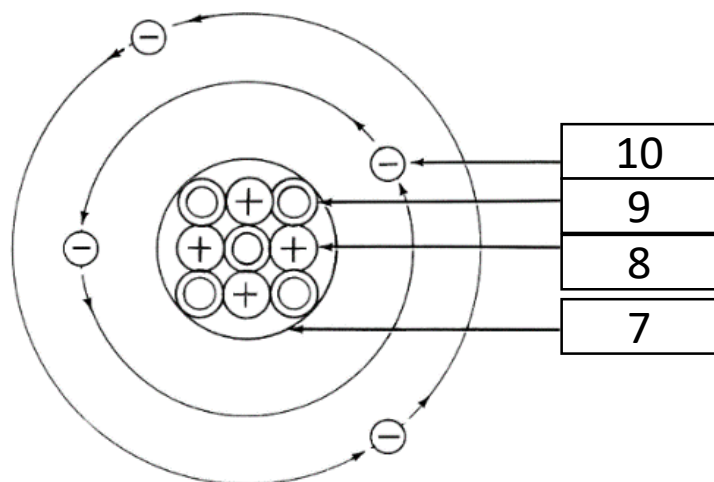


# Chemistry topic 1: Atomic structure

## 1. Keywords

<b>1. Atom</b>	The smallest possible piece of an element. Has a radius of 0.1nm (or $1 \times 10^{-10} \text{m}$ )
<b>2. Element</b>	A substance in which all the atoms have the same atomic number
<b>3. Isotope</b>	Atoms with the same number of protons but different numbers of neutrons
<b>4. Molecule</b>	Two or more atoms bonded together
<b>5. Compound</b>	Two or more <u>different</u> atoms bonded together
<b>6. Mixture</b>	At least two different elements or compounds together. Can be separated easily
<b>7. Nucleus</b>	The centre of an atom. Contains protons and neutrons
<b>8. Proton</b>	A positively charged particle found in the nucleus
<b>9. Neutron</b>	A neutral particle found in the nucleus. Has no charge
<b>10. Electron</b>	A negatively charged particle found in energy levels (shells) around the nucleus



## 2. Properties of sub-atomic particles

Particle	Relative mass	Relative charge	Location
Proton	1	+1	Nucleus
Neutron	1	0	Nucleus
Electron	0	-1	Shells

### Key

relative atomic mass  
**atomic symbol**  
name  
 atomic (proton) number

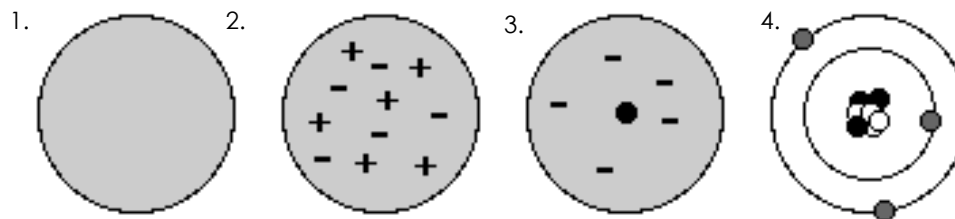
1  
**H**  
 hydrogen  
 1

## 3. Using the periodic table

Number of..	Is the...	Found by..
Protons	Atomic (proton) number	Smaller number on periodic table
Electrons	Atomic (proton) number	Smaller number on periodic table
Neutrons	Difference between the atomic mass and atomic number	Big number - small number

## 4. History of the atom

Discovery	By	Model	Diagram
Solid particle called atom	John Dalton	Particle: solid spheres	1
The electron	JJ Thompson	Plum pudding: positive 'cake' with negative 'plums'	2
Nucleus	Rutherford	Nuclear: Positive nucleus surrounded by electrons	3
Neutron	James Chadwick	Nuclear: Now with protons and neutrons in nucleus	3
Energy levels (shells)	Niels Bohr	Planetary: Electrons now 'orbit' in different shells	4



### 5. Electron arrangement rules

1.	Always fill from the inside to the outside
2.	The first shell can only hold 2 electrons
3.	The second and third can hold 8

### 6. History of the Periodic Table

Invented by	Dmitri <b>Mendeleev</b> , a Russian scientist.
Arranged	In order of <b>atomic mass</b> , and by their <b>chemical properties</b>
What was special about it?	<b>Predicted</b> the existence of <b>other elements</b> not discovered, and <b>left gaps</b> for them in his table
Why was it used?	<b>New elements</b> were <b>discovered</b> that <b>matched these gaps</b>

### 7. Properties – metals and non-metals

Property	Metals	Non-metals
Density	High (they feel heavy for their size)	Low (they feel light for their size)
Strength	Strong	Weak
Malleable or brittle	Malleable (they bend without breaking)	Brittle (they break or shatter when hammered)
Conduction of heat	Good	Poor (they are insulators)
Conduction of electricity	Good	Poor (they are insulators) apart from graphite

### Period No. of shells

1	1
2	2
3	3
4	4
5	5
6	6
7	7

### TL/DR:

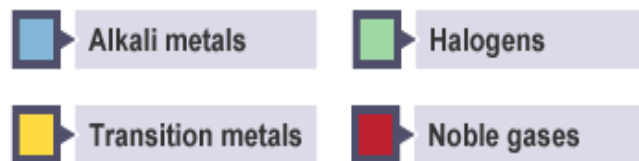
**Group number**  
Tells you're the number of outer electrons

**Period number**  
Tells you how many shells

### 8. Layout of the periodic table

#### Groups

	1	2		3	4	5	6	7	0									
	↓	↓																
	Li	Be							He									
	Na	Mg							Ne									
	K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
	Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe
	Cs	Ba	La	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn
	Fr	Ra	Ac															



Group	1	2	3	4	5	6	7	8
Electrons in outer shell	1	2	3	4	5	6	7	8
Charge of ion	+1	+2	+3	N/A	-3	-2	-1	N/A
Number of covalent bonds	N/A	N/A	N/A	4	3	2	1	N/A

N/A = not applicable (does not do it)

## 9. Properties – Groups 1 and 7

Group 1 (I)	Melting point	Density	Reactivity	Group 7 (VII)	Melting point	Density	Reactivity	Group 0 (VIII)	Melting point	Density	Reactivity
Lithium (Li)	<b>Decreases</b> down the group	<b>Increases</b> down the group	<b>Increases</b> down the group	Fluorine (F)	<b>Increases</b> down the group	<b>Increases</b> down the group	<b>Decreases</b> down the group	Helium (He)	<b>Increases</b> down the group	<b>Increases</b> down the group	<b>INERT</b>  <b>(DO NOT REACT)</b>
Sodium (Na)				Chlorine (Cl)				Neon (Ne)			
Potassium (K)				Bromine (Br)				Argon (Ar)			
Rubidium (Rb)				Iodine (I)				Xenon (Xe)			

## 10. Transition metals (TRIPLE ONLY)

Properties compared to group 1 elements	Other useful properties
More dense	Ions can have different charges
Harder	Form coloured compounds
Stronger	Good catalysts
Higher melting points	
Less reactive	

## 11. Common separation techniques

### 1. Chromatography

Used to separate a mixture of dyes in ink.

### 2. Filtration

Used to separate insoluble solids from liquids (e.g. sand from water).

### 3. Evaporation

Used to separate a soluble salt from solution. The solution is heated strongly in an evaporating basin until dry crystals are left.

### 4. Crystallisation

Used to separate a soluble salt from solution. The solution is heated gently in an evaporating basin until crystals form; the remaining liquid is filtered out.

### 5. Simple distillation

Is used to separate a liquid from a solution – e.g. water from ink. A condenser is used to cool hot gas until it forms a liquid.

### 6. Fractional distillation

Used to separate a mixture of liquids with different boiling points.