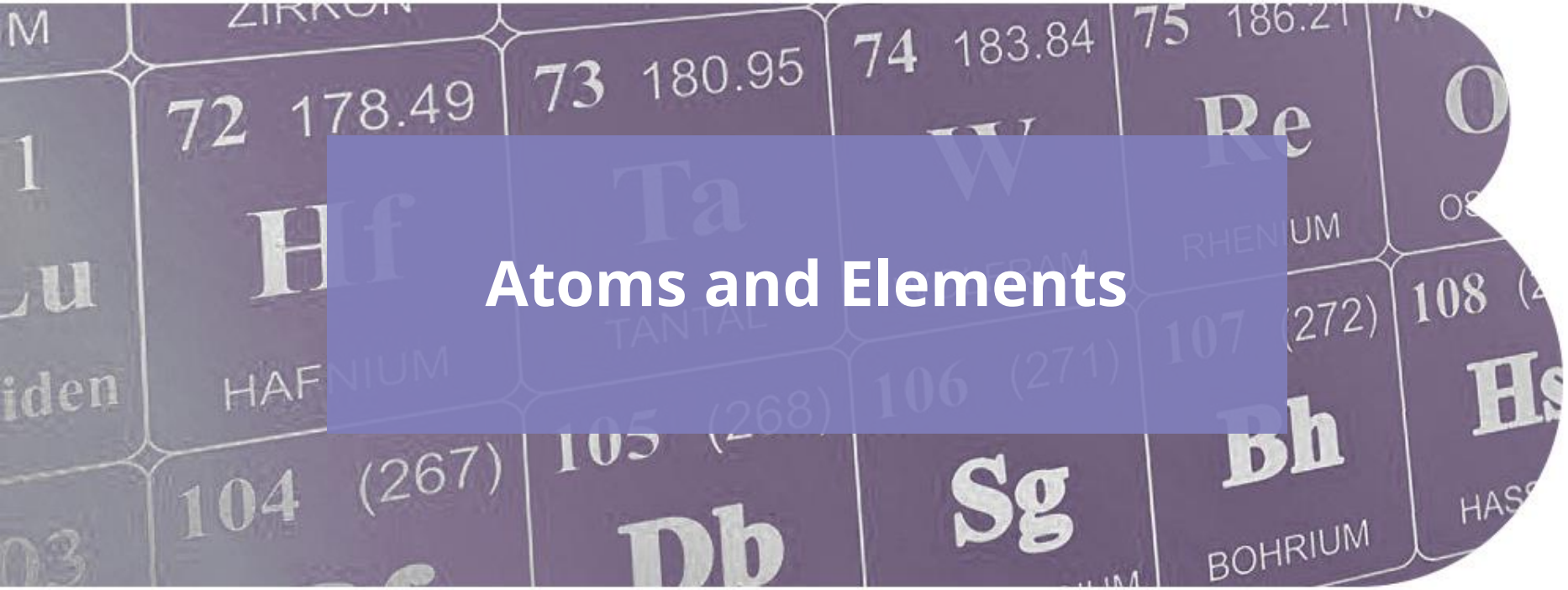


Atoms and Elements

BEYOND SCIENCE

Learning Objective

To understand the difference between atoms and elements.

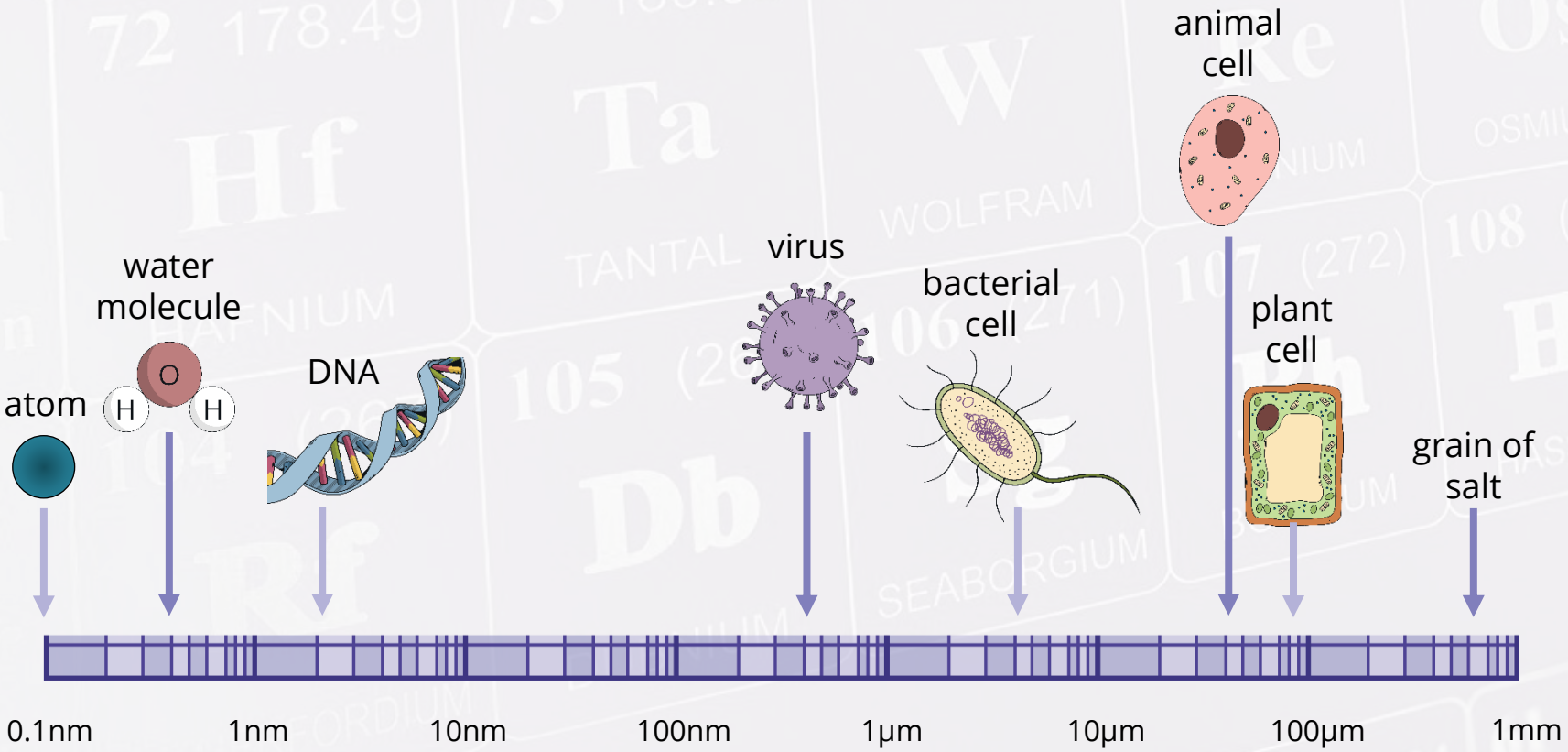
Success Criteria

- To state what an atom and element are.
- To describe the Dalton atomic model.
- To identify elements on the periodic table.

What Do You Think?

What is the smallest thing you can see?

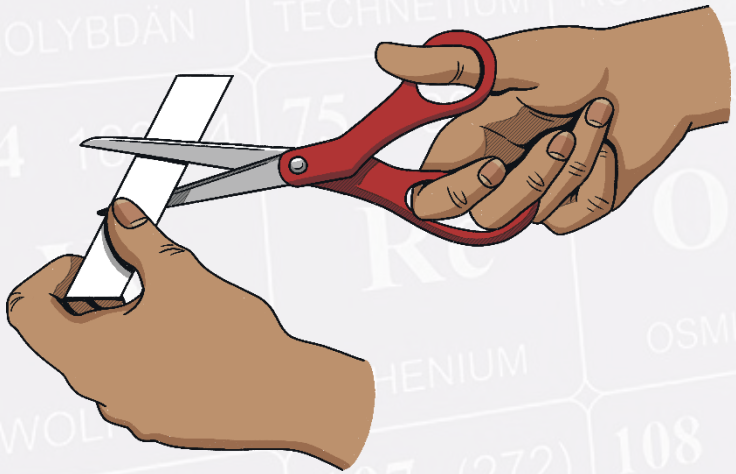
What is the smallest thing you know about?



The Smallest Piece of Matter

Cut your strip of paper in half. Each half of the paper has the same properties as the original strip.

Take one of the halves, and cut it in half again. How many times are you able to cut the paper in half before it is too small to cut anymore?



In 442BC, Democritus reasoned that if you continued to do this with a stone, eventually you would reach the point that the stone was so tiny it could no longer be divided.

He named these tiny pieces of matter *atomos* which is Greek for ‘indivisible’ (can’t be divided any further).

The Smallest Piece of Matter

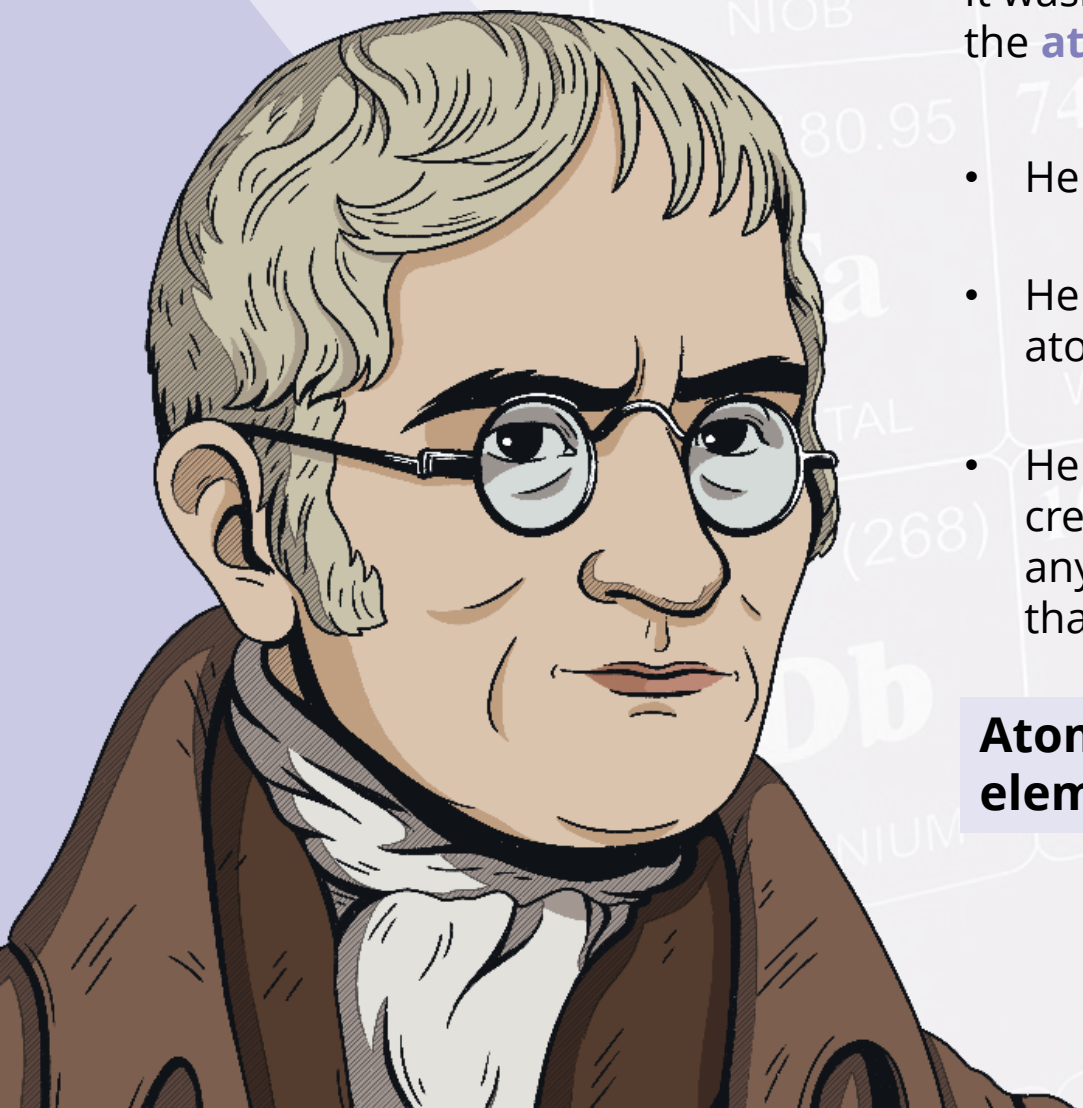
If you had the technology to do it, how many times do you think you would have to cut your strip of paper in half before you reached the point it could no longer be divided?

31!

After 31 cuts your paper would be 1×10^{-10} metres (that's 0.0000000001 metres!).

This is the radius of one **atom**, the modern word derived from Democritus' *atomos*.

An atom is so small that you could fit 7 million of them into the thickness of a crisp.



Atoms

It wasn't until 1803 that John Dalton formed the **atomic theory of matter**.

- He imagined atoms to be tiny spheres.
- He thought that all matter was made of atoms.
- He thought that atoms could not be created, destroyed, or broken down into anything else (although we now know that this isn't the case).

Atom: The smallest part of an **element** that can exist.

Elements

An element is a substance that cannot be broken down into other substances.

There are 92 naturally occurring elements. Gold and oxygen are examples of naturally occurring elements.

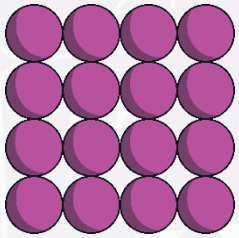
Dalton thought that:

- All atoms of the same element were identical (we now know it's not quite this simple!)
- Different elements have different types of atoms.

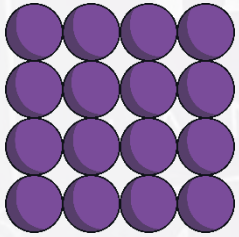
Element: A substance made of only one type of **atom**.

Atoms and Elements

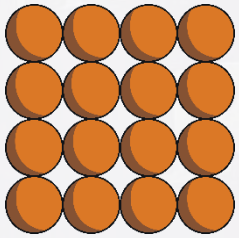
In the diagrams below, each circle represents one atom of that element.



The element gold is made of only gold atoms.
One atom of gold is the smallest amount of gold you can get.



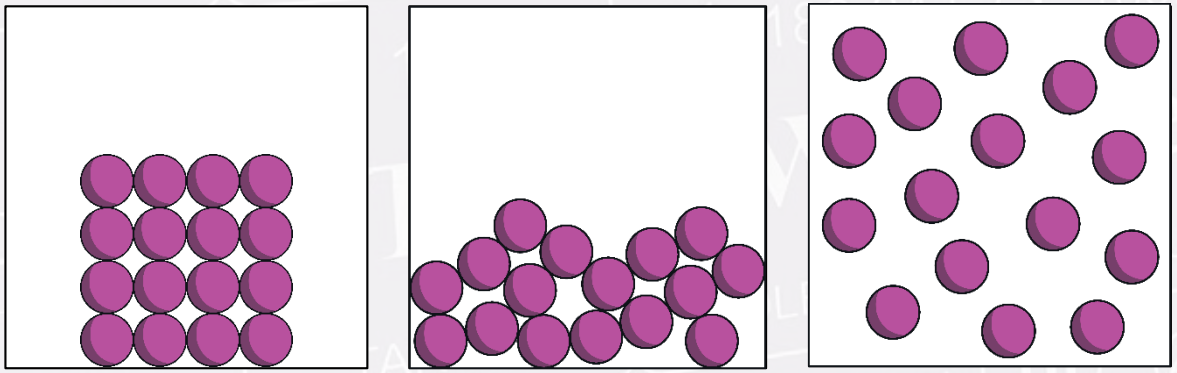
The element sodium is made of only sodium atoms.
One atom of sodium is the smallest amount of sodium you can get.



The element iron is made of only iron atoms.
One atom of iron is the smallest amount of iron you can get.

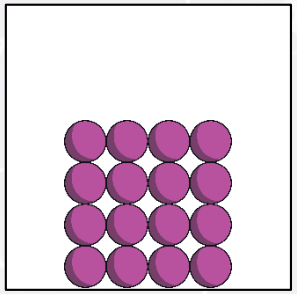
Elements and The Particle Model

How would the particles be organised in each of the states below?

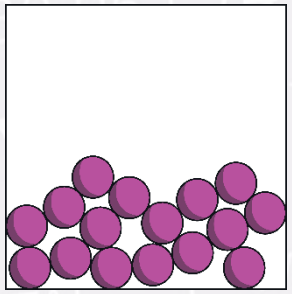


solid **liquid** **gas**

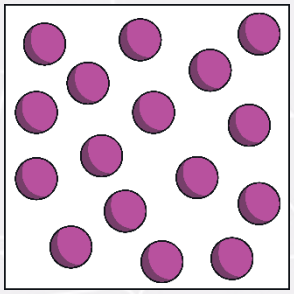
Elements and The Particle Model



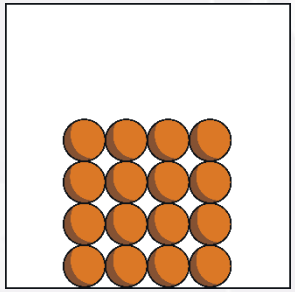
solid gold



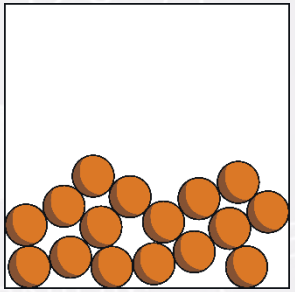
liquid gold



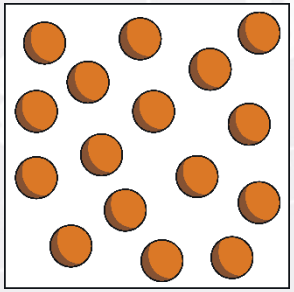
gaseous gold



solid iron



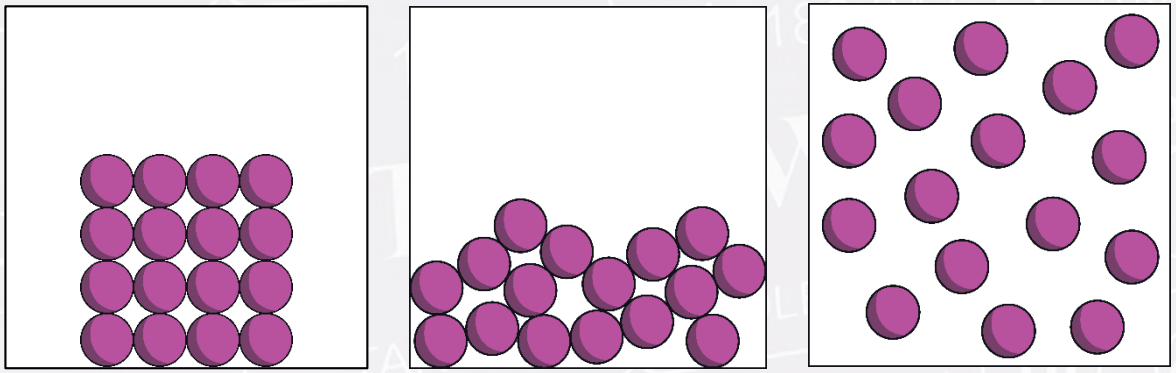
liquid iron



gaseous iron

Elements and The Particle Model

One atom alone does not have the properties of the element.



solid gold **liquid gold** **gaseous gold**

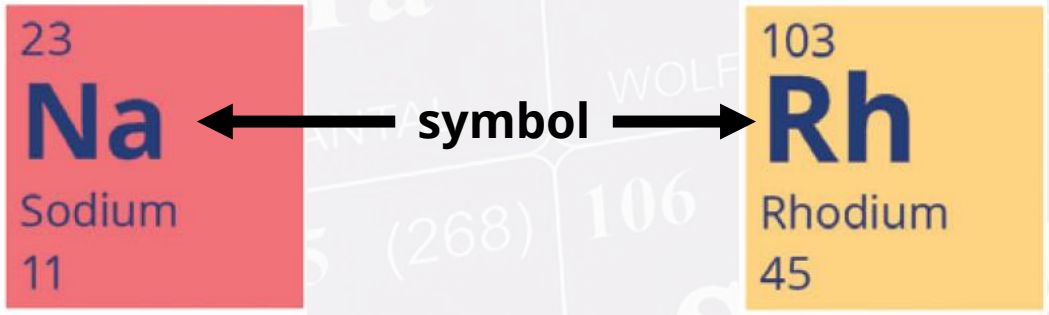
One atom of gold is not shiny or golden. Only a group of atoms together will look like gold.

One atom of gold is not a solid, a liquid or a gas.
Only a group of atoms together can melt or boil.

Chemical Symbols

Each element is represented by a symbol.

The symbol comes from the first letter or letters of its name. For elements discovered early on, the symbol usually comes from its Latin or Greek name. For example the symbol for sodium is Na, which comes from the Latin ‘natrium’.



The first letter of the symbol is always capitalised. Any following letters are lower case.

The symbol for each element can be found on the periodic table.

Instructions

You have been given the first paragraph of a story but it is incomplete. You need to use the periodic table to work out the missing words.

The number underneath each gap represents a sequence of elements in the key below.

Replace the name of the elements in the sequence with their symbol to spell a word.

Dalton was wearing a **HAt**.

1: hydrogen, astatine

Elements Storytelling

When she opened her eyes, she let out a _____ (1: gasp). _____ (2: How) did she get here? Her _____ (3: brain) was as much use as a _____ (4: chocolate) teapot. But this was no time for a lesson in _____ (5: thermodynamics). Come on, _____ (6: Luna), _____ (7: think)! The room was spinning; _____ (8: motion) _____ (9: sickness) was setting in. She needed air. She scrambled to her feet, trying not to _____ (10: barf). If she could just get to the _____ (11: psychic) _____ (12: unicorns), she was sure they would have some answers.

Elements Storytelling

Write the next paragraph of the story, including five missing words and a periodic table key to help the reader work them out.

Swap your story with a partner and see if they can figure out the missing words.

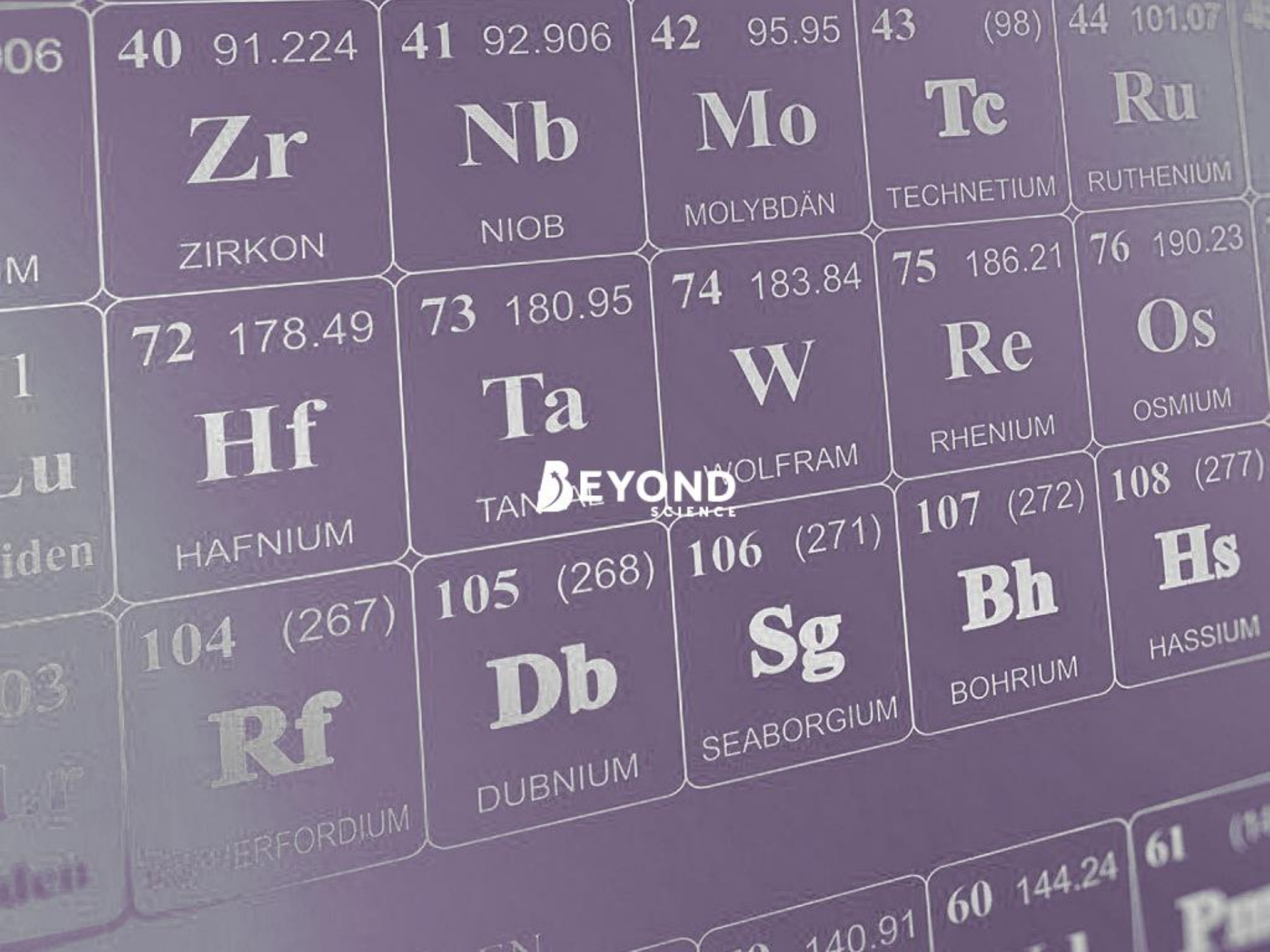
Atoms and Elements

Use the words in the box below to write a definition for each of the key words from this lesson.

Atom: The smallest part of an element that can exist.

Element: A substance made of only one type of atom.

part	of	made	type	The	exist	.		
atom	A	can	smallest	of	only	an		
substance	element	one	of	that	.			


40 91.224
Zr
ZIRKON
41 92.906
Nb
NIOB
42 95.95
Mo
MOLYBDÄN
43 (98)
Tc
TECHNETIUM
44 101.07
Ru
RUTHENIUM
72 178.49
Hf
HAFNIUM
73 180.95
Ta
74 183.84
W
WOLFRAM
75 186.21
Re
RHENIUM
76 190.23
Os
OSMIUM
104 (267)
Rf
105 (268)
Db
DUBNIUM
106 (271)
Sg
SEABORGIUM
107 (272)
Bh
BOHRIUM
108 (277)
Hs
HASSIUM
60 144.24
61
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SCIENCE