

# MODULE: *Matter 1*

## Post Test Marking Scheme

1. (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.

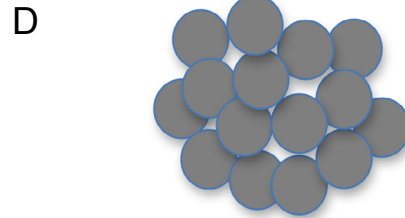
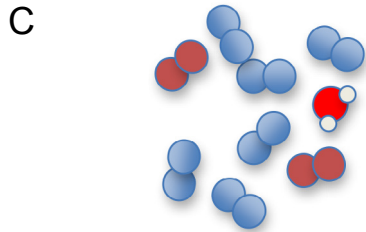
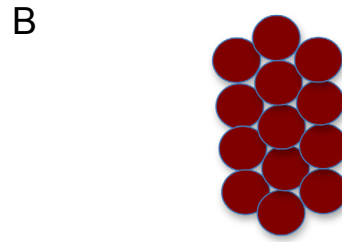
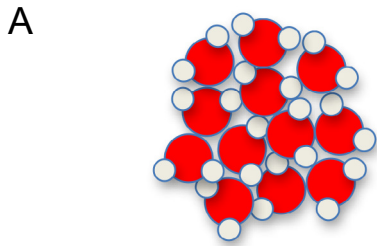
The properties of elements and compounds depend on how the atoms, molecules and giant structures are bonded together.

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

*A is a (pure substance) compound and a liquid.*

*Because:*

*the molecules are made from more than one type of atom*

*and the molecules are in contact with each other, but not in a pattern.*

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

*B is a (pure substance) element and a solid.*

*Because:*

*the particles are made from only one type of atom*

*and the particles are in contact and in a pattern.*

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

*C is a mixture and a gas*

*Because:*

*the molecules are of different types.*

*and the molecules are not in contact with each other.*

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

*D is a (pure substance) element and a liquid.*

*Because:*

*the particles are made from only one type of atom. (1 mark)*

*and the particles are in contact but not in a pattern. (1 mark)*

2. (5 minutes)

### The outer part of an atom

Outside the nucleus are the electrons.

They are very tiny indeed, with almost no mass - much, much smaller than protons and neutrons.

They move so fast around the nucleus that they form one or more 'shells' around it.

Each electron has a negative charge.

An atom normally has the same number of electrons as protons.

So the electrons' negative charge balances the protons' positive charge. This means that an atom normally has no charge.

The electrons fill the outer part of the atom, and are the part other atoms react with.

Describe the rest of the atom other than the nucleus

State what type of sub-atomic particle is found there, and describe what that particle is like.

Describe the differences between the particles outside the nucleus and those inside it.

Describe what the outer particles do.

### Answer

*The rest of the atom is made up of shells of electrons.*

*Electrons are very small in size, even compared to a proton or neutron.*

*They have a tiny mass, much less than a proton or neutron. Electrons move round the atom very, very fast, so fast that they seem to make complete shells round the nucleus.*

*Each electron has a negative charge that exactly balances the positive charge of a proton.*

*So in a neutral atom there has to be an equal number of protons and electrons (1 mark).*

*Also:*

*Electrons occupy most of the space in an atom.*

*As they are the outer part of the atom, they are only part of it that other atoms can interact with.*

3. (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.

What did the Ancients define as the elements?

*Earth, air, fire, water*

What do we define as an element?

*A substance whose atoms are all the same type*

Describe a particle of water; what is this particle called?

*Two hydrogen atoms bonded to one oxygen atom*

*This is a water molecule*

How many elements are there? And how many of these can be found in naturally?

*118 are known*

*90 occur naturally*

*from the text*

Describe what a particle of hydrogen peroxide would look like.

*Two hydrogen atoms would have chemical bonds to two oxygen atoms, it would look like water molecule with an extra oxygen atom in the middle (correct molecular structure not required at this stage).*

Would you expect hydrogen peroxide to have similar properties to water?

Yes

*The atoms making up the molecule of hydrogen peroxide are very similar to those making up water, and hydrogen peroxide is, like water, a molecular structure; so its properties are similar to those of water.*