

Chemistry Topic 1 Revision

Atomic Structure and the Periodic Table

Key word	Definition
Element	substances made of more than 1 atom joined together
Mixture	substances that contain atoms of at least two elements that are chemically combined
Compound	substances that contain only 1 type of identical atom
Molecule	substances that contain atoms of at least two elements that are not chemically combined

Match up the separation technique with the substances it can separate

Simple distillation

Separates a liquid mixture, e.g. crude oil, into fractions based on their different boiling point

Fractional distillation

Separates an insoluble solid from a liquid or solution

Filtration

Separates mixtures of soluble substances, e.g. different coloured inks, that have different boiling points

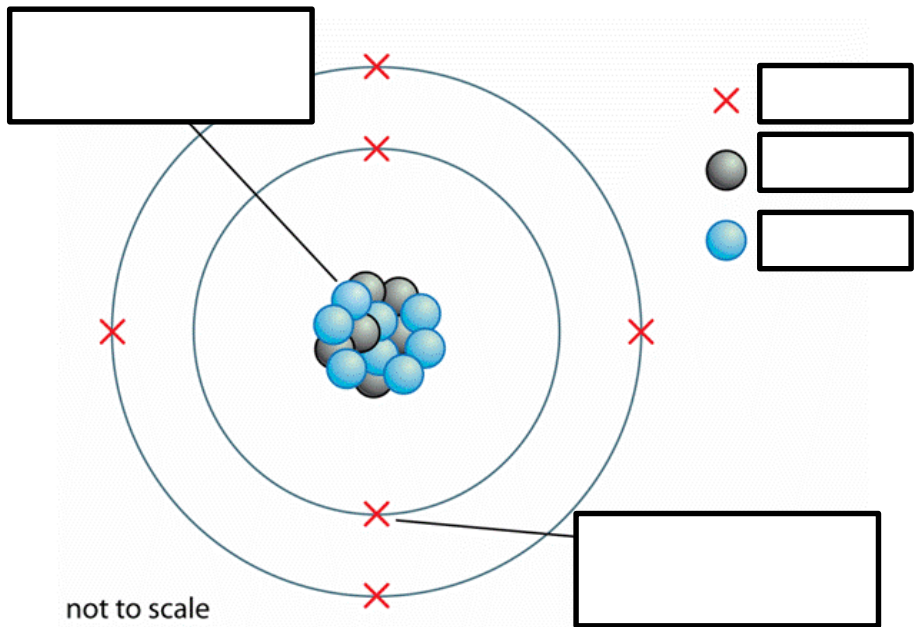
Crystallisation

Separates dissolved chemical substances by taking advantage of their different rates of migration

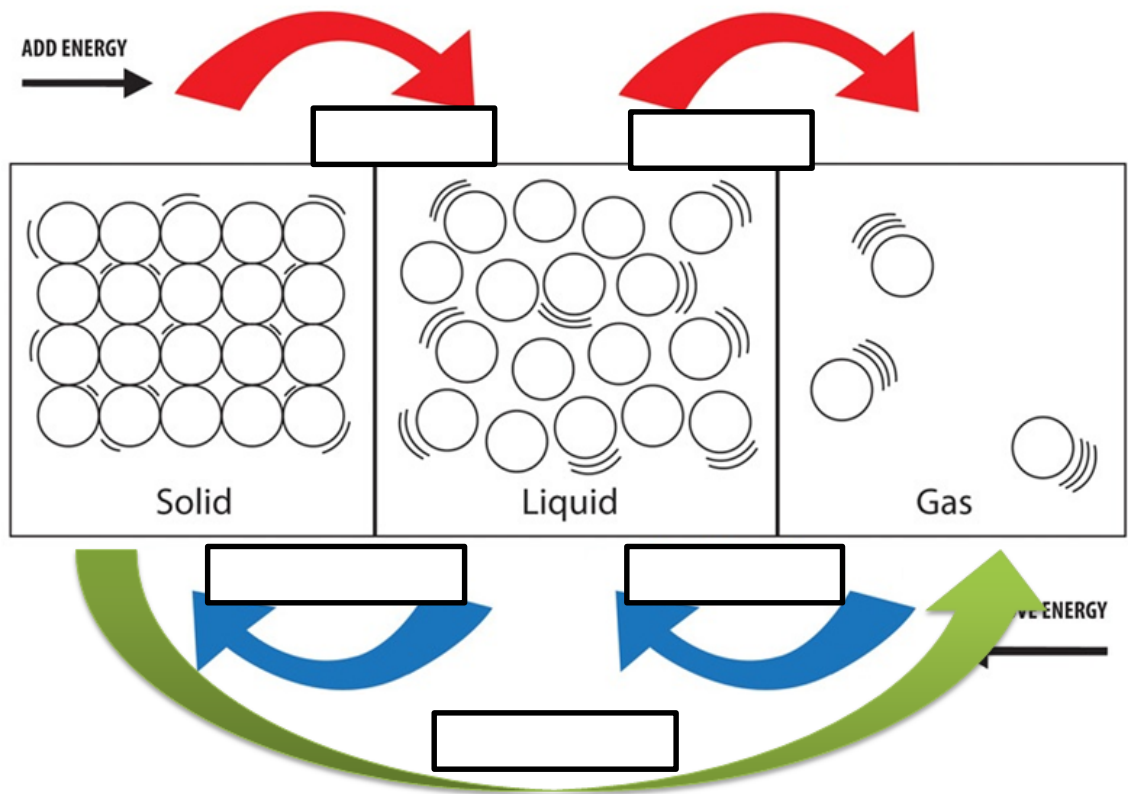
Paper chromatography

Separates a soluble solid from the solution or liquid that is has been dissolved in (it's solvent)

Label this atom:



Particle	Relative mass	Relative charge
Proton		
Neutron		
Electron		



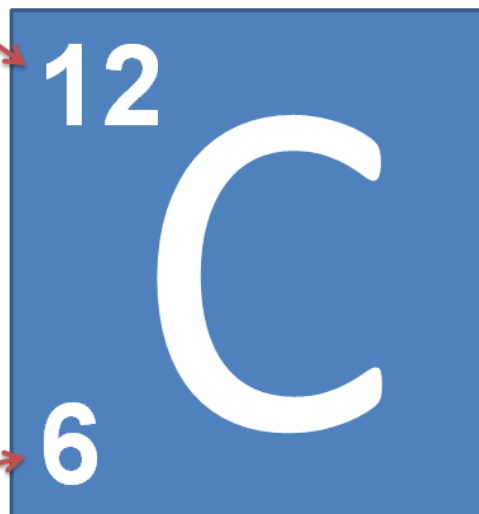
Relative atomic mass

= p _____ AND n _____

= e _____

= p _____

**Atomic or
proton number**



Symbol	Atomic number	Mass number	Number of protons	Number of electrons	Number of neutrons
He	2	4	2	2	2
C	6	12	6		
H	1	1	1		
Ca	20	40		20	
P	15	31			
F	9	19			

Electron configuration: the first shell can only hold 2 electrons but each shell after that can hold 8. Draw the electron configuration of...

Lithium

Boron

Fluorine

Isotopes are different atomic forms of the same e_____, they have the same number of p_____ but a different number of n_____

RAM = Relative atomic mass



$$\text{RAM} = \frac{(\text{mass of isotope}_1 \times \text{abundance}_1) + (\text{mass of isotope}_2 \times \text{abundance}_2)}{\text{total abundance (100)}}$$

Isotope	abundance
^{37}Cl	25%
^{35}Cl	75%

Calculate the RAM for chlorine...

Group	Properties
Group 1 Alkali metals	<ul style="list-style-type: none"> • They all have ____ electron in their outer shell • The reactivity of the elements i_____ going down the group • They react with oxygen to form oxides (e.g. sodium + oxygen → _____) • They react with chlorine to form chlorides (e.g. lithium + chlorine → _____) • They react with water to form hydroxides (e.g. potassium + water → _____ + hydrogen)
Group 7 Halogens	<ul style="list-style-type: none"> • They have ____ electrons in their outer shell • They are non-metals and exist as d_____ molecules, eg. Cl_2 • The further down the group an element is the h_____ its relative molecular mass, melting point and boiling point • The reactivity of the elements d_____ going down the group • A more reactive halogen can d_____ a less reactive halogen from an aqueous solution of its salt (e.g. fluorine + potassium bromide → _____ + _____)
Group 0 Noble gases	<ul style="list-style-type: none"> • They are u_____ • They have ____ electrons in their outer shell, except for helium, which has only ____ electrons • The boiling points of the noble gases i_____ with increasing relative atomic mass (going down the group)

This question is about elements and the periodic table.

- (a) Newlands and Mendeleev both produced early versions of the periodic table.

- (i) Complete the sentence.

In their periodic tables, Newlands and Mendeleev arranged the elements in order of

(1)

- (ii) Name the particle that allowed the elements to be arranged in order of their atomic number in the modern periodic table.

(1)

- (b) The diagram below shows the position of nine elements in the modern periodic table.

[illegible]

- (i) Which **one** of the nine elements shown in the diagram above has the lowest boiling point?

(1)

(ii) Copper and potassium have different melting points and boiling points.
Give **one other** difference between the properties of copper and potassium.

.....

.....

(1)

(iii) Explain why the reactivity of the elements increases going down Group 1 from lithium to rubidium but decreases going down Group 7 from fluorine to iodine.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

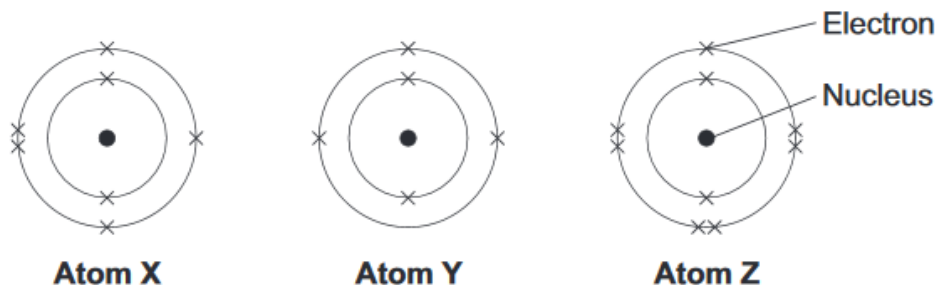
.....

(4)
(Total 8 marks)

1 (c) **Figure 2** shows the electron arrangements of three different atoms, **X**, **Y** and **Z**.

These atoms are from elements in the second row (lithium to neon) of the periodic table.

Figure 2



Which atom is from an element in Group 3 of the periodic table?

[1 mark]

Tick (✓) **one** box.

Atom X

☐

Atom Y

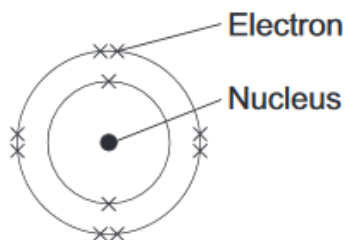
☐

Atom Z

☐

1 (d) **Figure 3** shows the electron arrangement of a different atom from an element in the second row of the periodic table.

Figure 3



1 (d) (i) Give the chemical symbol of this element.

[1 mark]

1 (d) (ii) Why is this element unreactive?

[1 mark]

4 **Figure 2** shows the chemical symbols of five elements in the periodic table.

Figure 2

Group 1 2							3 4 5 6 7 0				
											He
									C		
Na											Cl

4 (a) Choose the correct chemical symbol from **Figure 2** to complete each sentence.

4 (a) (i) The element that is an alkali metal is

[1 mark]

4 (a) (iii) The element in Group 4 is

[1 mark]

4 (a) (iv) The element with a full outer energy level (shell) of electrons is

[1 mark]

4 (b) Which other element goes in the shaded box in **Figure 2**?

[1 mark]

7 This question is about the periodic table of elements.

Use the Chemistry Data Sheet to help you to answer these questions.

In 1869 Dmitri Mendeleev produced an early version of the periodic table.

7 (a) Draw a ring around the correct answer to complete each sentence.

7 (a) (i) Mendeleev first arranged the elements in order of their

atomic weight.

date of discovery.

electron number.

[1 mark]

7 (a) (ii) Mendeleev then placed elements with similar properties in columns called

groups.

periods.

shells.

[1 mark]

7 (a) (iv) Mendeleev was not able to include the noble gases (Group 0) in his periodic table

because the noble gases

are not elements.

are not reactive.

had not been discovered by 1869.

[1 mark]

7 (b) Use the correct word from the box to complete each sentence.

[2 marks]

electrons

molecules

neutrons

protons

In the modern periodic table elements are arranged in order of the number of in their nucleus. Elements in the same group have the same number of in their highest energy level (outer shell).

7 (d) Chlorine, bromine and iodine are in Group 7 of the periodic table.

Chlorine is more reactive than bromine.

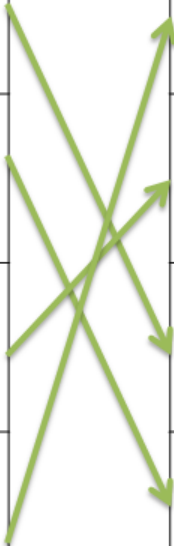
7 (d) (i) Complete the word equation for the reaction between chlorine and sodium bromide.

[1 mark]

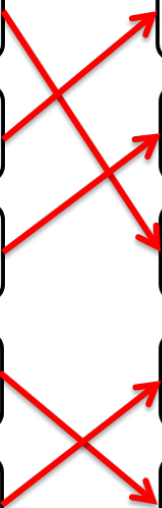
chlorine + sodium bromide \longrightarrow + sodium chloride

Answers

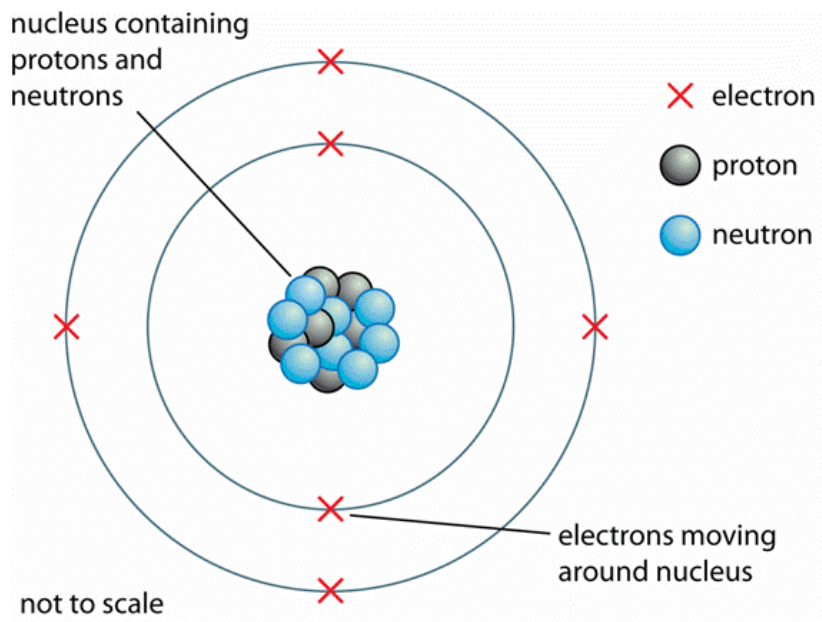
Key word	Definition
Element	substances made of more than 1 atom joined together
Mixture	substances that contain atoms of at least two elements that are chemically combined
Compound	substances that contain only 1 type of identical atom
Molecule	substances that contain atoms of at least two elements that are not chemically combined



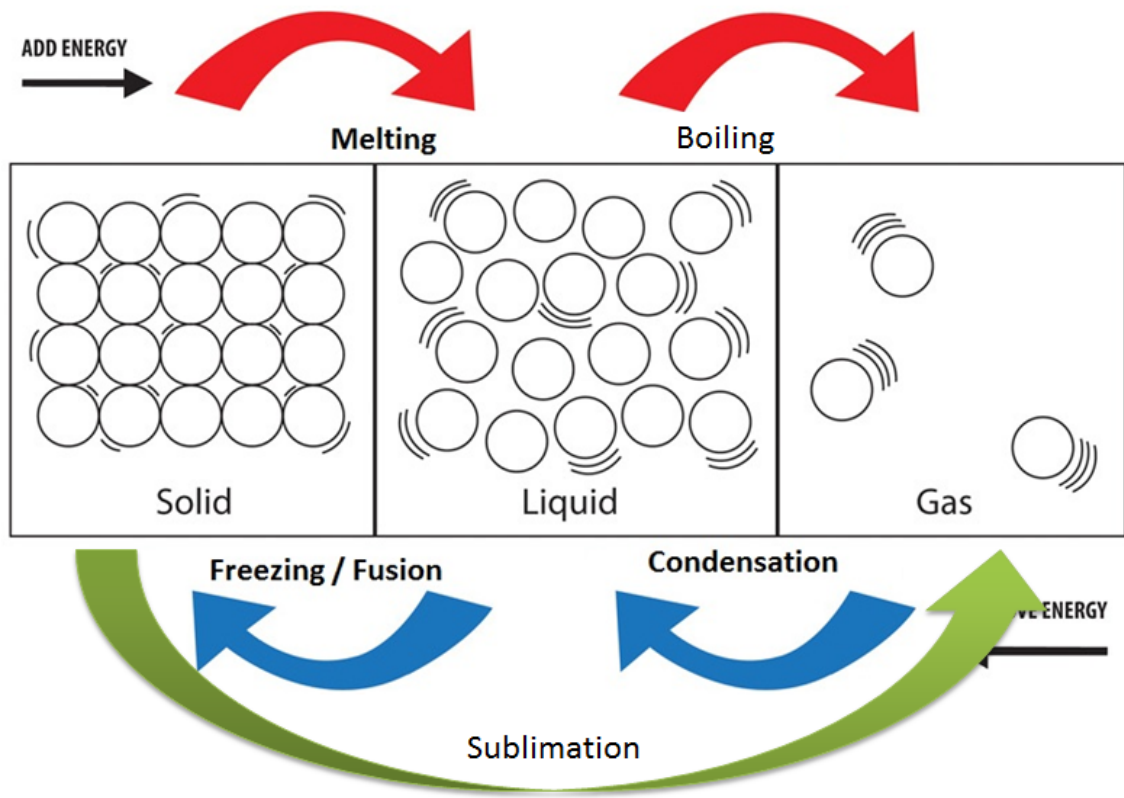
Simple distillation	Separates a liquid mixture, e.g. crude oil, into fractions based on their different boiling point
Fractional distillation	Separates an insoluble solid from a liquid or solution
Filtration	Separates mixtures of soluble substances, e.g. different coloured inks, that have different boiling points
Crystallisation	Separates dissolved chemical substances by taking advantage of their different rates of migration
Paper chromatography	Separates a soluble solid from the solution or liquid that is has been dissolved in (it's solvent)



Label this atom:



Particle	Relative mass	Relative charge
Proton	1	+1
Neutron	1	0
Electron	Negligible (almost 0)	- 1



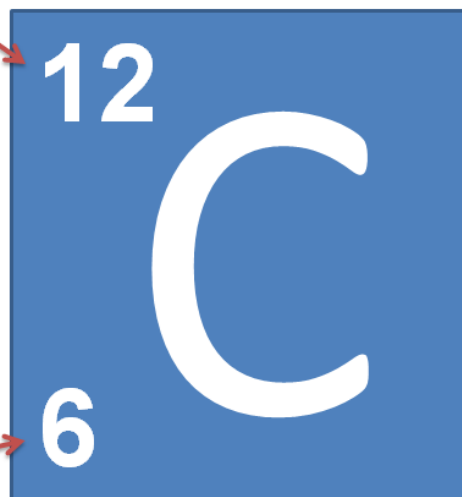
Relative atomic mass

= protons AND neutrons

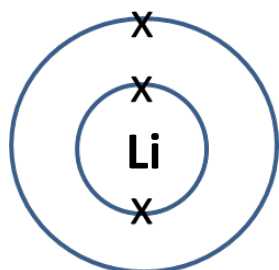
= electrons

= protons

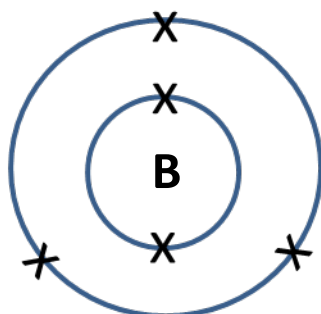
Atomic or
proton number



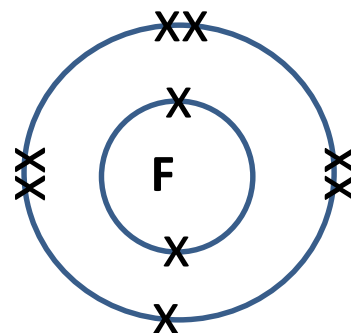
Symbol	Atomic number	Mass number	Number of protons	Number of electrons	Number of neutrons
He	2	4	2	2	2
C	6	12	6	6	6
H	1	1	1	1	0
Ca	20	40	20	20	20
P	15	31	15	15	16
F	9	19	9	9	10



Lithium 2,1



Boron 2,3



Fluorine 2,7

Isotopes are different atomic forms of the same element, they have the same number of protons but a different number of neutrons

RAM = Relative atomic mass



$$\text{RAM} = \frac{(\text{mass of isotope}_1 \times \text{abundance}_1) + (\text{mass of isotope}_2 \times \text{abundance}_2)}{\text{total abundance (100)}}$$

Isotope	abundance
^{37}Cl	25%
^{35}Cl	75%

$$\text{RAM} = \frac{(37 \times 25) + (35 \times 75)}{100} = 35.5$$

Group	Properties
Group 1 Alkali metals	<ul style="list-style-type: none">• They all have 1 electron in their outer shell• The reactivity of the elements increases going down the group• They react with oxygen to form oxides (e.g. sodium + oxygen → sodium oxide)• They react with chlorine to form chlorides (e.g. lithium + chlorine → lithium chloride)• They react with water to form hydroxides (e.g. potassium + water → potassium hydroxide + hydrogen)
Group 7 Halogens	<ul style="list-style-type: none">• They have 7 electrons in their outer shell• They are non-metals and exist as diatomic molecules, eg. Cl_2• The further down the group an element is the higher its relative molecular mass, melting point and boiling point• The reactivity of the elements decreases going down the group• A more reactive halogen can displace a less reactive halogen from an aqueous solution of its salt (e.g. fluorine + potassium bromide → potassium fluoride + bromine)
Group 0 Noble gases	<ul style="list-style-type: none">• They are unreactive• They have eight electrons in their outer shell, except for helium, which has only two electrons• The boiling points of the noble gases increase with increasing relative atomic mass (going down the group)

(a)	(i)	atomic weights <i>allow atomic masses</i>	1
	(ii)	proton <i>allow proton number</i>	1
(b)	(i)	F/fluorine <i>allow F₂</i>	1
	(ii)	any one from: <ul style="list-style-type: none"> copper has a higher density copper is stronger copper is harder copper is less reactive <i>allow named property</i> <i>ignore colour, conductivity, melting point and boiling point</i> <i>allow converse for potassium</i>	1
	(iii)	relative distance from nucleus <i>allow more / fewer energy levels / shells or larger / smaller atom</i>	1
		relative attraction to nucleus <i>allow more / less shielding</i>	1
		relative ease of gain or loss of electron	1
		opposite explanation of ease of gain or loss of electron for other group <i>max 3 marks if 'outer' not mentioned</i>	1

1(c)	atom Y		1	AO2 1.1.1 h; 1.1.2a	
1(d)(i)	Ne	allow neon	1	AO2 1.1.2a/b	
1(d)(ii)	has a full outer shell or full outer energy level or has 8 electrons in its outer shell	allow in Group 0 allow a noble gas allow the shells are full ignore in Group 8	1	AO2 1.1.2b; 1.1.3a	
2(a)(i)	Na	allow sodium	1	AO1 3.1.3.a	
2(a)(iii)	C	allow carbon	1	AO2 3.1.2.b	
2(a)(iv)	He	allow helium	1	AO1 3.1.2.b	
2(b)	H	allow hydrogen do not allow H ₂	1	AO2 3.1.2.b	
1(a)(i)	atomic weight		1	1 / 3.1.1a	A
1(a)(ii)	groups		1	1 / 3.1.1a	A
1(a)(iv)	had not been discovered by 1869		1	3 / 3.1.1b	A
1(b)	protons electrons	<i>must be in correct order</i>	1 1	1 / 3.1.2a/b	G
1(d)(i)	bromine	allow Br ₂ / Br do not allow bromide	1	2 / 3.1.3g	E

- (c) any **two** from:
ignore other properties / specific reactions
they / it = transition elements

transition elements:

allow if state group 1 elements

- high melting point **or** high boiling point
 - *low melting point or low boiling point*
- high density
 - *low density*
- strong / hard
 - *weak / soft*
- not very reactive
 - *reactive*
- catalysts
 - *not catalysts*
- ions have different charges
 - *+1 ions*
- coloured compounds
 - *white compounds*