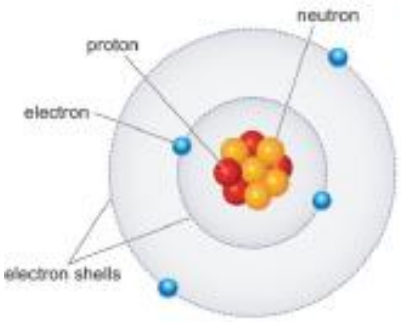
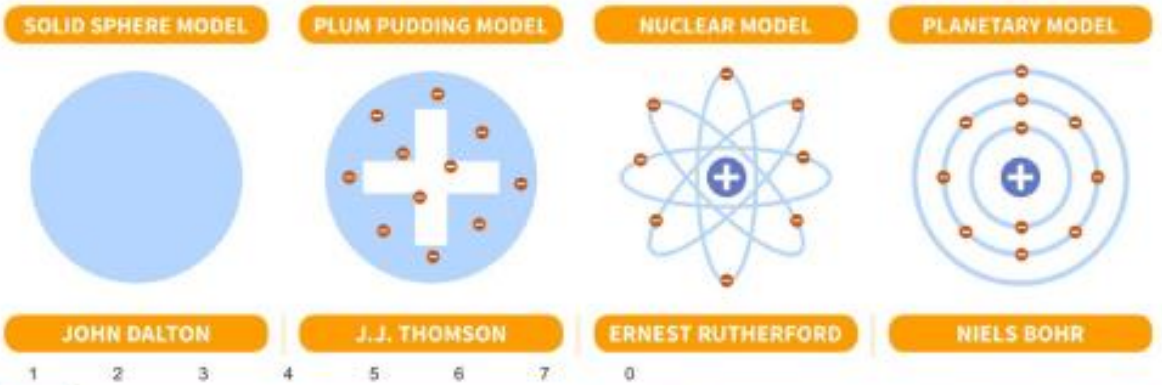
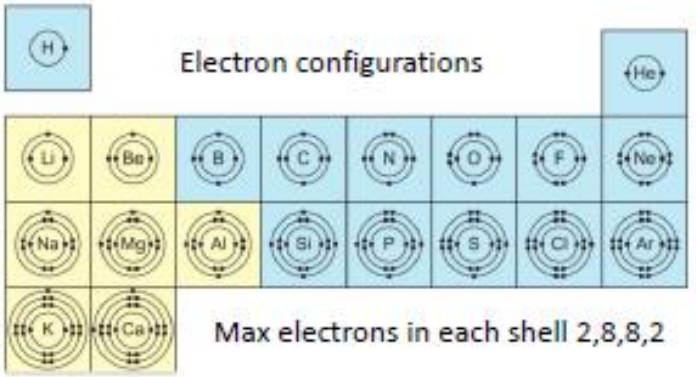
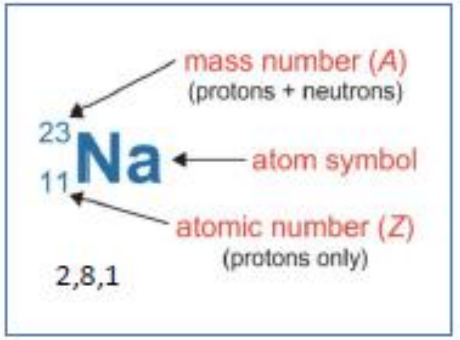
1	**Atom** is the smallest neutral part of an element that can take part in chemical reactions
2	**Element** is a substance made up of one type of atom
3	**A proton is a** small positively charged particle with a relative mass of 1
4	**A neutron** is a small neutral particle with a relative mass of 1
5	**An electron** is a small negatively charged particle with a relative atomic mass of 0.0005 (negligible)
6	**Nucleus** consists of protons and neutrons and is at the centre of every atom
7	**Electron** shell an area around a nucleus that can be occupied by electrons
8	**Periodic Table** is a chart of elements arranged in order of increasing atomic number
9	**Atomic number** of an element is the number of protons in its nucleus
10	**Mass number** of an element is the number of protons and neutrons in its nucleus
11	**Isotope** of an element has the same number of protons but a different number of neutrons
12	**Chemical properties** are how a substance reacts with other substances
13	**Physical properties** are how a substance responds to changes in force and energy
14	**Relative atomic mass** is the mean mass of an atom relative to the mass of an atom of carbon-12 which is assigned a mass of 12



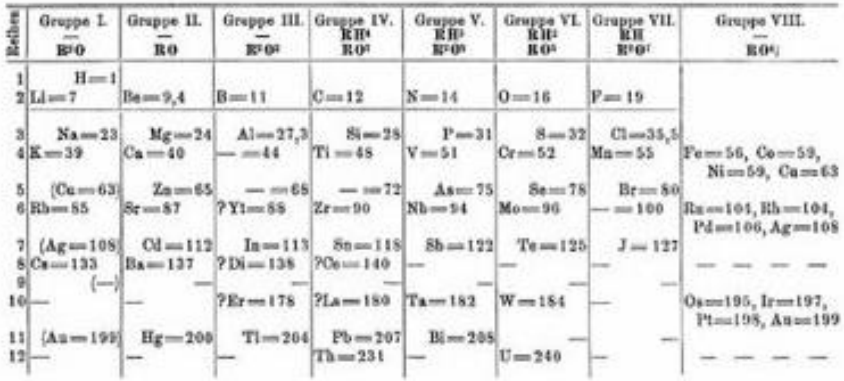
Standard form	number	prefix	Word
$1x10^{9}$	1,000,000,000	Giga (G)	Billion
$1x10^{6}$	1,000,000	Mega (M)	Million
$1x10^{3}$	1,000	Kilo (K)	Thousand
1			
$1x10^{-3}$	0.001	Milli (m)	Thousandth
$1x10^{-6}$	0.000 001	Micro (μ)	Millionth
$1x10^{-9}$	0.000 000 001	Nano (n)	billionth







1	**Dmitri Mendeleev** arranged elements in order of increasing atomic mass in the first periodic table (fig.1)
2	He left **gaps** for in his table for elements that were undiscovered.
3	He would **swap** the positions of elements in the table such as iodine and tellurium suited to their chemical properties (fig.2)
4	Mendeleev was able to make **predictions** about undiscovered elements using the information he gathered about the properties of already discovered elements.
5	The elements in the modern periodic table are arranged in **increasing atomic number**
6	**Elements** in a row are called periods in order of increasing atomic number.
7	**Elements** with similar properties are in groups.
8	**Non-metals** are found to the righthand side of the table.
9	**Electrons** are found **on orbits/shells**. The way in which they are arranged is called the electron configuration.
10	The first orbit/shell can hold up to 2 electrons. The second and third orbit/shell can hold up to 8 electrons.
11	For example if chlorine has 17 electrons it will have: -2 electrons in the first orbit/shell -8 electrons in the second orbit/shell -7 electrons in the third orbit/shell (fig.3)
12	The number of occupied orbit/shells in an atom of an element is equal to the period number.
13	The number of electrons in the outer orbit/shell is equal to the group number.
14	Group 0 elements have a full outer shell.
15	Electron configuration is directly related to the position of elements in the periodic table.
16	Electrons start to fill up their orbit/shells from the centre of the atom to outwards.



Reihen	Gruppe I. R²O	Gruppe II. RO	Gruppe III. R²O³	Gruppe IV. RH⁴ RO²	Gruppe V. RH³ R²O⁵	Gruppe VI. RH² RO³	Gruppe VII. RH R²O⁷	Gruppe VIII. RO⁴
1	H=1							
2	Li=7	Be=9,4	B=11	C=12	N=14	O=16	F=19	
3	Na=23	Mg=24	Al=27,3	Si=28	P=31	S=32	Cl=35,5	
4	K=39	Ca=40	—=44	Ti=48	V=51	Cr=52	Mn=55	Fe=56, Co=59, Ni=59, Cu=63
5	(Cu=63)	Zn=65	—=68	—=72	As=75	Se=78	Br=80	
6	Rb=85	Sr=87	?Yt=88	Zr=90	Nb=94	Mo=96	—=100	Ru=104, Rh=104, Pd=106, Ag=108
7	(Ag=108)	Cd=112	In=113	Sn=118	Sb=122	Te=125	J=127	
8	Cs=133	Ba=137	?Di=138	?Ce=140	—	—	—	— — — —
9	(—)	—	—	—	—	—	—	
10	—	—	?Er=178	?La=180	Ta=182	W=184	—	Os=195, Ir=197, Pt=198, Au=199
11	(Au=199)	Hg=200	Tl=204	Pb=207	Bi=208	—	—	
12	—	—	—	Th=231	—	U=240	—	— — — —

Fig.1

Fig.2

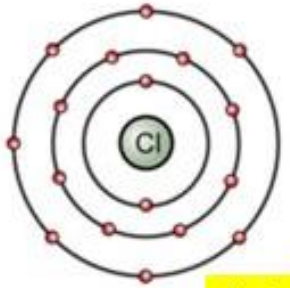


Fig.3

1	An ion is an atom that has lost or gained electrons which also means it will gain a positive or negative charge.
2	A positively charged ion is called a cation. A negatively charged ion is called an anion.
3	Metals can bond with non-metals to form an ionic substance. The metals will transfer an electron(s) to the non-metal. An electrostatic attraction will form between them-an ionic bond (fig.1) This forms a regular repeating arrangement called a lattice.
4	Ionic compounds have a high melting/boiling points. They can conduct electricity when molten or dissolved in water.
5	Non-metals can share electrons to form a covalent bond. By sharing electrons they gain a full outer shell (fig.2)
6	Simple covalent compounds: -have low melting/boiling points. -sometimes can dissolve in water. -don't conduct electricity.
7	Giant covalent compounds: -have high melting/boiling points. -are insoluble in water. -do not conduct electricity apart from graphite.
8	Metals outer electrons are normally lost leaving behind a positive metal ion. The metal cation sits in a 'sea' of delocalized electrons forming an electrostatic attraction-metallic bonding (fig.3)
9	Metals: -have high melting/boiling points. -are insoluble in water. -conduct electricity when solid or liquid.

10	Carbon different structural forms. These are called allotropes.
11	The four allotropes of carbon are fullerenes, graphene, diamond and graphite. These can be displayed via different types of bonding models.

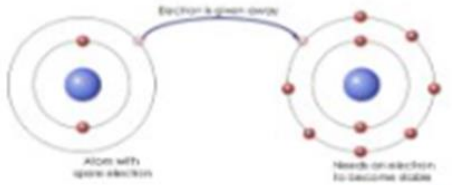


Fig.1

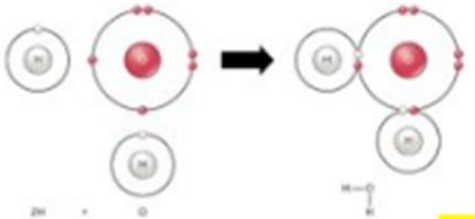


Fig.2

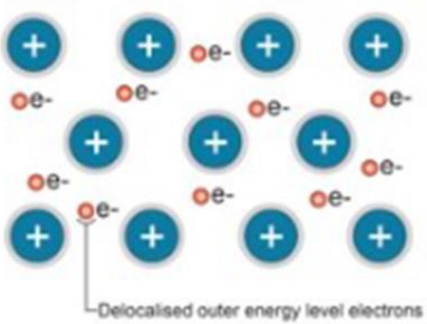


Fig.3

Knowledge Organiser: Chemistry, Key Concepts Part D

Jesus grew in wisdom and stature" Luke 2:52

1	The **atomic number** tells us the number of **protons** in an atom
2	The **mass number** tells us the number of **protons and neutrons** in the nucleus of an atom
3	The number of **electrons** is the same as the atomic number in an element (not in an ion)
4	**Isotopes** are atoms with the same proton number but different number of neutrons
5	**Relative atomic mass (RAM)** is the mean mass of all of a substances isotopes
6	To work out **RAM** we use the calculation: $\frac{\text{Total mass of the atoms (\% x mass)}}{100}$
7	**Relative formula mass (RFM)** is the sum of the RAM of all atoms in a molecule
8	**Empirical formula** is the simplest whole number ratio of atoms or ions in a substance
9	Ethene has the **molecular formula** C_2H_4 but **empirical formula** CH_2
10	Sometimes **empirical formula** and **molecular formula** are the same e.g. H_2O
11	**Molecular formula** represents the actual number of atoms of each element in a molecule
12	To work out **empirical formula** follow these steps: 1. Divide the mass given in the question by the RAM 2. Divide all answers by the smallest answer from step 1 3. Write out the empirical formula using the ratio from step 2
13	A **solute** is a solid substance that can be placed into a solvent
14	A **solvent** is a fluid that can be mixed with a solute
15	A **solution** is where a solute is dissolved in a solvent
16	The mass of the solution is equal to the mass of the solvent + the solute. This is called the **conservation of mass**
17	The amount of solute dissolved in a solvent is called **concentration**
18	To calculate **concentration in g dm^{-3}** use this equation: Concentration = $\frac{\text{mass of solute in g}}{\text{Volume of solution in dm}^3}$
19	A **closed system** is one where no new substances are added or removed in a reaction. These systems show the **mass of the reactants = mass of products** due to **conservation of mass**.
20	When gas can escape it is described as a **non-enclosed system**

Ca	Cl
10.0	17.8
40	35.5
$\frac{10.0}{40} = 0.25$	$\frac{17.8}{35.5} = 0.5$
$\frac{0.25}{0.25} = 1$	$\frac{0.5}{0.25} = 2$
$CaCl_2$	

21	Relative mass and balanced equations are used to work out the **mass of a reactant/product**
22	To calculate the **mass of reactants** or products follow these steps: 1. Write the balanced equation 2. Calculate the RFM of the substances needed 3. Find the ratio of molecules involved (using balancing numbers) 4. Work out the mass of 1g of reactant / product 5. Scale up or down to the mass given
23	1 mole is equal to 6.02 x 10^{23} particles and is known as **Avogadro constant** 
24	You can calculate the number of **moles** of a substance using the above equation
25	When a substance is added in **excess**, there is more than enough for the reaction to happen
26	A **limiting reactant** is the substance that will run out in a chemical reaction
27	The ratio of moles of each substance in a reaction is called **stoichiometry**

28	**Theoretical yield** is the amount of product that should form in a chemical reaction
29	**Actual yield** is the amount of product that forms in reality due to loss in the process
30	**Percentage yield** is worked out using: Percentage yield = actual yield / theoretical yield
31	**Atom economy** is a method of showing how efficient a reaction is
32	**Atom economy** is worked out using the following equation: Atom economy = RFM of useful product / Sum of RFM of all reactants

Calculate the mass of chlorine needed to make 53.4 g of aluminium chloride.

Write the balanced equation	$2Al + 3Cl_2 \rightarrow 2AlCl_3$
Calculate relative formula masses of the substances needed	$M_r\ Cl_2 = 2 \times 35.5 = 71$ $M_r\ AlCl_3 = 27 + (3 \times 35.5) = 133.5$
Calculate ratio of masses (multiply M_r values by the balancing numbers shown in the equation).	$3Cl_2$ makes $2AlCl_3$ so $3 \times 71 = 213$ g Cl_2 makes $2 \times 133.5 = 267$ g $AlCl_3$
Work out the mass for 1 g of reactant or product. (Here we want 1 g of the product because that's the mass we know already)	$\frac{213}{267}$ g Cl_2 makes $\frac{267}{267}$ g $AlCl_3$ (÷ 267 / ÷ 267) 0.798 g Cl_2 makes 1 g $AlCl_3$
Scale up or down (from 1 g to the mass you are given)	× 53.4 / × 53.4 42.6 g Cl_2 makes 53.4 g $AlCl_3$