**Build an Atom**

**Student Worksheet**

Name:

Class:

Date:

**Aim**

To build a model of an atom out of lollies and then turn it into an ion and an isotope.

**Background Information**

Atoms are the most basic building blocks of matter. They are so tiny that we can’t see them with the naked eye, but they make up everything on earth. In this investigation, you will build your own atom out of lollies. This will give you a better idea of what subatomic particles are and how they fit together.

The three subatomic particles are protons, neutrons, and electrons. These are organized in a very specific was to make sure that the atom is stable. The protons and neutrons are found in the nucleus of the atoms, which is at the centre of the atom. Electrons are found in orbitals (or shells) around the nucleus. Different orbitals have different energies and are found at different distances from the nucleus. Electrons are so far away from the nucleus that if the nucleus were the size of a golf ball, the closest electron would be a kilometer away!

Electrons are organized in a special way. Each orbital can only hold a certain number of electrons. The innermost orbital can hold two electrons, the next one out can hold eight electrons and the third orbital can also hold eight electrons. Electrons always fill up the orbital that is closest to the nucleus first. You wouldn’t find an atom with five electrons in the third shell but none in the first two shells!

Protons and neutrons are the same size. However, electrons are much, much smaller than these two particles. An electron is 1840 times smaller than a proton or neutron.

Protons are positively charged, neutrons are neutral, and electrons are negatively charged. Since protons and electrons have opposite charges, they attract each other. The neutrons act like a buffer and prevent the electrons and protons from crashing into each other.

An atom is neutral if it has the same number of protons and electrons. This means that the charges from the protons and electrons cancel out, so the atom has no net charge. If an electron is added to or removed from the atom, an ion is formed. The charges no longer cancel, so the ion carries a charge. Remember that electrons are negatively charged. This means that if an electron is added to the atom, the ion will have a negative charge. Likewise, if an electron is removed, the ion will have a positive charge.

Isotopes are another special type of atom. They occur when atoms have the same number of protons and electrons but different numbers of neutrons. This means that the mass number of the atom changes, but the atomic number stays the same. The number of neutrons in an isotope can be found by subtracting the atomic number from the mass number.

**Pre-Practical Questions**

1. Describe the structure of an atom. Your answer should discuss the three subatomic particles and where they are located within the atom

1. Compare and contrast protons, neutrons and electrons. Think about their size and charge.

1. What is the advantage of using a model, rather than trying to observe the real thing?

**Practical**

**Instructions**

Go through the safety information with the teacher.

Get into groups of three.

Inform the teacher of any allergies/intolerances you have.

Build the atom on a clean surface (especially if you want to eat it once the investigation is finished!)

Make sure the area is clear.

Read through the practical instructions and begin when ready.

**Materials**

* Range of lollies

**Method**

1. Decide which atom your group will build a model of. Choose an atom that has at least three protons.
2. Discuss which lollies your group will use to represent each subatomic particle. Think about how relative sizes and charges will be represented.
3. Calculate how many neutrons the atom needs to make the most common isotope. Do this by subtracting the atomic number from the mass number (round the mass number to the nearest whole number first).
4. Build an atom. This should be a neutral atom that is the most common isotope of your group’s element.
5. Research the most common ion that your element forms.
6. Adapt the model so that it forms this ion.
7. Turn the model back into a neutral atom.
8. Research another common isotope that your element forms.
9. Adapt the model to form this isotope.

**Results Questions**

1. Name the element that your group build a model of. State the number of protons, neutrons and electrons that were used in your model.

1. State the number of protons, neutrons and electrons that were needed to make ion model. Determine the charge of the ion.

1. State the number of protons, neutrons and electrons that were needed to make a model of the isotope.

**Discussion** **Questions**

1. Name the lollies that were used to represent each subatomic particle in your model. Explain how these lollies represented the relative sizes and charges of the subatomic particles.

1. Describe the electron configuration in the model of the neutral atom and describe how it changed when the ion model was made.

1. Research the atom that your group built. Explain what this element is used for.