the smallest particle in a piece of metal.

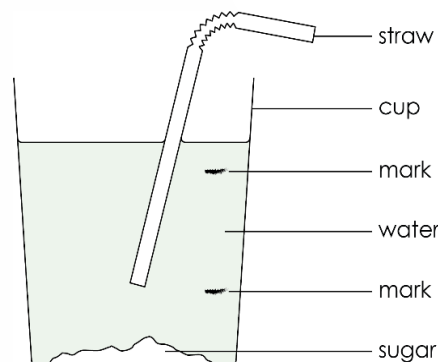


Tasty particles practical activity

Apparatus

Each group needs:

- One glass or plastic drinking cup
- Drinking straws – one per taster
- Tap water
- About 20 drops lemon juice – enough to taste in water
- One teaspoon of sugar
- One dropping pipette
- Safety glasses



Method

- 1. Taste the water**
 - Fill the cup with water to 1 cm from the top.
 - Use the straw to taste the water in the three sections of the cup – above the top mark, between the two marks and below the bottom mark.
 - Write down what it tastes like at each level.
 - Refill the cup.
- 2. Add lemon juice**
 - Add about 10 drops of lemon juice to the water.
 - Taste the water again at the three levels.
 - Write down what it tastes like at each level.
 - Keep the water for the next step.
- 3. Add sugar**
 - Add one teaspoon of sugar to the water.
 - Don't stir. Let the sugar settle.
 - Taste the water again at the three levels.
 - Write down what it tastes like at each level.
 - Keep for the next step.
- 4. Wait and taste again**
 - Wait for 2 minutes.
 - After waiting, taste the water at the three levels.
 - Write down what it tastes like at each level.
 - If you can, wait even longer and taste again.



Results

Use the following table to record your observations during the practical.

Level	Water alone	Water and lemon juice	Water, lemon juice and sugar	Water, lemon juice and sugar after waiting
Top				
Middle				
Bottom				

Follow-up questions

1. Use the test results to explain whether water, lemon juice and sugar particles are all the same.

2. Describe how particles can behave using the results from your investigation.
Hint: How did the taste change depending on where you tasted it from? Did this change after you left it?

3. Summarise what you have learned about particles (and atoms) in this lesson by completing the following sentences.

Matter is made of _____ which are too small to be seen with the naked _____.

Atoms are the _____ parts of elements.

An atom retains the property of the _____.

Particles can _____.