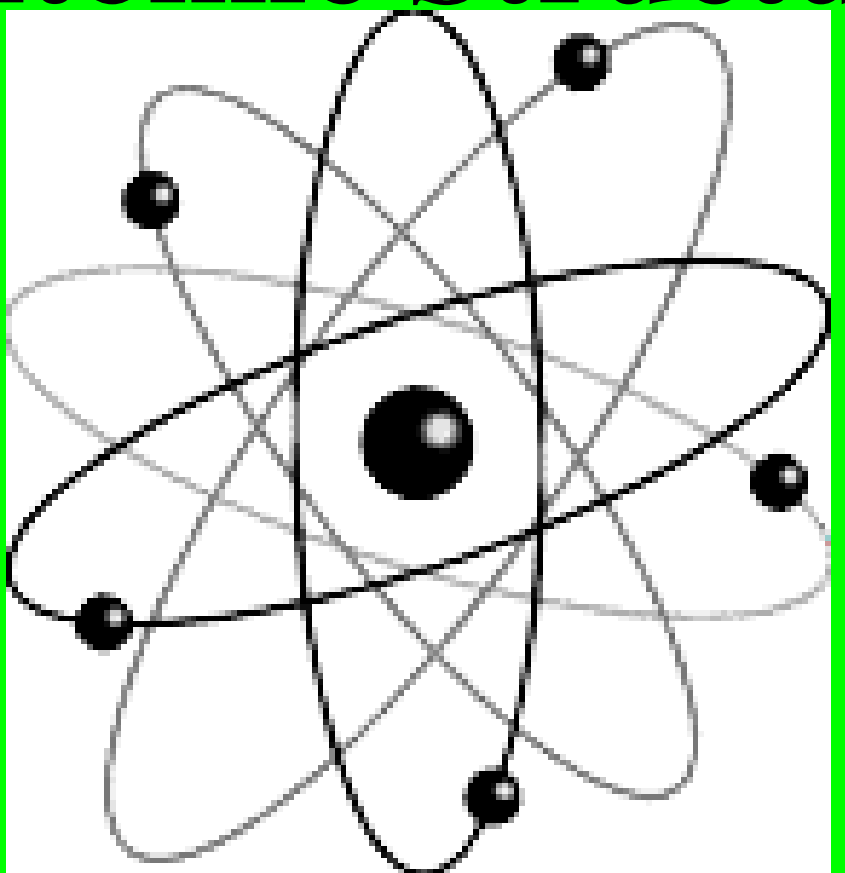
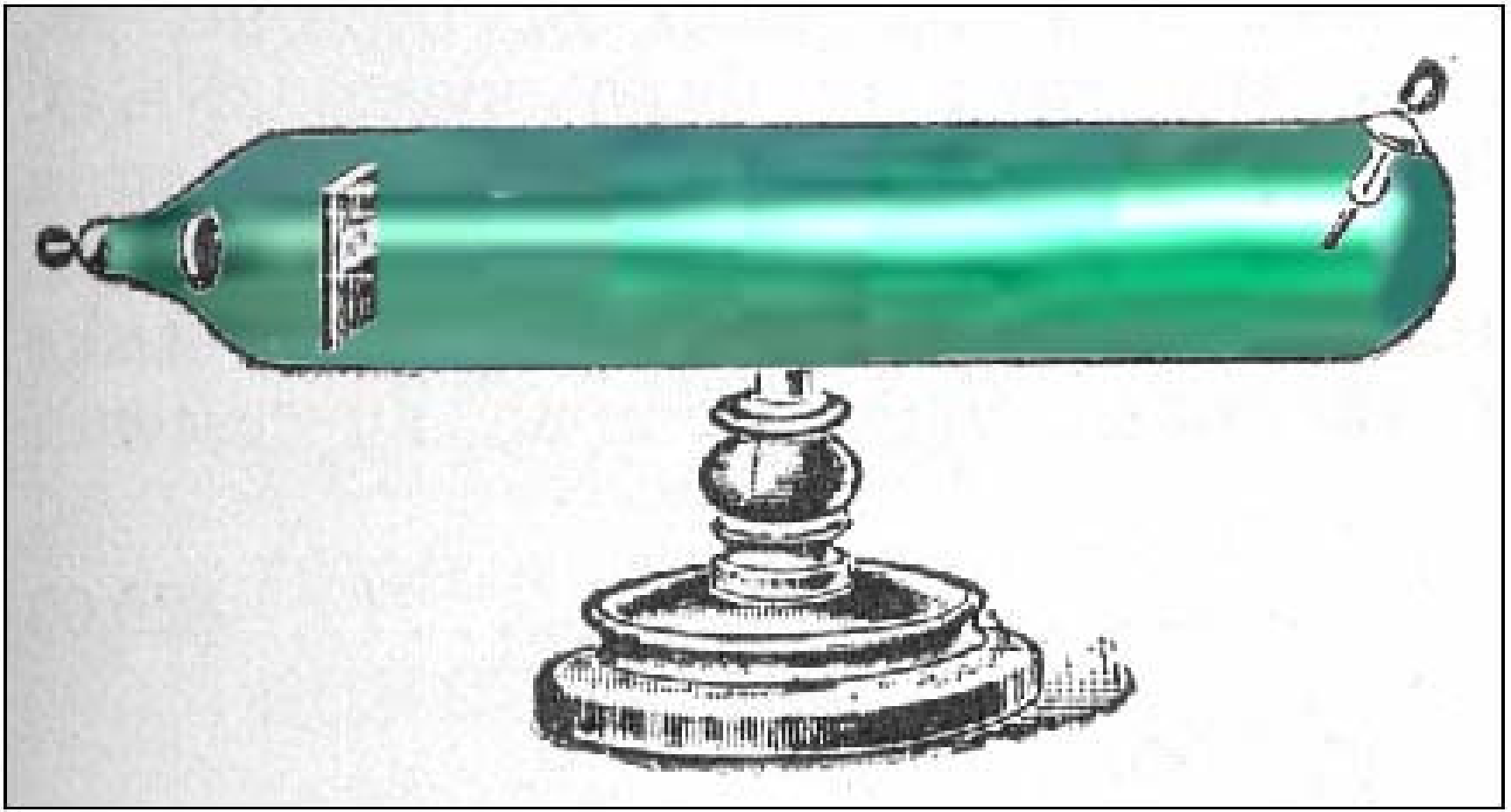
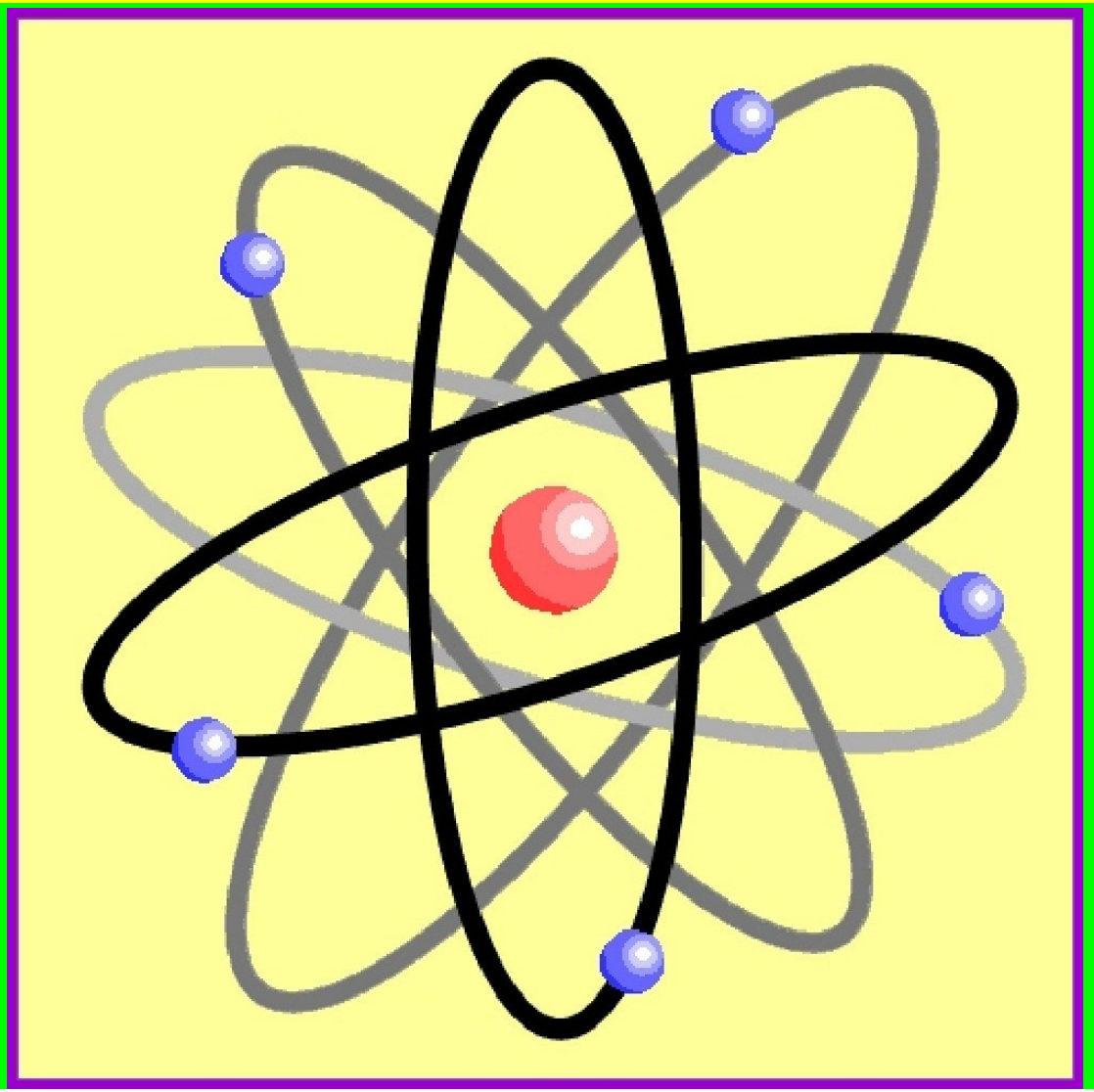
The Modern Theory of Atomic Structure

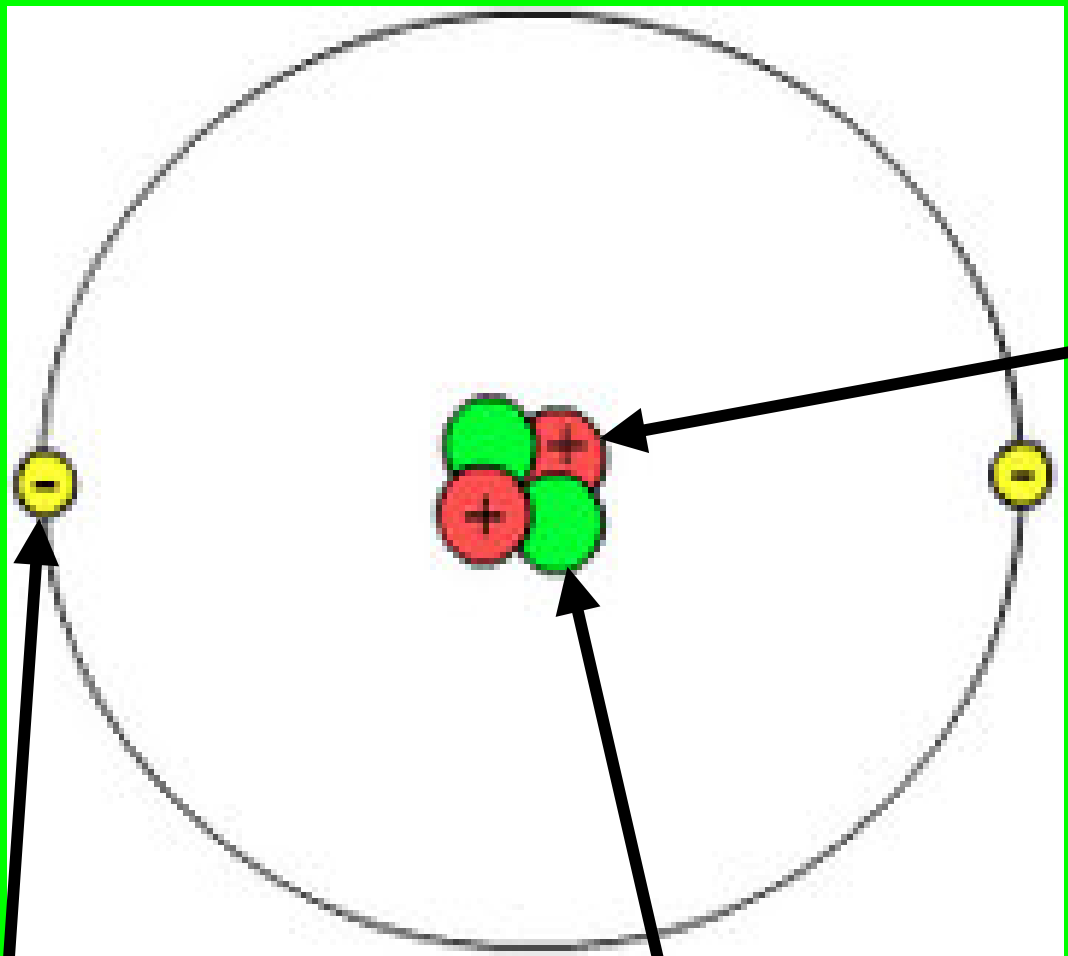




Atoms can be broken down into smaller particles. This was first done with a Crooke's Tube.

Particles which make up the atom are called subatomic particles.





Protons

Positively charged particles in the nucleus

Electrons

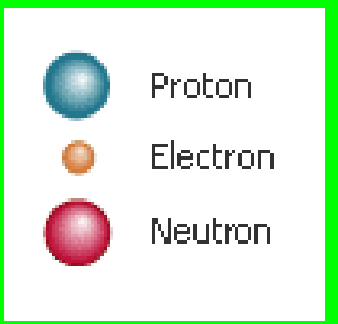
Neutrons - Neutral particles in the nucleus

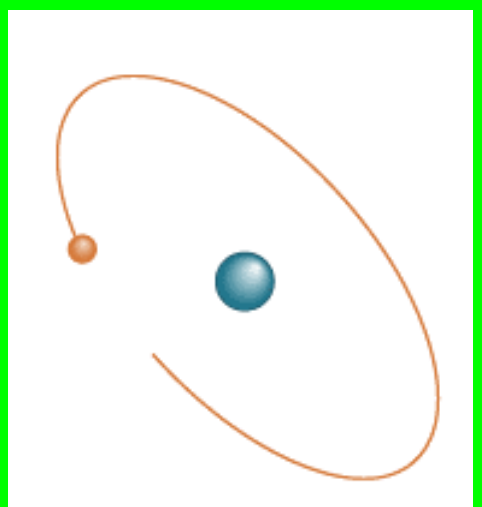
Particle	Mass (P = 1)	Charge	Location
Proton			
Neutron			
Electron			

Do “Instant Practice” on top of page 170

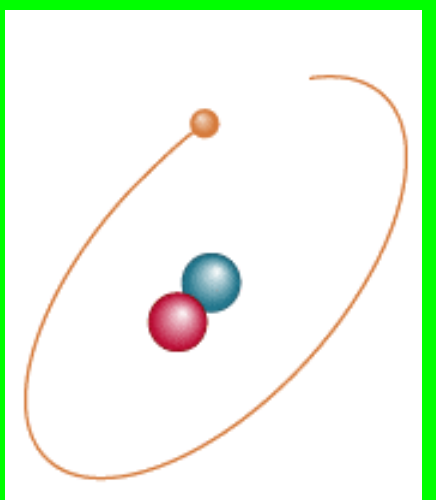
Element	Symbol	Atomic Number	Number of Protons
Hydrogen		**1**	
Beryllium		**4**	
Carbon			
Cobalt			
Krypton		**36**	

Isotopes of Hydrogen

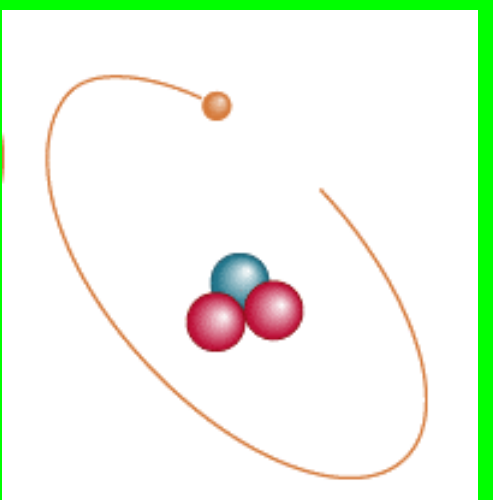




Hydrogen-1



Hydrogen-2

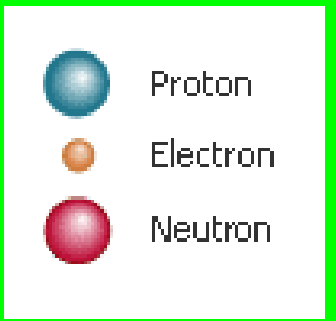


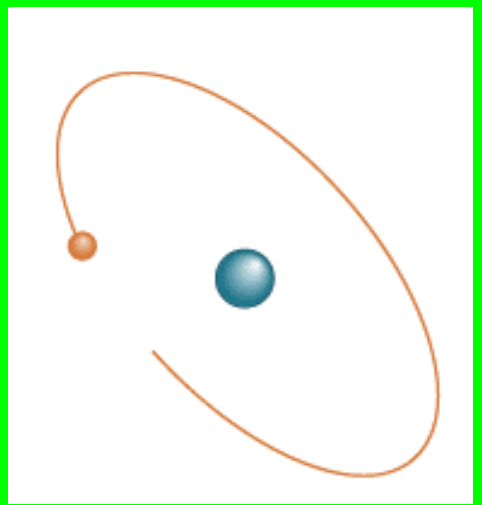
Hydrogen-3

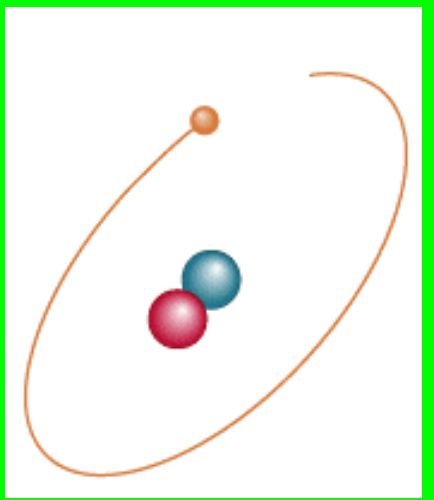
Isotopes are:

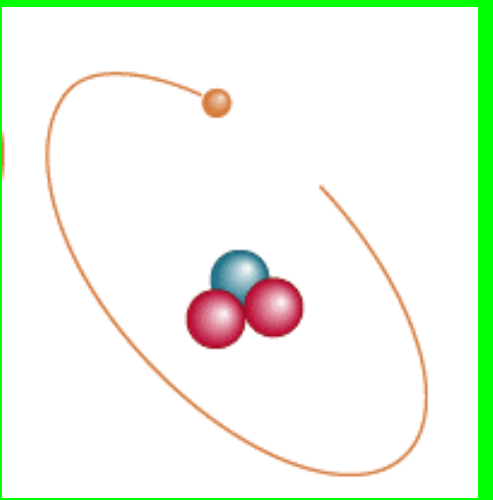
Different forms of the same element with the SAME # of Protons but with DIFFERENT #'s of Neutrons

Isotopes of Hydrogen









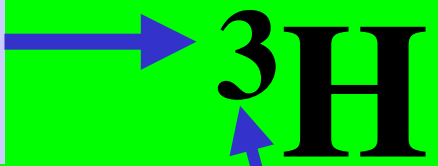
Hydrogen-1 **Hydrogen-2** **Hydrogen-3**

^{1}H **^{2}H** **^{3}H**

Mass Number = Total Protons + Neutrons in an isotope of an element

Mass Number
P + N

1 P + 2 N's



^{3}H

Also called "Hydrogen – 3"

^{3}H

Called the "Nuclear Notation"

To find P's and N's from Nuclear Notation

Mass # = P + N

To find # of Neutrons, put Atomic Number Here:

$$^{41}_{20}Ca$$

Subtract to get # of Neutrons

21

Calcium's atomic Number = 20

So it has 20 Protons

Find the # of Protons and # of Neutrons in Each of the Following Isotopes:

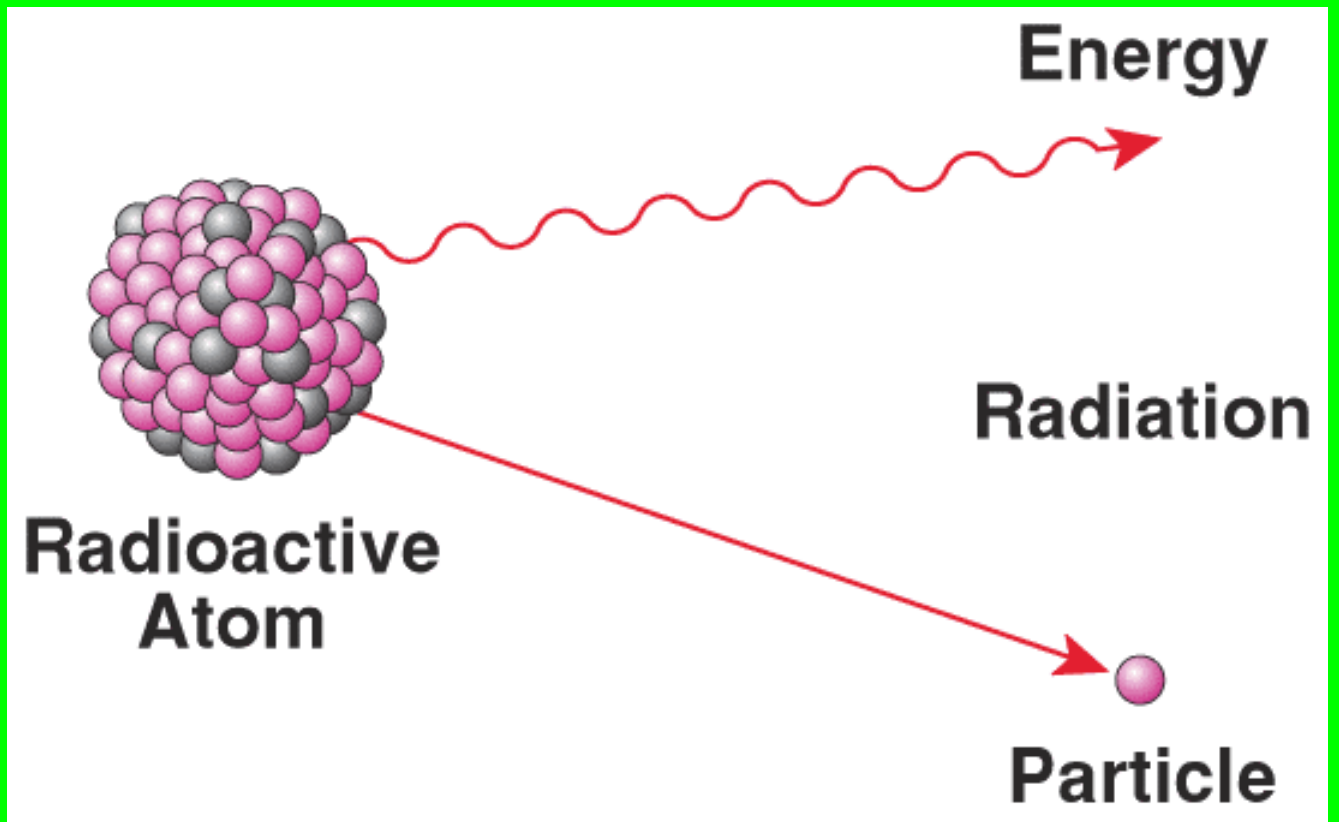
Isotope	Mass #	Atomic #	# of Protons	# of Neutrons
^{54}Fe				
^{56}Mn				
^{237}Np				
^{12}C				

Now try the other way!

Isotope	Mass #	Atomic #	# of Protons	# of Neutrons
		55		78

Radioactive Isotopes

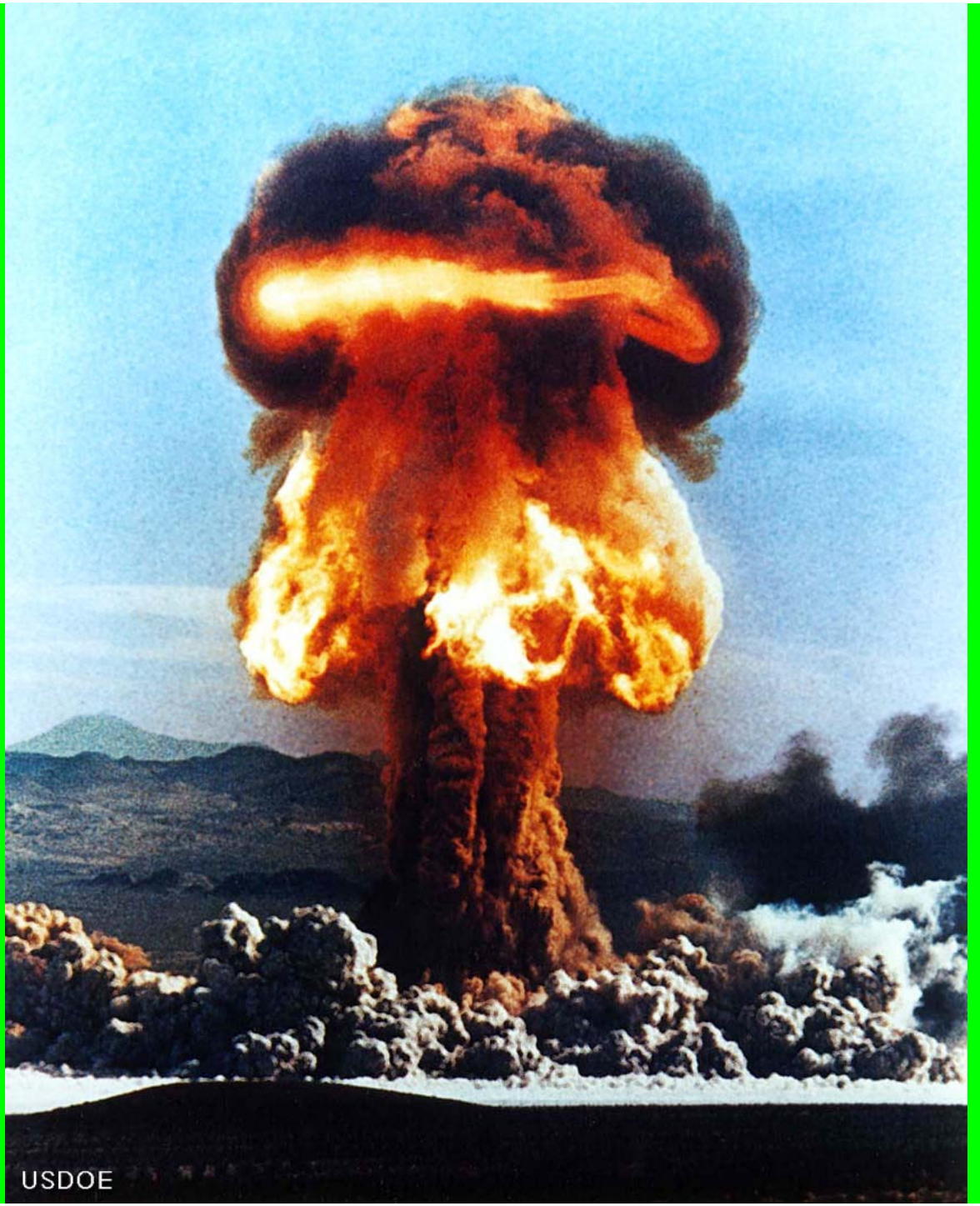
-Isotopes that have unstable nuclei
-They “fall apart” giving off radiation



Cobalt – 60 or ^{60}Co

-Is used to kill cancer cells in radiation therapy

Uranium-235 or ^{235}U is used to make atomic bombs!

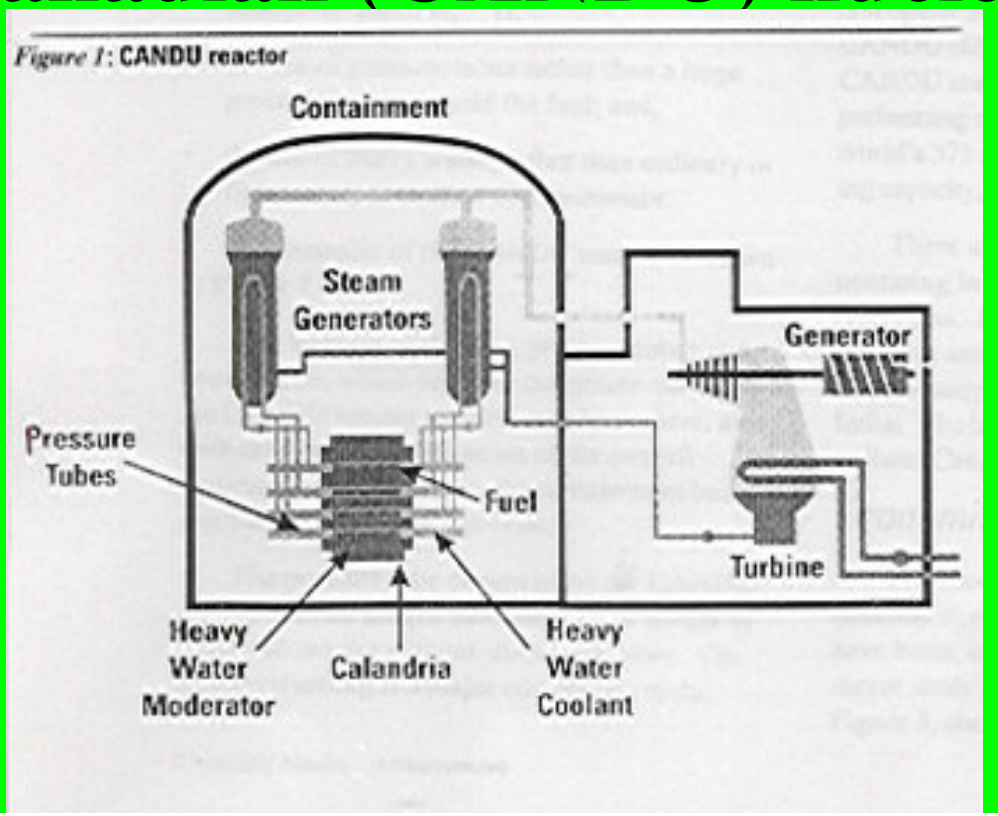


Radiation from atomic bombs can cause severe radiation burns to the skin!

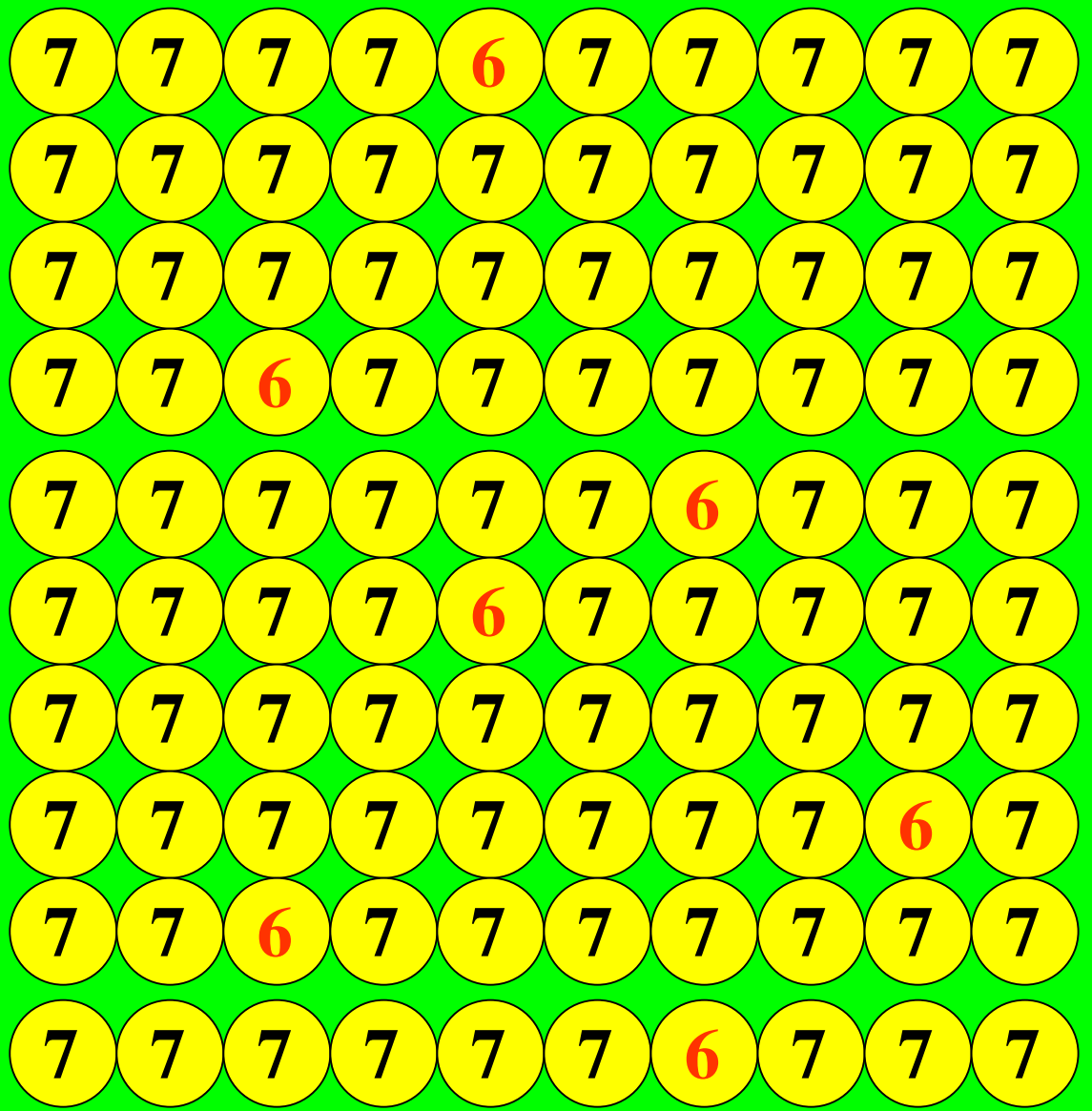
Hydrogen-2 or ^2H is called deuterium.

Deuterium oxide ^2H_2O is also called "Heavy Water"

It is used in Canadian (CANDU) nuclear power plants.



Lithium on Earth is about 7% ^{6}Li and 93% ^{7}Li.



Total Mass of ^{6}Li
= 7 x 6 = 42

Total Mass of ^{7}Li
= 93 x 7 = 651

Total Mass of 100 Lithium Atoms
= 42 + 651 = 693

Average Mass of 1 Li Atom = 693/100 = 6.93

The “weighted average” mass of isotopes of an element is called it’s Atomic Mass

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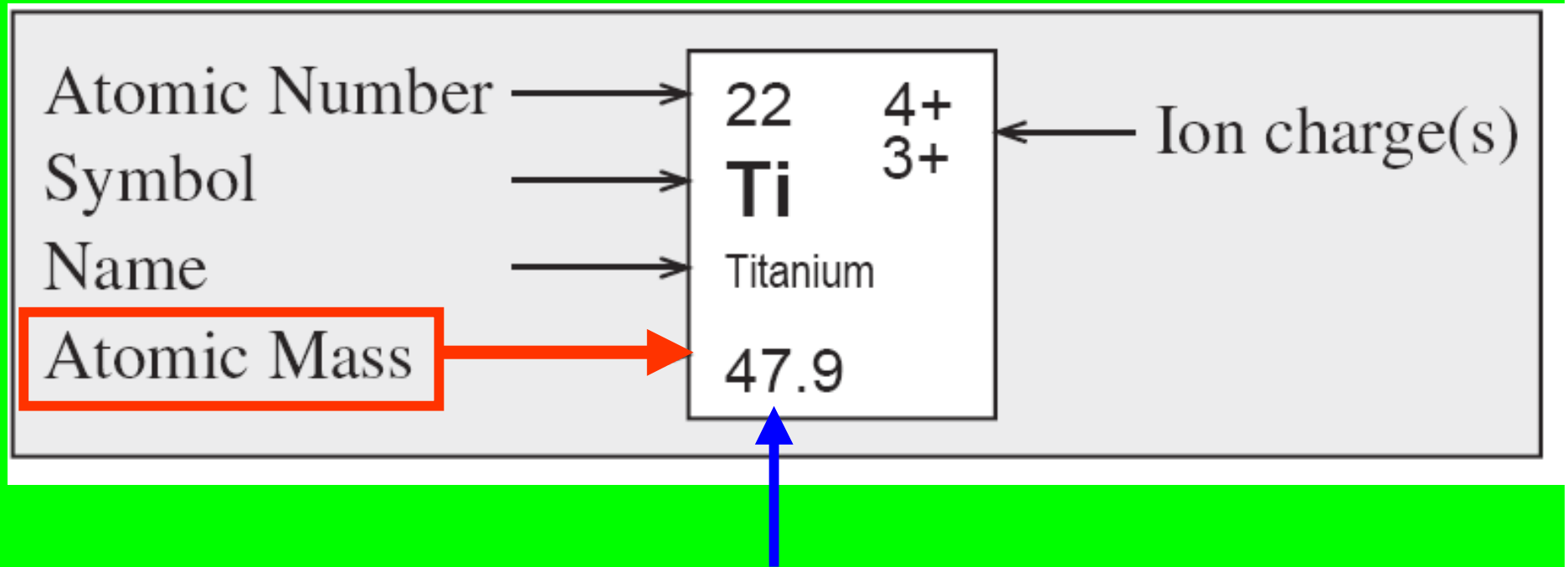


It is shown underneath the symbol on the Periodic Table

Element	Atomic Number	Number of Protons	Atomic Mass
Ag			
Se			
Bh			

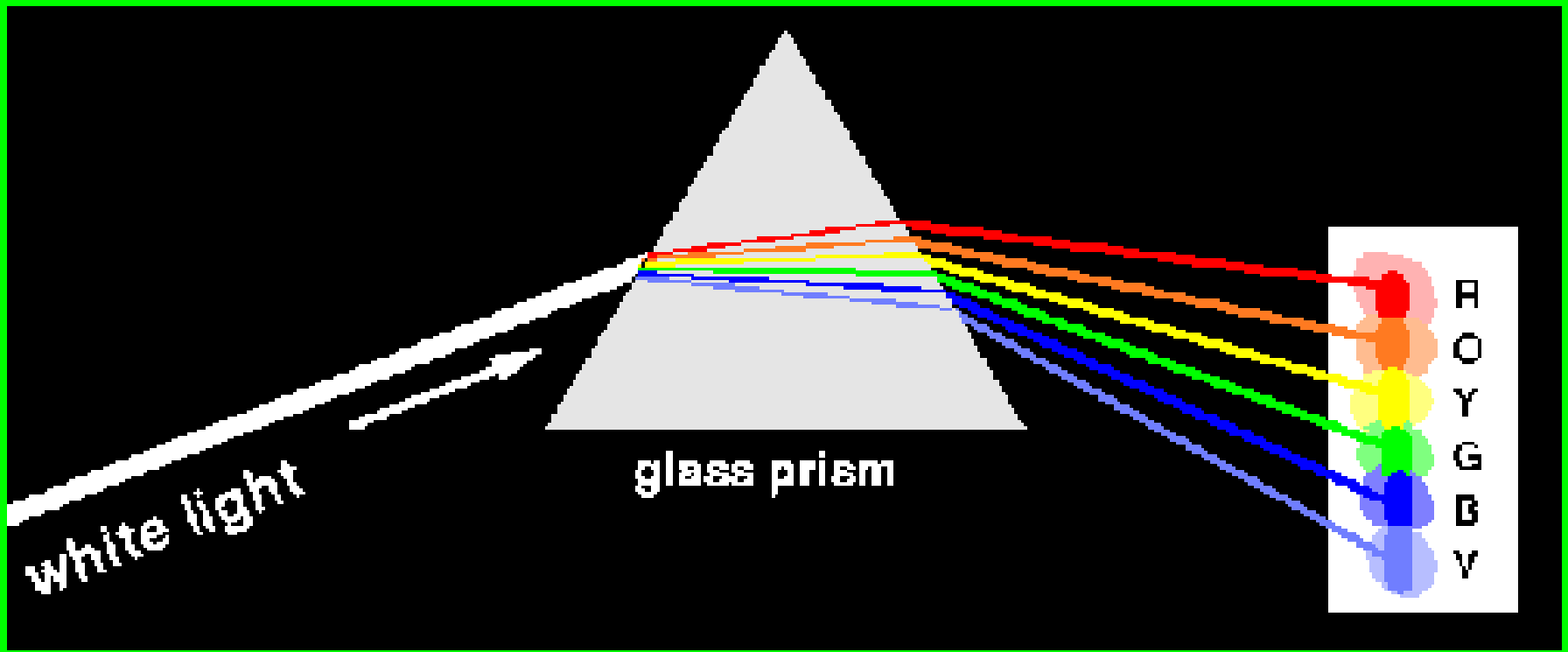
In a Neutral Atom of an Element:

The # of Electrons(-) = The # of Protons(+)

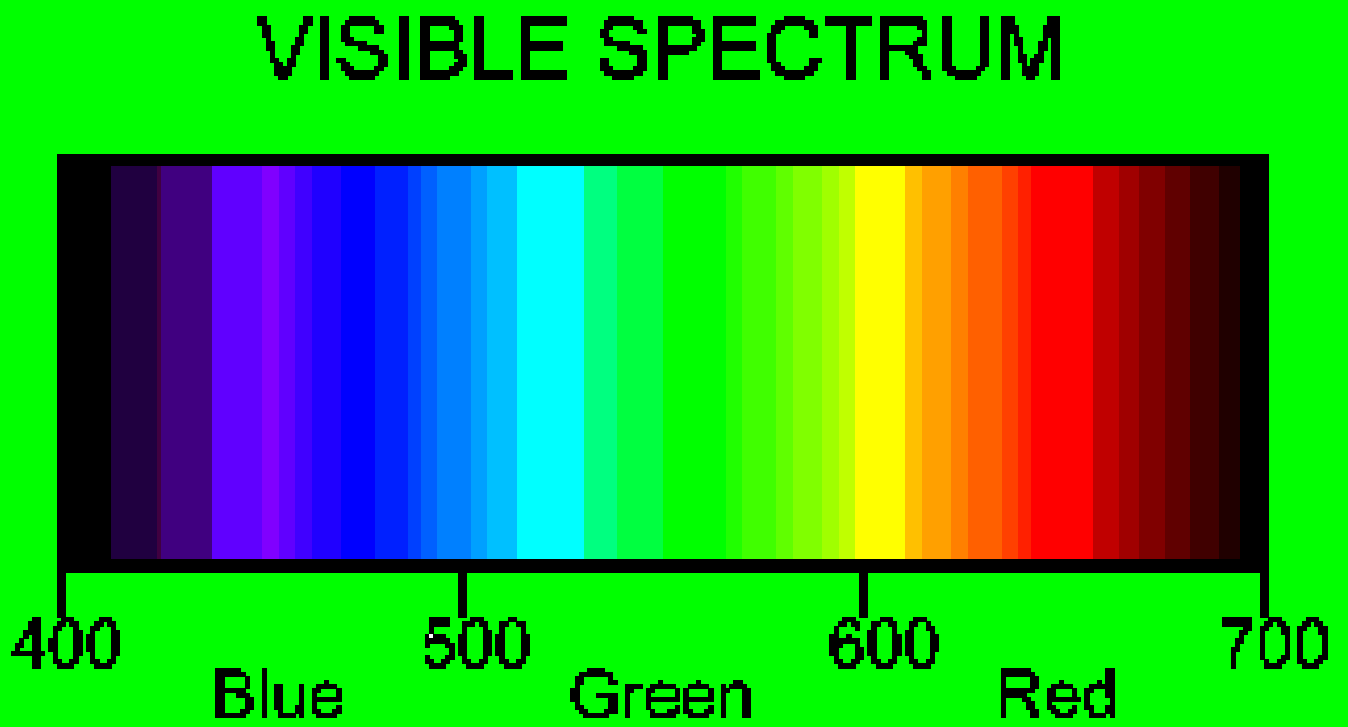
In a Neutral Atom of an Element:

The # of Electrons(-) = The # of Protons(+)

Neutral Carbon has _____ Protons



When white light is shone through a prism, it is separated into different colours.



The Pattern of Colours is called a SPECTRUM

If a single element is subjected to a high voltage, it has a spectrum too, but it is different!

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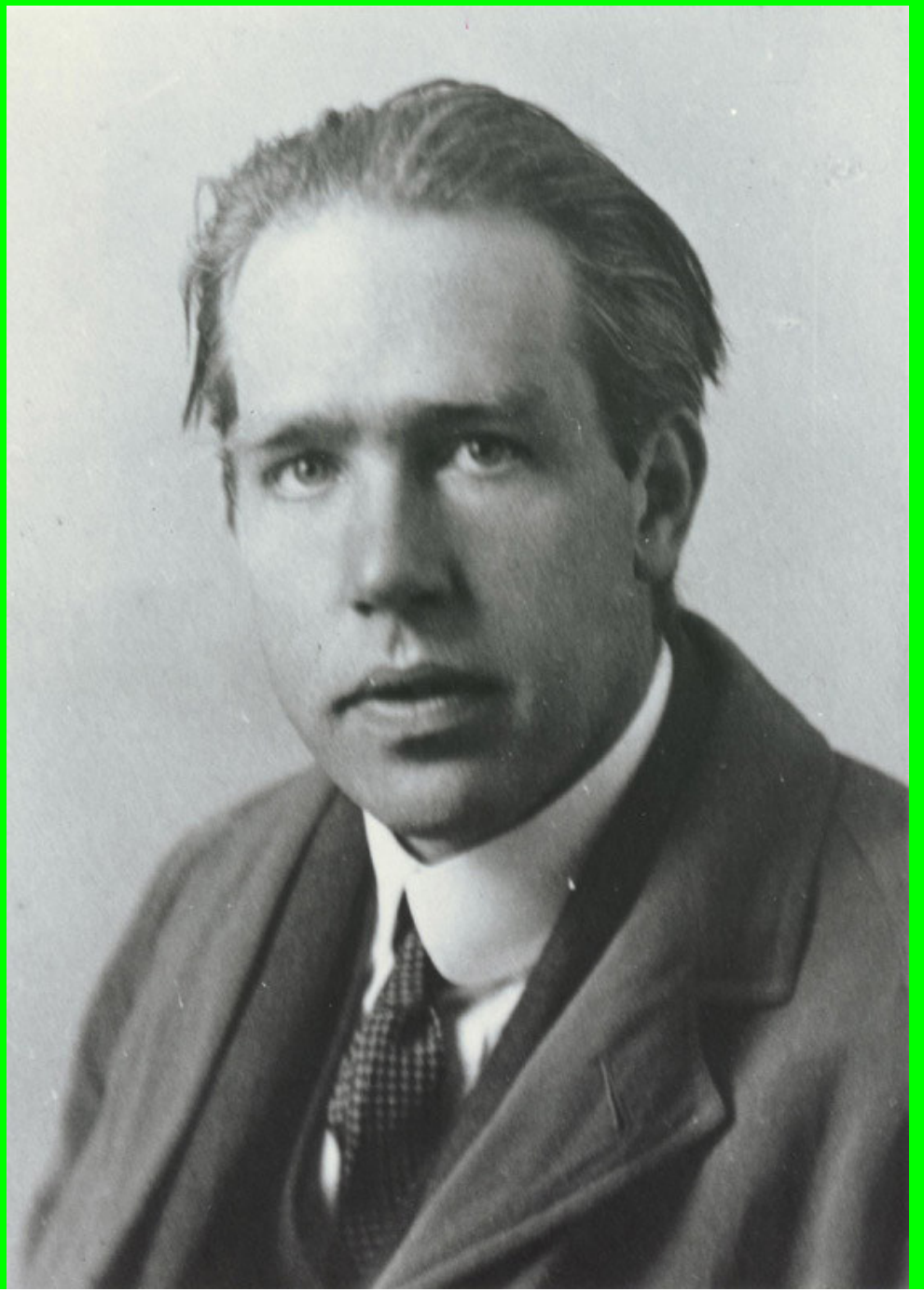
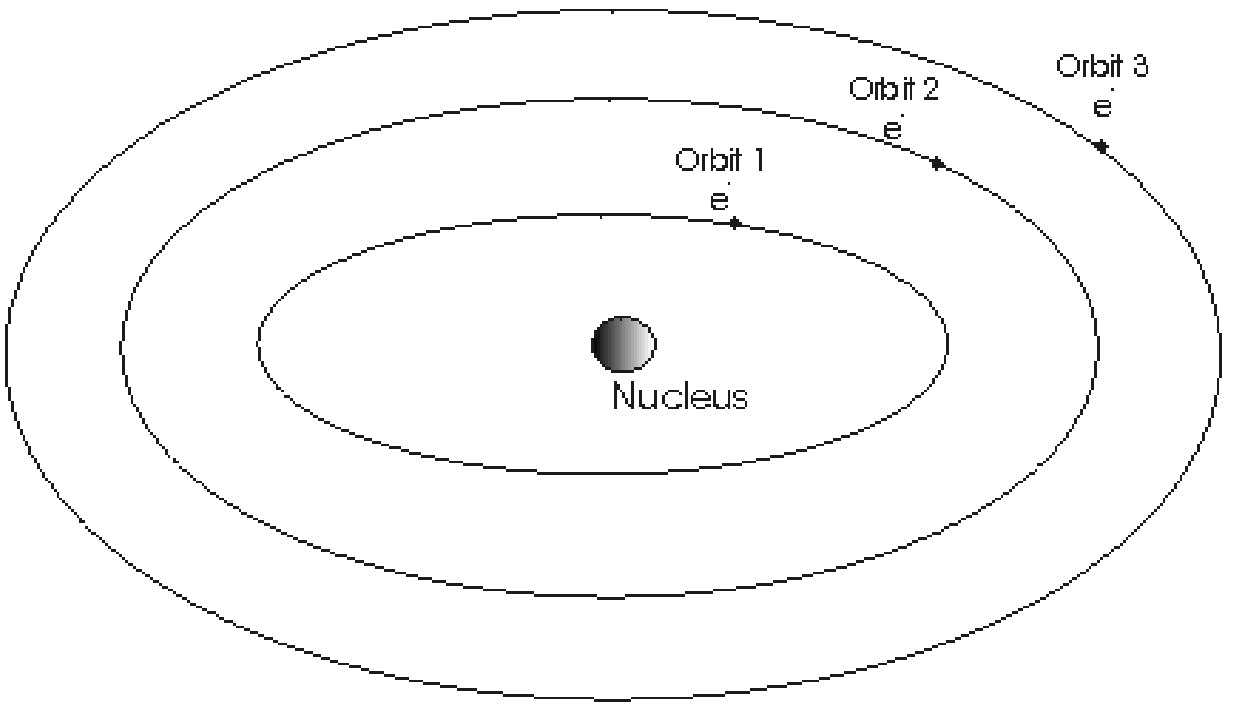
The spectrum of Hydrogen only has a few "lines"

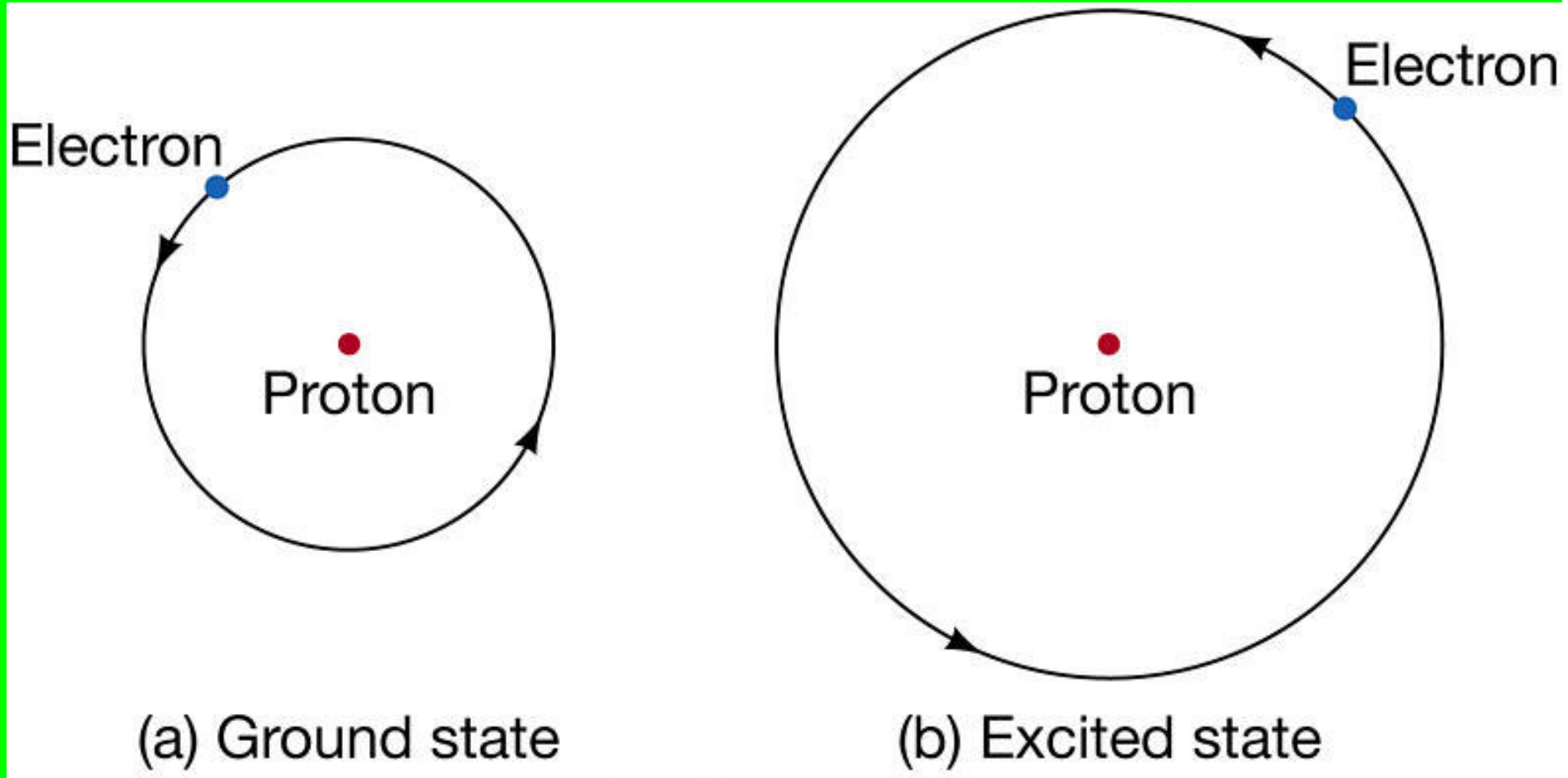
Niels Bohr

A Danish Physicist

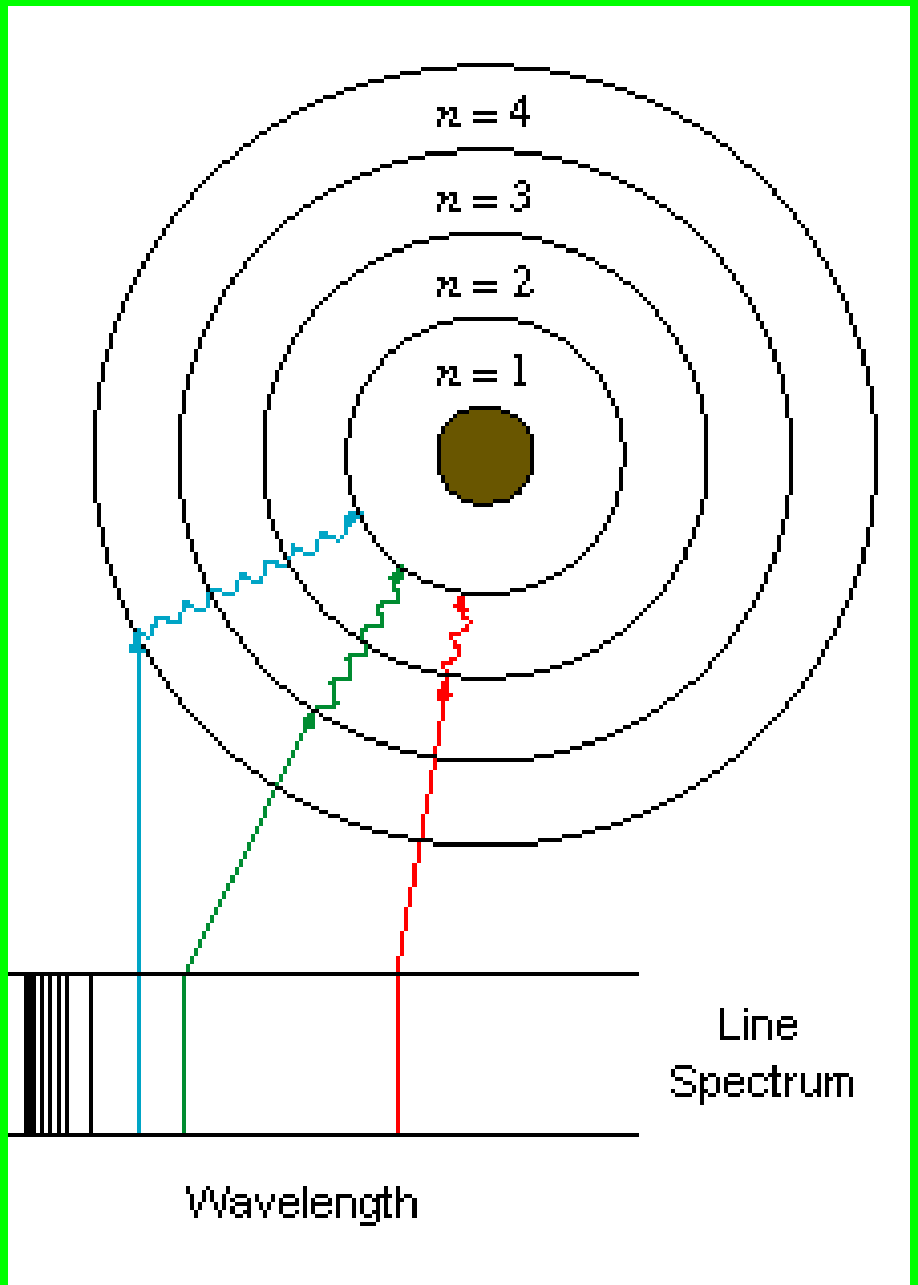




Bohr said the atom has different "Energy Levels" or "Orbits" or "Shells" which the electrons could inhabit.

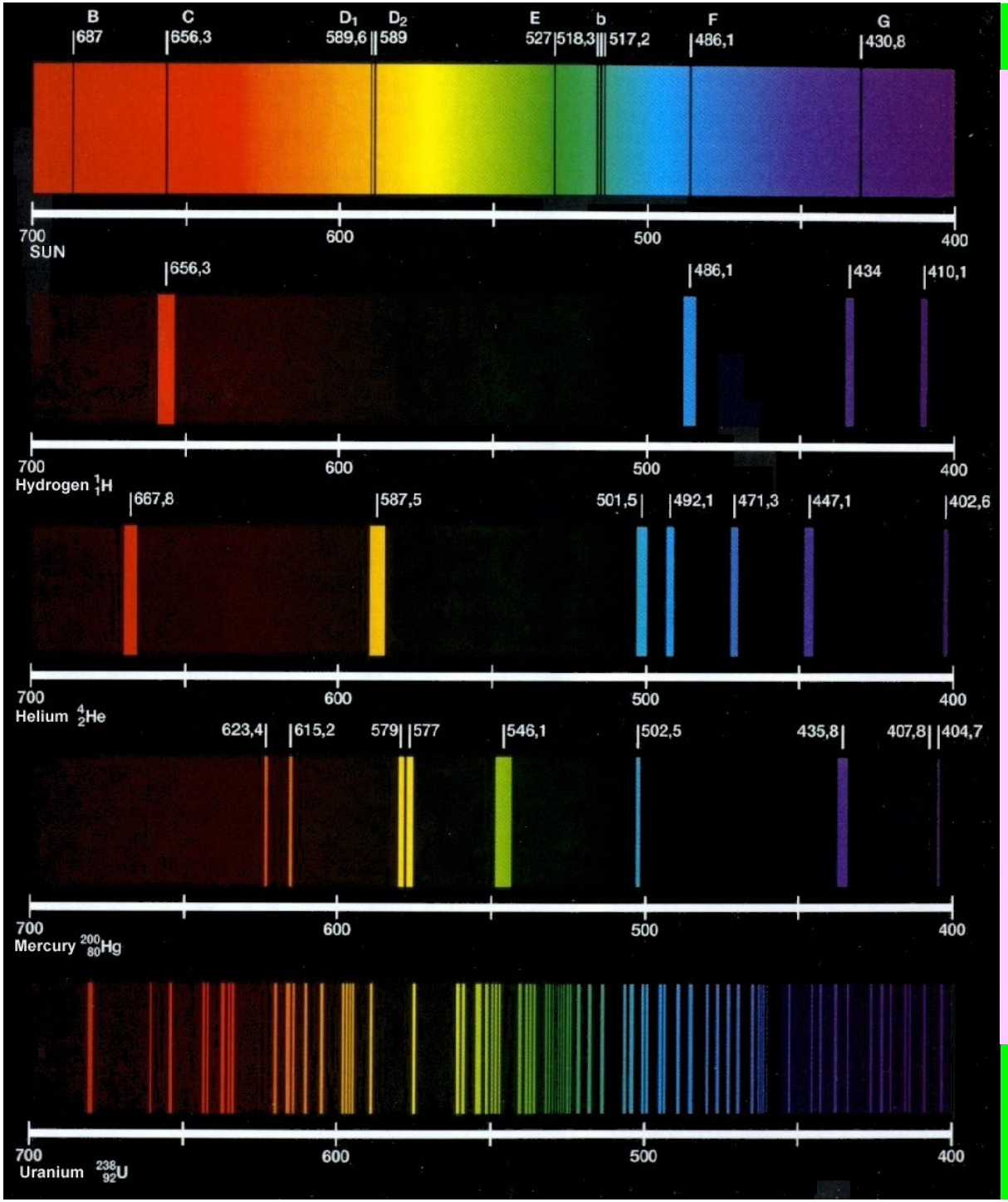


When energy is added to an atom, the electron "jumps" to a higher orbit (the atom is then in an "excited state")



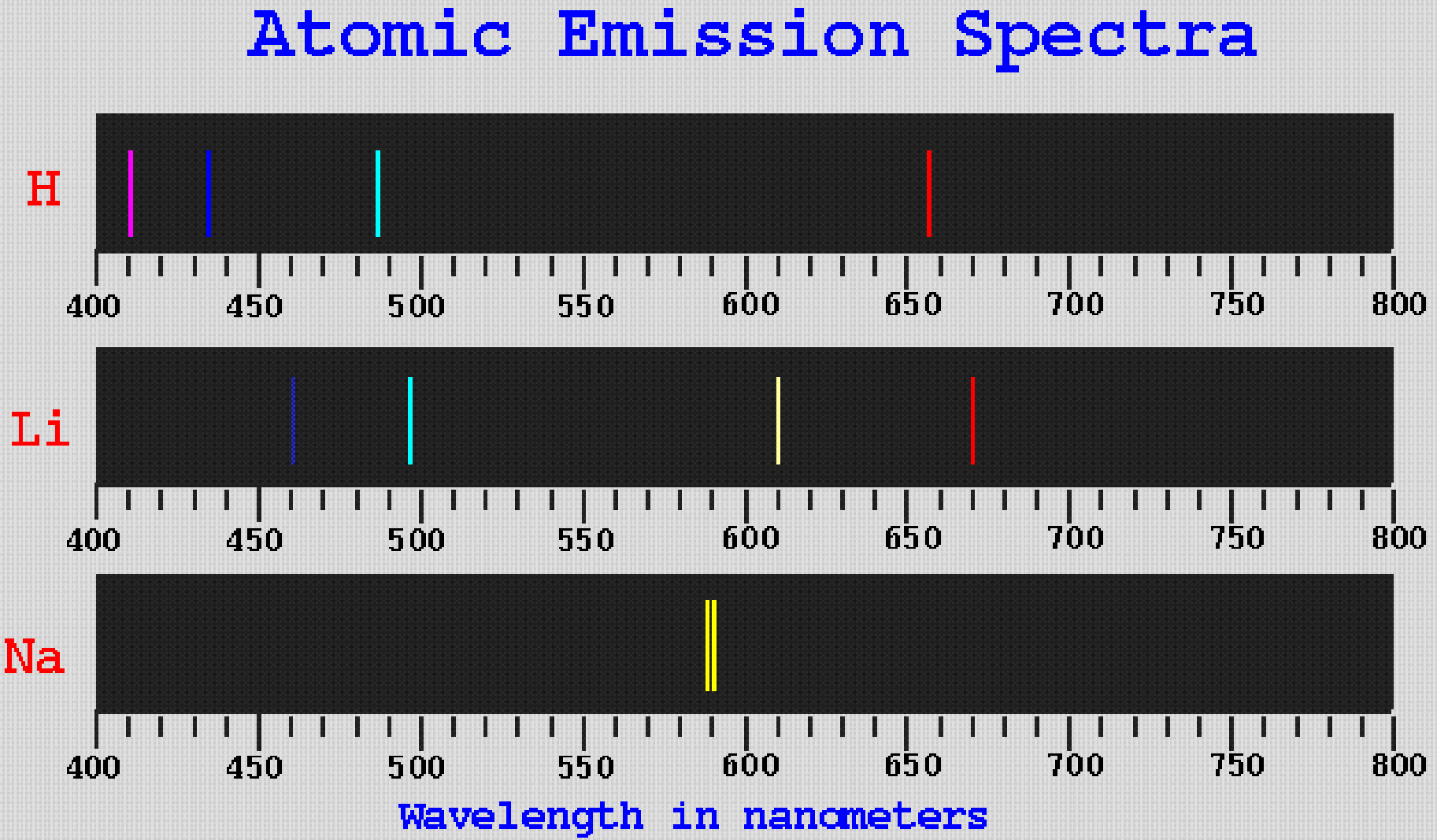
When electrons jump from higher orbits back to lower orbits, they "give off" energy in the form of light.

Different "jumps" give different colours.



Since atoms of different elements have different electron arrangements, each element has its own unique spectrum!

Spectra can be used to "identify" an unknown element – like a fingerprint!



Bohr's Orbits

	First Orbit	Second Orbit	Third Orbit
Maximum # of Electrons			

Bohr Models:

Element	Atomic Number	Total # of Electrons	Electrons in First Orbit	Electrons in Second Orbit	Electrons in Third Orbit
He					

Bohr Models:

Element	Atomic Number	Total # of Electrons	Electrons in First Orbit	Electrons in Second Orbit	Electrons in Third Orbit
C					

Bohr Models:

Element	Atomic Number	Total # of Electrons	Electrons in First Orbit	Electrons in Second Orbit	Electrons in Third Orbit
N					

Bohr Models:

Element	Atomic Number	Total # of Electrons	Electrons in First Orbit	Electrons in Second Orbit	Electrons in Third Orbit
Cl					