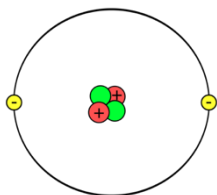




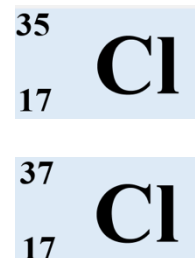
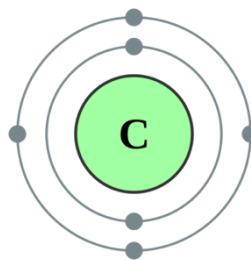
## Atomic Structure



1. Atoms are very small and have a radius of about  $1 \times 10^{-10}$  m
2. Atoms consist of a positively charged **nucleus**, containing **protons** and **neutrons**, surrounded by negatively charged electrons
3. The radius of a nucleus is less than 1/10000 of the radius of an atom
4. The mass of an atom is concentrated in the nucleus
5. The electrons are arranged in **energy levels**, which are different distances from the nucleus
6. The **atomic number** is the number of protons in an atom of the element
7. All atoms of a particular element have the same number of protons in their nuclei
8. Atoms of different elements have different numbers of protons
9. The **mass number** of an element is the total number of protons and neutrons
10. The relative charges of the subatomic particles are: protons (+), electrons (-) and neutrons (0)

## Electronic Configuration

11. Electron arrangement may change with the absorption or emission of electromagnetic radiation
12. Electrons in an atom occupy the **lowest available energy level**
13. The electronic structure of an atom can be represented by numbers or a diagram
14. Atoms have no overall electrical charge because the **number of electrons is equal to the number of protons** in the nucleus
15. Elements that react to form positive **ions** are metals
16. Elements that do not form positive ions are non-metals
17. Atoms form **positive ions** if they **lose** one or more outer **electrons**
18. Atoms form **negative ions** if they **gain** one or more outer **electrons**

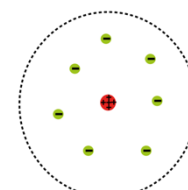
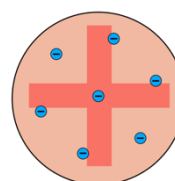


## Isotopes

19. Isotopes are atoms of the same element that have different numbers of neutrons
20. An element's relative atomic mass is an average value that takes account of the abundance of different isotopes

## Atomic Theory

21. Before electrons were discovered, atoms were thought to be tiny spheres that could not be divided any further
22. The **plum pudding model** was developed after the discovery of electrons, with the atom thought to be a **ball of positive charge** with negative **electrons embedded** throughout it
23. The nuclear model was developed after the alpha particle scattering experiment concluded that the **mass** of an atom was concentrated in the centre (**nucleus**) and that the nucleus was charged
24. Niels Bohr used theoretical calculations and experimental observations to adapt the nuclear model by suggesting that **electrons orbit** the nucleus at specific distances
25. Protons were discovered after later experiments concluded that positive charges of any nucleus could be subdivided into a whole number of smaller particles, each with the same amount of charge
26. Experiments by Chadwick provided evidence for the existence of neutrons within the nucleus, about 20 years after the nucleus became an accepted Scientific theory





### The Periodic Table

27. Elements in the periodic table are arranged in order of **increasing atomic number** and elements with **similar properties** are in columns, known as **groups**
28. It is called the Periodic Table because similar properties occur at regular intervals
29. Elements in the same group have similar properties because they have the **same number of electrons in their outer shell**
30. Early periodic tables had elements missing and some elements were placed in the wrong groups because the strict order of atomic mass was followed
31. **Mendeleev** left gaps for elements he thought had not yet been discovered and changed the order of some elements
32. Elements with properties predicted by Mendeleev were discovered and filled the gaps
33. Knowledge of **isotopes** helped to explain why the strict order of atomic weights is not always correct

Group	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	1 H																	2 He
2	3 Li	4 Be								5 B	6 C	7 N	8 O	9 F	10 Ne			
3	11 Na	12 Mg								13 Al	14 Si	15 P	16 S	17 Cl	18 Ar			
4	19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr
5	37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe
6	55 Cs	56 Ba	57 La	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn
7	87 Fr	88 Ra	89 Ac	104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt	110 Ds	111 Rg	112 Cn	113 Nh	114 Fl	115 Mc	116 Lv	117 Ts	118 Og
				58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb	71 Lu	
				90 Th	91 Pa	92 U	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lr	

### The Noble Gases

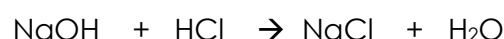
34. Elements in **Group 0** are called the **Noble Gases**
35. They are **unreactive** and do not easily form molecules because they have a **stable arrangement of electrons**
36. They have 8 electrons in their outer shell, except Helium which has 2
37. Boiling point increases with increasing atomic mass (as you go down the group)

### The Alkali Metals

38. Elements in **Group 1** are called **Alkali metals**
39. They have **1 electron in their outer shell**

40. They are soft and shiny and have relatively low melting and boiling points
41. **Reactivity increases** as you go down the group
42. Alkali metals react with oxygen to form metal oxides
43. Alkali metals react with water to form metal hydroxides and hydrogen gas
44. Chemical reactions can be represented by word equations or equations using symbols and formulae

e.g. Sodium Hydroxide + Hydrochloric Acid → Sodium Chloride + Water



### The Halogens

45. Elements in **Group 7** are known as the **Halogens**
46. They have similar reactions because they all have **7 electrons in their outer shell**
47. The Halogens are non-metals and consist of molecules made up of pairs of atoms
48. Melting and boiling points increase with increasing relative molecular mass (as you go down the group)
49. **Reactivity decreases** as you do down the group
50. A more reactive halogen can **displace** a less reactive halogen from an aqueous solution of its salt

### The Transition Metals

51. *Metals including Cr, Mn, Fe, Co, Ni and Cu are transition metals with similar properties, which are different from the properties of Group 1*
52. *Many transition elements form ions with different charges, form coloured compounds and can be useful as catalysts*

