

MODULE: *Matter 1*

Intervention Session

This session has been designed to help you to practice answering PISA questions, both paper and computer based assessments about Matter. It also helps you to practice reading and interpreting text; analysing and interpreting data; evaluating scientific inquiries; and explaining the key concepts and applying your understanding.

1. (15 minutes)

Carry out the Hunting the Quark computer based assessment question on the computer. Read the information, instructions and questions carefully before selecting or typing in your answers.

Remember that you can navigate backwards and forwards to check and change your answers.

When you have finished, print your answers by clicking on the print icon.

2. (10 minutes)

Read the information below and then answer the questions.

Atoms and Bonding

Atoms are the smallest particle that can exist on their own. One type of atom can't be changed into another type through normal reactions and by physical changes.

Atoms of all the same type make substances called elements. Atoms of two or more different types can join together in fixed combinations; this makes compounds. The atoms in compounds can be grouped together either as molecules, or as giant structures in an array.

The properties of elements and compounds depend on how the atoms, molecules and giant structures are bonded together.

Making new and useful materials depends on knowing how to manipulate atoms.

Particle Pictures

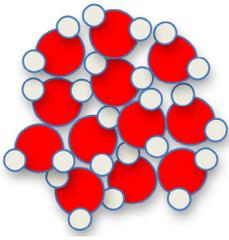
Particle pictures are a way of showing the structure of particles in a substance. They are not real pictures, because the particles are too small to see with our eyes – even by using a microscope.

A substance can be classified as either a **mixture** (with two or more different types of molecule in it) or a **pure substance** (with one type of molecule in it).

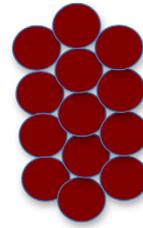
A pure substance can then be classified as a compound (with two or more different types of atom in it) or an element (with one type of atom in it).

A substance can also be classified as a **solid**, a **liquid** or a **gas**. Particle pictures give clues to this, as well.

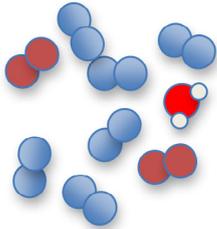
A



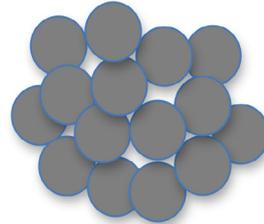
B



C



D



- a. Explain how you would classify substance A. Give reasons for your answer.

- b. Explain how you would classify substance B. Give reasons for your answer.

- c. Explain how you would classify substance C. Give reasons for your answer.

- d. Explain how you would classify substance D. Give reasons for your answer.

5. (5 minutes)

Elements and compounds

- When atoms of the same type join up, they make elements.
- When different types of atoms join up in lots of identical combinations, and those combinations then join up, they make compounds.
- Elements and compounds are examples of pure substances, because all their molecules are the same as each other.

Here is a list of materials:

| | | | |
|------------|-----------------|-------------------------|---------|
| Helium | Chalk | Ethanoic acid (vinegar) | Gold |
| Cake | Magnesium oxide | Nitrogen | Brine |
| Zinc metal | Polythene | Hard rubber for tyres | Diamond |

Using reference books or the internet if necessary, classify each of these as an element, a compound or a mixture. Give reasons for your choice.

Element

Compound

Mixture

6. (10 minutes)

Atoms make molecules

- Water is no longer defined as an element, despite what the Ancients thought. For them, the elements were fire, earth, air and water. But for us, none of these are elements.
- Water is the most important substance in our lives, and we define water as a pure substance, a compound. When two atoms of hydrogen react with one atom of oxygen, this makes a molecule of water.
- We can make water by burning hydrogen gas in air (which of course has oxygen in it).
- And we can make the reverse happen; passing an electric current through water can break it up into the gases it's made from: oxygen and hydrogen.
- But in water molecules, the oxygen atom and hydrogen atoms are very strongly bonded. So it takes a lot of electrical energy to pull them apart.
- Hydrogen and oxygen cannot be broken down into simpler materials; they are two of the 118 elements we know exist, of which 90 occur on Earth.
- Water is not the only compound made of hydrogen and oxygen. There is a compound made of molecules each with two oxygen atoms bonded to two hydrogen atoms: hydrogen peroxide.

- a. What did the Ancients define as the elements?

- b. What do we define as an element?

- c. Describe a particle of water; what is this particle called?

7. (10 minutes)

Structure and bonding

Diamond is a giant structure of carbon atoms. Each carbon atom shares electrons with four other carbon atoms around it. This sharing of electrons with four neighbouring carbon atoms extends for millions of atoms in three dimensions.

Because of this giant structure, diamond is one of the hardest materials known to us.

Polystyrene is a common plastic. It is made of long, straight molecules that stick to each other with some force of attraction. Because that force of attraction is weak, polystyrene is fairly flexible, and is used in many places where a rigid material would break.



Diamond



Polystyrene

- What is it about a diamond that makes it very hard?
- Would you expect diamond to melt easily? Explain your answer.
- What hardness would you expect from polystyrene compared to diamond?
- Would you expect polystyrene to melt easily? Explain your answer.

e. Suggest a use for diamond (other than jewellery). Explain your answer.

f. Suggest a use for polystyrene. Explain your answer.