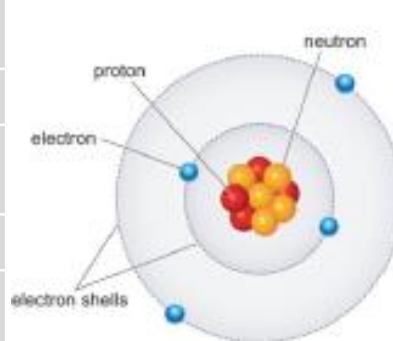




- 1 **Atom** is the smallest neutral part of an element that can take part in chemical reactions
- 2 **Element** is a substance made up of one type of atom
- 3 **A proton** is a small positively charged particle with a relative mass of 1
- 4 **A neutron** is a small neutral particle with a relative mass 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
1×10^9	1,000,000,000	Giga (G)	Billion
1×10^6	1,000,000	Mega (M)	Million
1×10^3	1,000	Kilo (K)	Thousand
1			
1×10^{-3}	0.001	Milli (m)	Thousandth
1×10^{-6}	0.000 001	Micro (μ)	Millionth
1×10^{-9}	0.000 000 001	Nano (n)	billionth

SOLID SPHERE MODEL



JOHN DALTON

PLUM PUDDING MODEL



J.J. THOMSON

NUCLEAR MODEL



ERNEST RUTHERFORD

PLANETARY MODEL

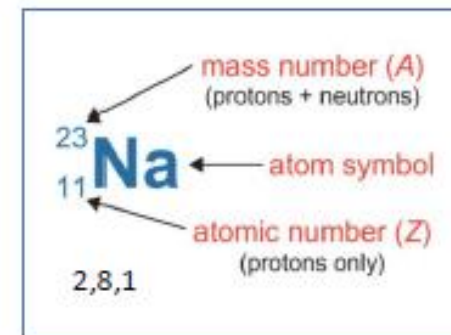


NIELS BOHR

1	2	3	4	5	6	7	0

Electron configurations

Max electrons in each shell 2,8,8,2





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.

Zeilen	Gruppe I. — E ⁰	Gruppe II. — R ⁰	Gruppe III. — E ⁰	Gruppe IV. RH ⁰ R ⁰	Gruppe V. RH ⁰ E ⁰	Gruppe VI. RH ⁰ R ⁰	Gruppe VII. RH ⁰ E ⁰	Gruppe VIII. — R ⁰
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	(Ca=63)	Zn=65	—=65	—=72	As=75	Se=78	Br=80	
6	Rb=85	Sr=87	?Y=88	Zr=90	Nb=94	Mo=96	—=100	Ru=104, Rh=104, Pd=106, Ag=108
7	(Au=108)	Cd=112	In=113	Sn=118	Sb=122	Te=125	J=127	
8	Cs=133	Ba=137	?Di=138	?Ce=140				
9	(—)		?Er=178	?La=180	Ta=182	W=184		
10								
11	(Au=199)	Hg=200	Tl=204	Pb=207	Bi=208			
12			Th=231		U=240			

Fig.1



Fig.2

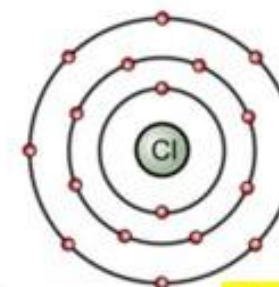


Fig.3



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.

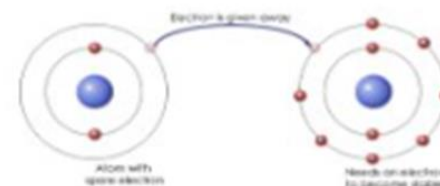


Fig.1

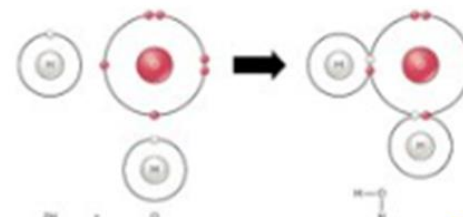


Fig.2

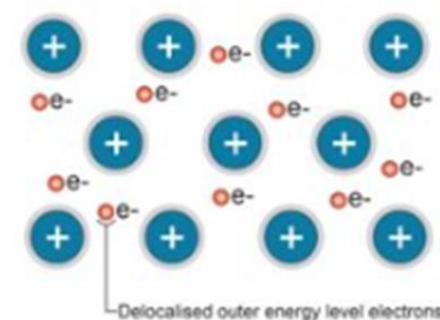


Fig.3



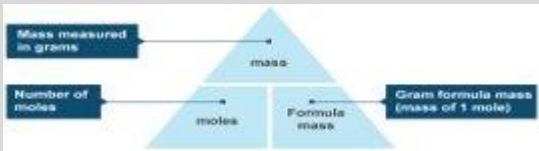
1	The atomic number tells us the number of protons in an atom
2	The mass number tells us the number of protons and neutrons in the nucleus of an atom
3	The number of electrons is the same as the atomic number in an element (not in an ion)
4	Isotopes are atoms with the same proton number but different 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: $\frac{\text{Total mass of the atoms (\% \times \text{mass})}}{100}$
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 ₂ H ₄ but empirical formula CH ₂
10	Sometimes empirical formula and molecular formula are the same e.g. H ₂ O
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: $\text{Concentration} = \frac{\text{mass of solute in g}}{\text{Volume of solution in dm}^3}$
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 6.02×10^{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 = $\frac{\text{RFM of useful product}}{\text{Sum of RFM of all reactants}}$

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

Write the balanced equation	$2\text{Al} + 3\text{Cl}_2 \rightarrow 2\text{AlCl}_3$
Calculate relative formula masses of the substances needed	$M_r \text{Cl}_2 = 2 \times 35.5 = 71$ $M_r \text{AlCl}_3 = 27 + (3 \times 35.5) = 133.5$
Calculate ratio of masses (multiply M_r values by the balancing numbers shown in the equation).	
3Cl_2 makes 2AlCl_3 so $3 \times 71 = 213 \text{ g Cl}_2$ makes $2 \times 133.5 = 267 \text{ g AlCl}_3$	
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)	
$\frac{213}{267} \text{ g Cl}_2$ makes $\frac{267}{267} \text{ g AlCl}_3$ $\div 267$	$\frac{267}{267} \text{ g AlCl}_3$ makes $\frac{213}{267} \text{ g Cl}_2$ $\div 267$
$\times 53.4$ 0.798 g Cl_2 makes 1 g AlCl_3	$\times 53.4$ 42.6 g Cl_2 makes 53.4 g AlCl_3
Scale up or down (from 1 g to the mass you are given)	