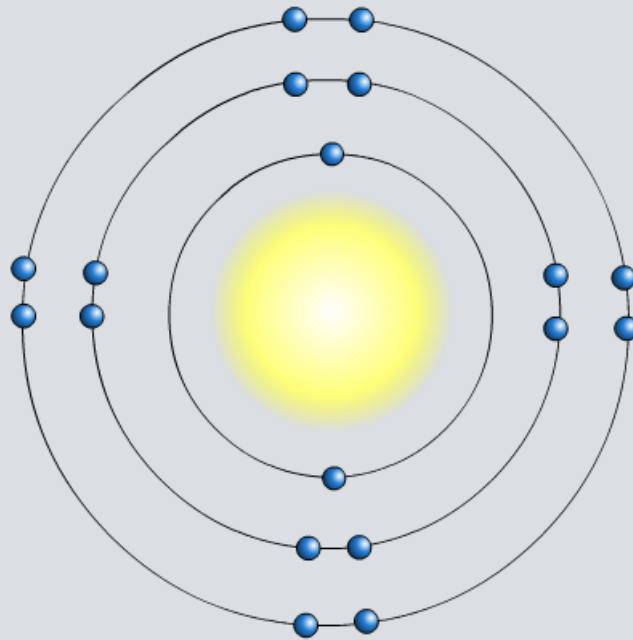


Electron Structure and the Periodic Table



The periodic table shows that patterns in the properties of elements are linked to atomic number.

What links atomic number and the properties of elements?

Electrons!

atomic number = number of protons

number of protons = number of electrons

atomic number = number of electrons

As atomic number increases by one, the number of electrons also increases by one.

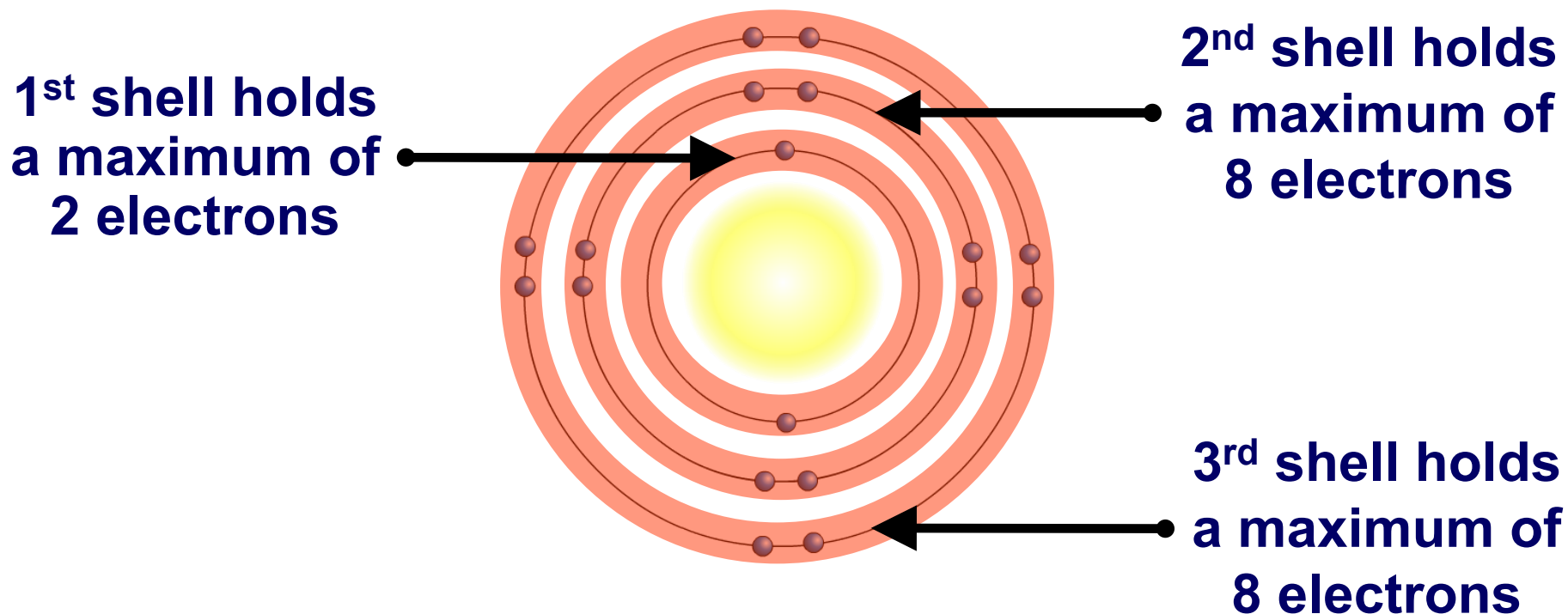
This means that the elements in the periodic table are also arranged in order of the number of electrons.



How are electrons arranged?

Electrons are arranged in **shells** around an atom's nucleus. (The shells can also be called energy levels).



Each shell has a maximum number of electrons that it can hold. Electrons will fill the shells nearest the nucleus first.



This **electron arrangement** is written as **2,8,8**.

Electrons in period 1

Elements in **period 1** only have electrons in the first shell.
Why are there only two elements in period 1?

	1	2	13	14	15	16	17	18
1	H							He
								
	1							2

The first shell can only hold a maximum of two electrons, so period 1 only includes the elements hydrogen and helium.

What is special about the outer shell of helium?



Electrons in period 2

Elements in **period 2** all have a complete first shell.

What happens to electrons in the **second shell** in period 2?

	1	2	13	14	15	16	17	18
2	Li	Be	B	C	N	O	F	Ne
	2,1	2,2	2,3	2,4	2,5	2,6	2,7	2,8

The second shell is completed one electron at a time going across the period from left to right.

What is special about the outer shell of neon?



Electrons in period 3

Elements in **period 3** have complete first and second shells.
What happens to electrons in the **third shell** in period 3?

	1	2	13	14	15	16	17	18
3	Na	Mg	Al	Si	P	S	Cl	Ar
	2,8,1	2,8,2	2,8,3	2,8,4	2,8,5	2,8,6	2,8,7	2,8,8

The third shell is completed one electron at a time going across the period from left to right.

What is special about the outer shell of argon?



Patterns of electron arrangement

Consider the electron arrangements of the first 20 elements in the periodic table.

	1	2	13	14	15	16	17	18
1	1							2
2	2,1	2,2	2,3	2,4	2,5	2,6	2,7	2,8
3	2,8,1	2,8,2	2,8,3	2,8,4	2,8,5	2,8,6	2,8,7	2,8,8
4	2,8,8,1	2,8,8,2						

What is the pattern of outer shell electrons in a group?

What is the pattern of outer shell electrons across a period?

What is the pattern of full electron shells in a group?



Trends **down** a group:

- the number of outer shell electrons is the same;
- the number of complete electron shells increases by one.

Trends **across** a period:

- the number of outer shell electrons increases by one;
- the number of complete electron shells stays the same.

The point at which a new period starts is the point at which electrons begin to fill a new shell.

Outer shell electrons are called **valence electrons**.
They are involved in bonding with other atoms.



Electrons and groups



Groups and periods

Click a number for more information about that group or period

1 2

13 14 15 16 17 18

1	H																He	
2	Li	Be										B	C	N	O	F	Ne	
3	Na	Mg										Al	Si	P	S	Cl	Ar	
4	K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
5	Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe
6	Cs	Ba	La*	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn
7	Fr	Ra	Ac*	Rf	Db	Sg	Bh	Hs	Ms	Ds	Rg	?	?	?	?	?	?	?



What's the electron arrangement?



What is the electron configuration of this element?

H																	He
Li	Be										B	C	N	O	F	Ne	
Na	Mg										Al	Si	P	S	Cl	Ar	
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	Rf	Db	Sg	Bh	Hs	Mt	Ds	Rg	?	?	?	?	?	?	?

potassium

2,8,7

2,8,1

2,8,8,1

2,4



Names of groups in the periodic table

Location of different categories of elements in the periodic table

H																	He
Li	Be											B	C	N	O	F	Ne
Na	Mg											Al	Si	P	S	Cl	Ar
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*	Rf	Db	Sg	Bh	Hs	Ms	Ds	Rg	?	?	?	?	?	?	?



alkali metals

alkaline earth metals

transition metals

halogens

noble gases



What are the missing words about the periodic table and electron structure?

1. Elements in the periodic table are arranged in order of the number of .

2a. are arranged in shells around the nucleus.

b. Electrons will fill the shells the nucleus first.

3a. The first shell can hold a maximum of electrons.

b. The second and third shells can hold a maximum of



solve

