Activity 3: Build an atom

Learning Intentions
Atoms have a core (nucleus) that is made up of protons and neutrons. Surrounding the nucleus is a cloud of particles known as electrons. The atom has two types of charged particles, the proton (+) and the electron (-). There is energy in these particles. It is the electron that is mobile and can leave its atom and it is the electron's movement through a circuit creates electrical energy (electricity). Except in certain circumstances, protons are fixed in the nucleus. They are immobile.

Atoms are mostly empty space and nearly all of this exists between the nucleus and the electrons.

The number of protons an atom has will determine what element it is. For example, Hydrogen has 1 proton, Helium has 2, Lithium has 3…and so on. The atom is most stable when it has the same number of protons and electrons that give it a neutral charge. Now it is time to build an atom model – one you can eat.

Materials

- Three different types of lolly, (or fruit if you want to be healthy). You will need three types to represent the neutrons, protons and electrons. Consider marshmallows, jubes or jelly beans. Anything you can stick a tooth pick or skewer into.
- Toothpicks
- Bamboo skewers
- Periodic table

Teacher Notes	Teaching Notes
The Atom and The Electron It was Benjamin Franklin in 1748 that suggested there were two types of charge that were opposites. The opposite charges attracted each other and like charges repelled each other. We now call these charges, positive and negative. It was not until 1897, however, that J. J. Thompson experimentally determined the existence of the electron and found it was the negatively charged particle. Our understanding of the atom today went through a few iterations over a few decades. J.J. Thomson used his knowledge of the electron to develop a model of the atom. It was still based on limited data and understanding, and consequently wrong. His model had the charged particles (electron and protons) all mixed in together in something akin to a charged soup, or as it was dubbed, a "plum pudding". Later we learned that an atom was mostly empty space, which is the knowledge that led us to our current understanding of the atom that has a nucleus where the protons and neutrons sit. Buzzing randomly around the nucleus in discrete energy levels are the electrons, with lots of space between the electrons and the nucleus. Imagine a tennis ball in the centre of a football ground. Inside the hollow tennis ball are all the protons and neutrons. Out in the grandstand where the crowd sit is the cloud of electrons randomly buzzing around the outside of the ground. This is a rough approximation of the distance between the nucleus and electrons and why atoms and therefore everything is mostly empty	Method Students can select an atom from the periodic table to build. Choose one with a lower atomic number otherwise you won't have enough lollies or fruit. Find the atomic number to know the number of protons and neutrons. Use the materials to build the model of your selected element. Assume you are building a neutral version – one that has equal numbers of protons, neutrons and electrons. Select which lolly or fruit will be the proton, neutron and electron. Use the toothpicks to join the protons and neutrons together to make the nucleus. Take the bamboo skewers and stick on an electron and join the other end of the skewer to a part of the nucleus. Note the large amount of space between the electrons and the nucleus. This reflects the fact an atom is mostly empty space. Take a photo of your model. Name the element and label the protons, neutrons and electrons *We have found that for upper primary students the process of looking at the periodic table, selecting their element and building it facilitates an understanding

space. For the older or more advanced students you can talk about each grandstand tier representing a distinct energy level or shell that the electrons are confined to as they move randomly though the tier that corresponds to their given energy level. Students can compare how their lolly models compare to different models through history. See Figure ? above on in the main resource [link]. Or there are loads of images on the web of the different atomics models as they were developed over time. Here is one - https://medium.com/@Intlink.edu/a-timeline-of-atomic-models-cb2607b1da85 Other resources Try the PHeT simulation to build an atom - https://phet.colorado.edu/sims/html/build-an-atom/latest/build-an-atom_en.html This website has a periodic table aimed at the primary level https://www.ducksters.com/science/periodic_table.php This site is more for the older kids – year 6-8, but it does contain insightful videos of each element - http://periodicvideos.com/	among many students that there is more than one sort of atom and they come in different sizes. ***Extension*** Get students to consider what a charged version would be. How would they change their atom to make it negative or positive charged version (ions)? That is, add or remove an electron. Get students to write the element with the correct charge eg, Na^+ or Cl^-

The concept of charge will be elaborated on as we move through the activities. Students will learn more about some of the scientists involved in making the initial discoveries that led to our current understanding of electricity

Before you explore in more detail the nature of electricity, get students to consider what they think electricity is. See the activity below, *What is electricity?* Draw a circuit [link]. This activity establishes a baseline understanding of circuits and electricity. It can be compared to their understanding at the end of the selected activities.