



Nat 5 : Unit 1 - Chemical Changes and Structure

Part A - Atomic Structure

Lesson 4 - Isotopes

Learning Outcomes

By the end of the lesson, you should be able to ...

1. State that atoms of the same element i.e., the same atomic number can have different mass numbers and these atoms are called Isotopes.
2. Explain that isotopes have the same number of protons but a different number of neutrons

Success Criteria

You will have been successful in this lesson if you:

1. Read and learn the notes given
2. Watch the links provided
3. Complete the self-checks provided

If you have any questions about the content of this lesson, you should ask your **class teacher** either through your class MS team or via email. MS Teams will be monitored throughout the week by a chemistry teacher. If you need help or clarification with either the task or the content of the lesson, just ask.

Links to Prior Knowledge

You may wish to revise the following to help you understand this lesson:

- Mass number and atomic number

You may wish to have a copy of the data booklet handy for this lesson. Download or print a copy of the Higher Chemistry Data Booklet from MS Teams or from the SQA website - [ChemistryDataBookletSQPN5.pdf \(sqa.org.uk\)](https://www.sqa.org.uk/ChemistryDataBookletSQPN5.pdf)



What to do

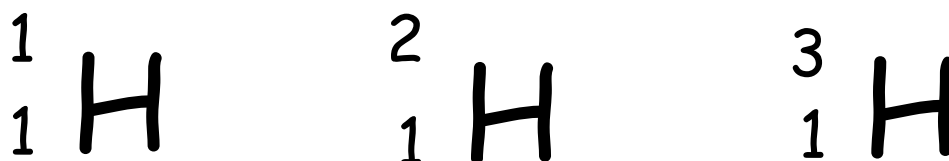
Work through the power point slide. Copy the notes (or print and stick into your note book). Follow the instructions to complete diagrams or tables. Remember to watch the video links

WATCH - [Atoms and isotopes - National 4 Chemistry - BBC Bitesize](#)
[YouTube - Isotopes: https://youtu.be/jULL0gH1_OI](https://youtu.be/jULL0gH1_OI)

Mass number and isotopes

The most common atom in the universe is a hydrogen atom that consists of one proton and one electron. Strangely, it possesses no neutrons, yet every other kind of atom does. There are, in fact, two others naturally occurring hydrogen atoms, one has a nucleus consisting of one proton and one neutron and the other has one proton and two neutrons in its nucleus.

These different atoms of the same element can be identified by their mass number. The atoms have the nuclide symbols shown below.



We can see that the difference between the isotopes is that they have different mass numbers. They have different mass numbers because they have different numbers of neutrons.

The atoms are said to be isotopes of hydrogen. Isotopes are atoms with the same atomic number but different mass numbers.

We have learned that since electrons are so light in comparison to protons and neutrons, the mass of an atom is determined by the total

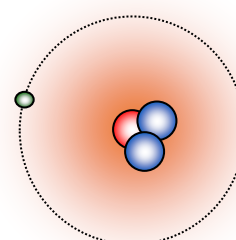
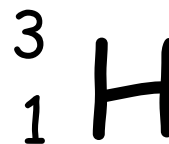
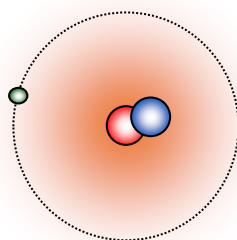
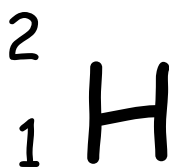
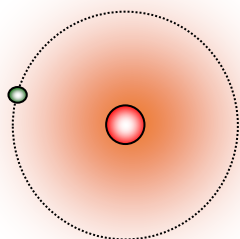
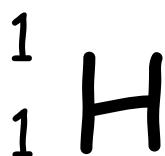


number of protons and neutrons in the nucleus. This total of protons and neutrons is called the mass number.

Mass number = number of protons + number of neutrons

For any element, the number of protons in the nucleus of its atoms is fixed and is referred to as the atomic number. **The number of neutrons can vary** and can be calculated by subtracting the atomic number from the mass number.

Mass number - atomic number = number of neutrons



These atoms are said to be isotopes of hydrogen. Isotopes are atoms with the same atomic number but different mass numbers.



Click on the link below to access the power point lesson on isotopes

Remember to add to your notes by copying or printing out and sticking in



Copy this definition into your notes

Definition

Atoms with the same **ATOMIC NUMBER** but different **MASS NUMBERS** are called **ISOTOPES**. They are atoms of the same element but have different numbers of neutrons.

Copy and Complete the tables below:

	${}^{35}_{17}\text{Cl}$	${}^{37}_{17}\text{Cl}$
Symbol	<i>Cl</i>	
Atomic Number	17	
Number of Protons	17	
Number of electrons	17	
Mass Number	35	
Number of Neutrons	$35-17 = 18$	

Isotopes have the same	Isotopes have different
ATOMIC NUMBER	MASS NUMBERS
NUMBER OF PROTONS	NUMBER OF NEUTRONS

For Fun Try the online quiz. Can you get more than 8/10??

https://www.ducksters.com/science/quiz/isotopes_questions.php

Further Reading



To learn more about isotopes, try the following online resources:

BBC Bitesize: [Atoms and isotopes - Nuclear atom and isotopes - Eduqas - GCSE Physics \(Single Science\) Revision - Eduqas - BBC Bitesize](#)

Evans2 chem web: <https://www.evans2chemweb.co.uk/login/index.php#>

Username: snhs password: giffnock

Select any teacher → revision material → Nat5 chemistry → Unit 1: chemical changes and structure → isotopes

Check your understanding - Answers the questions below in your class jotter

1. Atom A has an atomic number of 93 and a mass number of 239. Atom B has an atomic number of 94 and a mass number of 239. Are A and B isotopes? Explain your answer.
2. Two types of carbon atom exist, one has a mass number of 12, the other has a mass number of 14.
 - a) Write the nuclide notation for each atom showing the atomic and mass numbers.
 - b) Calculate the number of protons, neutrons, and electrons for the carbon atom with a mass of 14.
 - c) Give the electron arrangement of a carbon atom.
 - d) What name is given to atoms like the carbon atoms described above.
3. What is the definition of isotopes and how do isotopes differ.

**EXTRA WORK**

1. Give the electron arrangement of the following atoms. You will need to use your data book to find the atomic number

- a) ^{14}N
- b) ^{40}Ar
- c) ^{19}F
- d) ^{32}S

2. An atom of sodium with 12 neutrons and 10 electrons can be written as $^{23}\text{Na}^+$.

Represent each of the following atoms in a similar way.

- a) An atom of nitrogen with 7 neutrons and 10 electrons.
- b) An atom of hydrogen with a mass number of 2 and no electrons.
- c) An atom with 4 protons, 5 neutrons, and 5 electrons.
- d) An atom with 12 protons, 12 neutrons and 10 electrons

3. Fluoride ions are effective in preventing tooth decay. A fluoride ion contains 9 protons, 10 neutrons, and 10 electrons. The symbol for a fluoride ion is $^{19}\text{F}^-$.

Write the symbols for the following ions.

- a) A chloride ion which contains 17 protons, 20 neutrons, and 18 electrons.
- b) A calcium ion which contains 20 protons, 20 neutrons, and 18 electrons.
- c) A potassium ion which contains 19 protons, 20 neutrons, and 18 electrons.
- d) A beryllium ion which contains 4 protons, 5 neutrons and 2 electrons.

