Promoting scholarship of Science by maintaining curiosity, developing scientific skills and encouraging the application of knowledge to solve problems and communicate ideas.

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Chemistry Cram 1.1

Paper-1

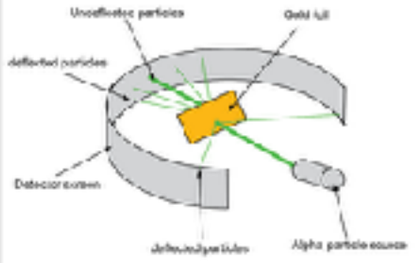
1. **Atomic Structure**
2. Groups of the Periodic Table
3. Structure and Bonding
4. Quantitative Chemistry
5. Chemical Reactions
6. Energy

Structure of the Atom

John Dalton

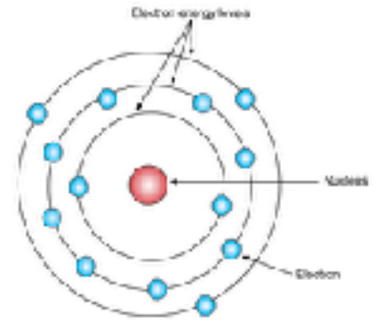
Billiard Ball Model

Geiger and Marsden



Gold Foil Experiment

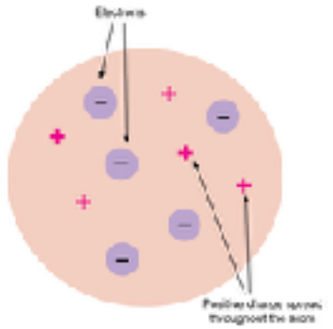
Neils Bohr



Bohr Model
(Energy Levels)

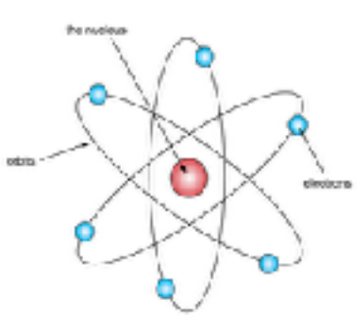
1897 – electron **1920 - Proton** **1930 - Neutron**

Joseph Thomson



Plum Pudding Model

Ernest Rutherford



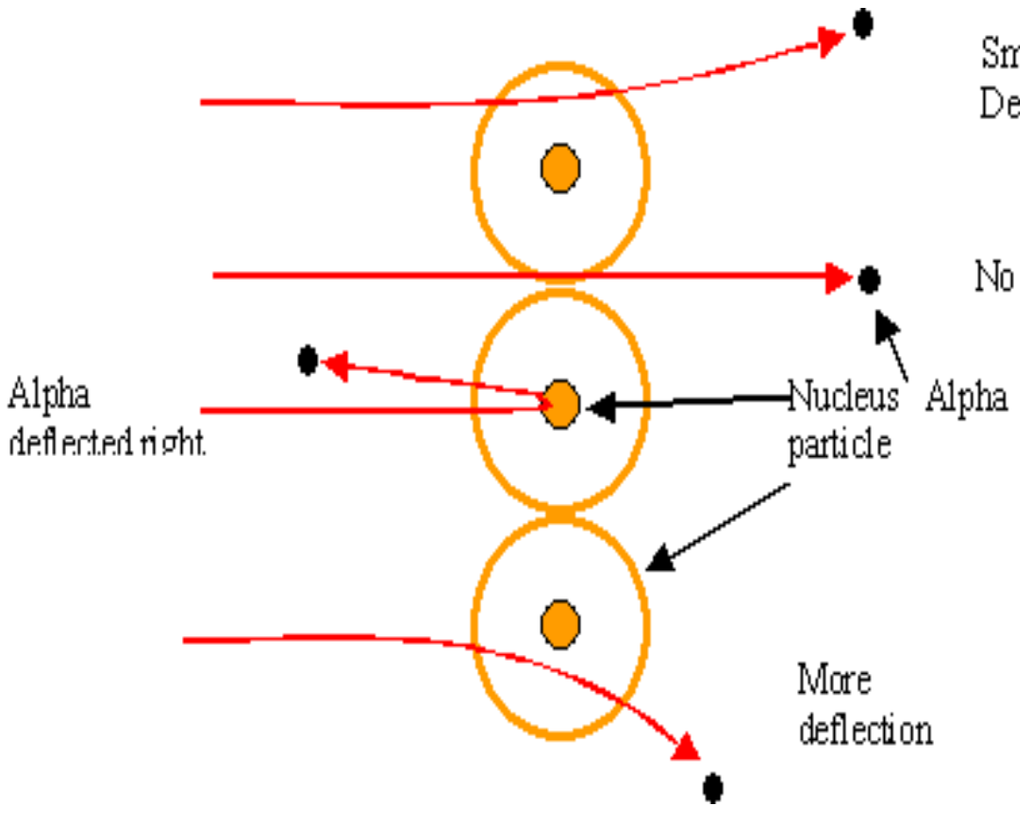
Planetary Model

You need to learn key discoveries and how our understanding changed over time with experimental results

Rutherford's Gold Foil Experiment

Key Experimental Points

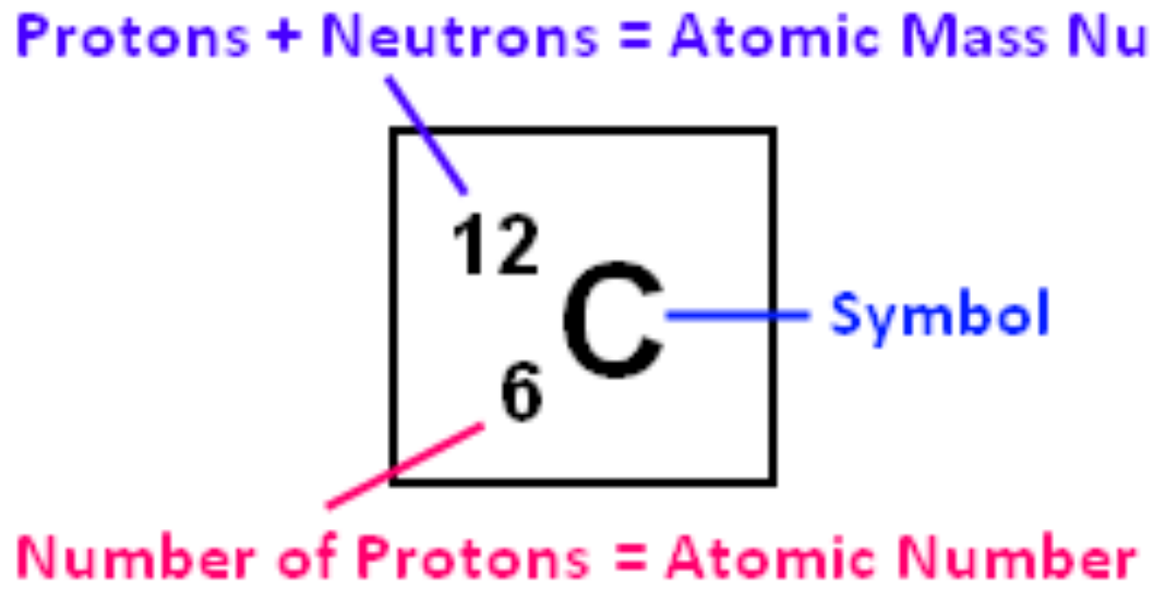
- The gold foil was very thin to try and be as few atoms thick as possible
- The experiment was done in a vacuum so that no other air particles were present
- The alpha particle that was fired towards the foil is small and positively charged
- Most alpha particles went straight through the foil
- A few were deflected a small amount
- A tiny amount were deflected straight back



Key Deductions

- The nucleus must be positive as the positive alpha particles were deflected
- The nucleus must be very small as most were not deflected as all and only a tiny amount hit the nucleus 'head-on' and were deflected backwards

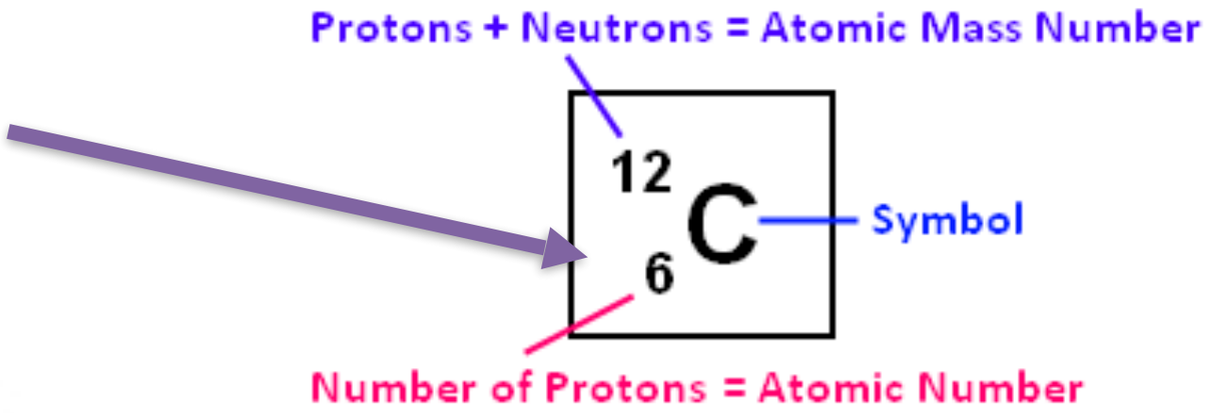
Atomic Structure

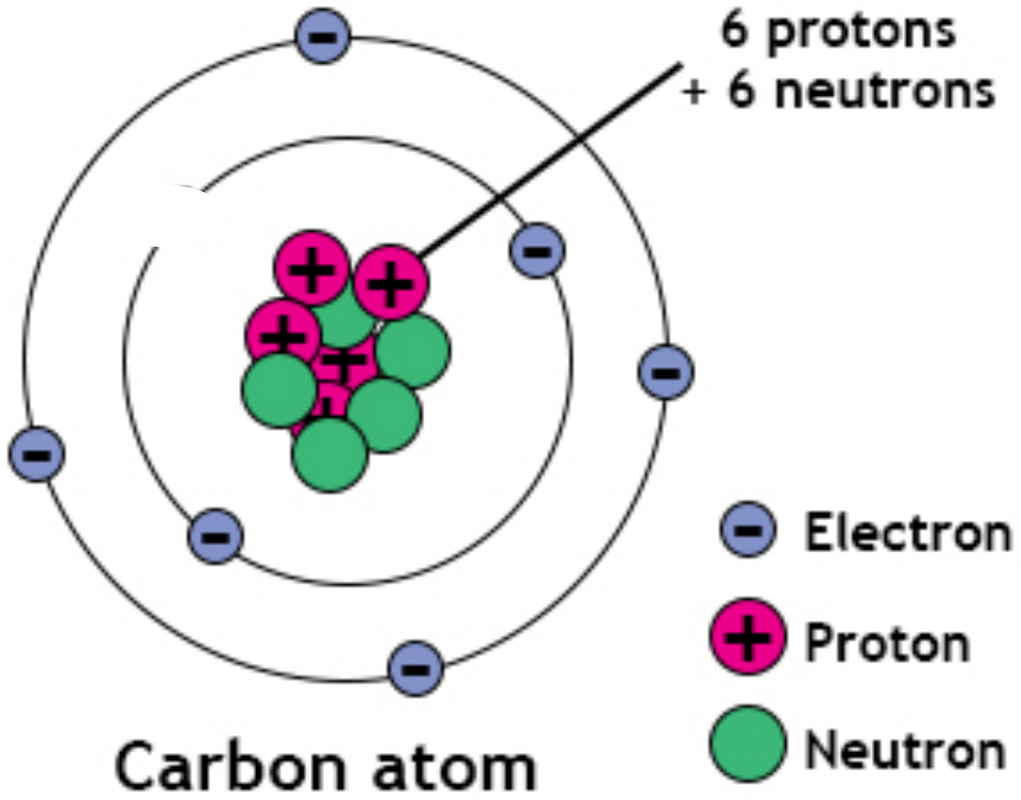


It is essential that you learn EVERYTHING on this page

Sub-atomic Particle	Mass	Charge
Proton	1	+1
Neutron	1	0
Electron	Almost 0	-1

Electrons = Protons
so all atoms are neutral





Neutrons = Top – Bottom

= 12- 6 = 6

The 6 electrons follow the 2,8,8 rule

2 in first shell or energy level

4 in next shell or energy level

2 shells (or energy levels) means Carbon is in period 2

4 electrons in the outer shell means Carbon is in group 4

Group 1

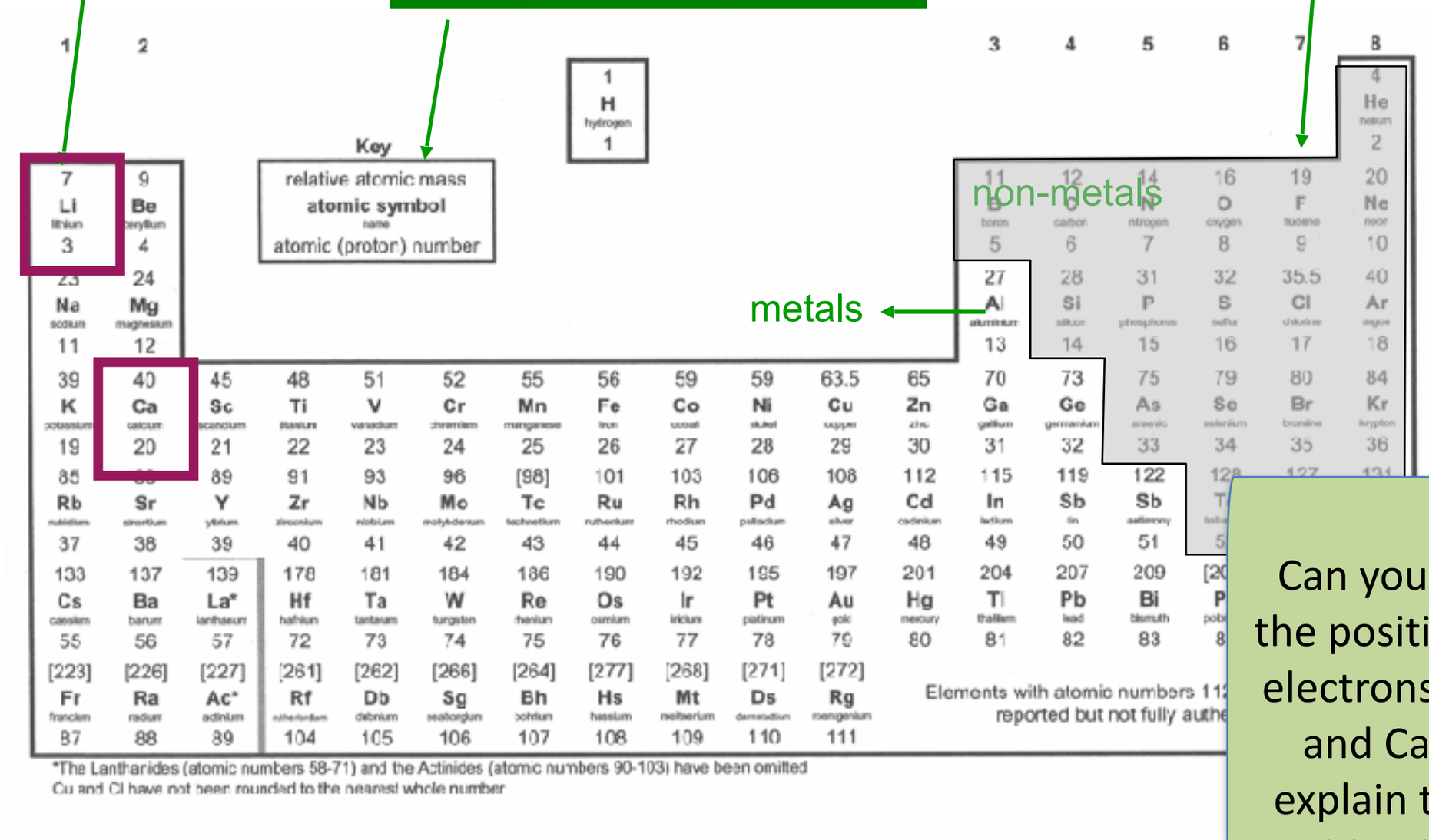
Alkali metals

each element has a mass number (relative atomic mass) and atomic number (proton number)

Group 7

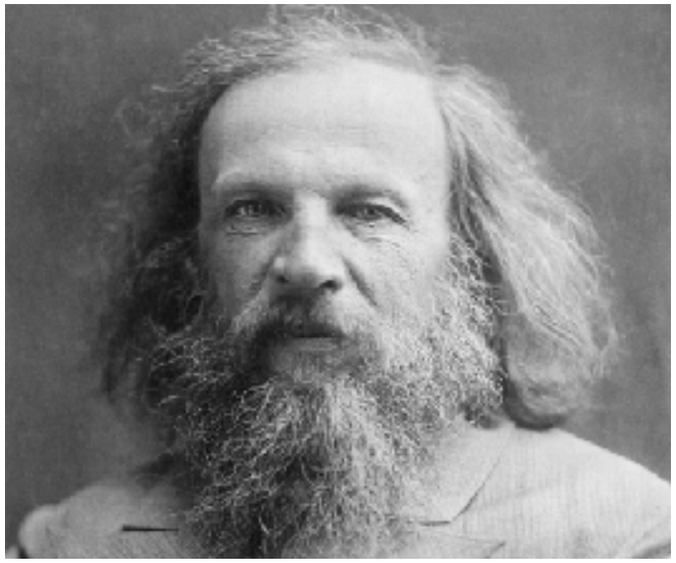
Halogens

Each row is a '**period**', and each column is a '**group**'



Can you use the position of electrons in Li and Ca to explain their position in the periodic table?

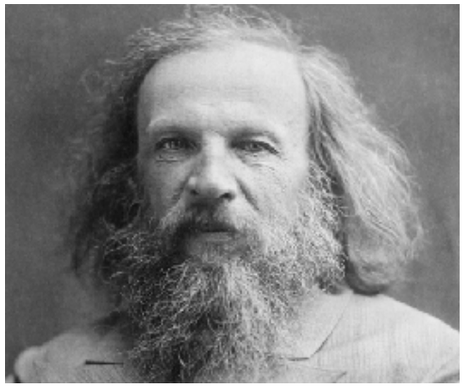
Mendeleev



- Sorted the elements into groups of **similar activity and properties**
- Through this sorting he noticed some groups had more elements than others
- He left gaps in his table for the missing elements and he correctly predicted what their properties would be when they were discovered
- He ordered the Periodic table based upon mass number we order it based upon Atomic number

Learn how Mendeleev arranged his periodic table and how it is similar and different to the modern periodic table

Mendeleev



1	2											3	4	5	6	7	8
																	4
																	He
																	helium
																	2
7	9											11	12	14	16	19	20
Li	Be											B	C	N	O	F	Ne
lithium	beryllium											boron	carbon	nitrogen	oxygen	fluorine	neon
3	4											5	6	7	8	9	10
23	24	45	48	51	52	55	56	59	59	63.5	65	27	28	31	32	35.5	40
Na	Mg	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Al	Si	P	S	Cl	Ar
sodium	magnesium	scandium	titanium	vanadium	chromium	manganese	iron	cobalt	nickel	copper	zinc	aluminium	silicon	phosphorus	sulfur	chlorine	argon
11	12											13	14	15	16	17	18
39	40	45	48	51	52	55	56	59	59	63.5	65	70	73	75	79	80	84
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
potassium	calcium	scandium	titanium	vanadium	chromium	manganese	iron	cobalt	nickel	copper	zinc	gallium	germanium				
19	20	21	22	23	24	25	26	27	28	29	30	31	32				
85	88	89	91	93	96	[98]	101	103	106	108	112	115	119				
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sb				
rubidium	strontium	yttrium	zirconium	niobium	molybdenum	technetium	ruthenium	rhodium	palladium	silver	cadmium	indium	tin				
37	38	39	40	41	42	43	44	45	46	47	48	49	50				
133	137	139	178	181	184	186	190	192	195	197	201	204	207				
Cs	Ba	La*	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb				
caesium	barium	lanthanum	hafnium	tantalum	tungsten	rhenium	osmium	iridium	platinum	gold	mercury	thallium	lead				
55	56	57	72	73	74	75	76	77	78	79	80	81	82				
[223]	[226]	[227]	[261]	[262]	[266]	[264]	[277]	[268]	[271]	[272]							
Fr	Ra	Ac*	Rf	Db	Sg	Bh	Hs	Mt	Ds	Rg							
francium	radium	actinium	rutherfordium	dubnium	seaborgium	bohrium	hassium	meitnerium	darmstadtium	roentgenium							
87	88	89	104	105	106	107	108	109	110	111							

Key

relative atomic mass
atomic symbol
name
atomic (proton) number

1
H
hydrogen
1

Elements with atomi
reported but

*The Lanthanides (atomic numbers 58-71) and the Actinides (atomic numbers 90-103) have been omitted
Cu and Cl have not been rounded to the nearest whole number

Mendeleev predicted the properties of Ga (similar to Al) before it was discovered as there was a gap below Al

Scientific or Standard Form

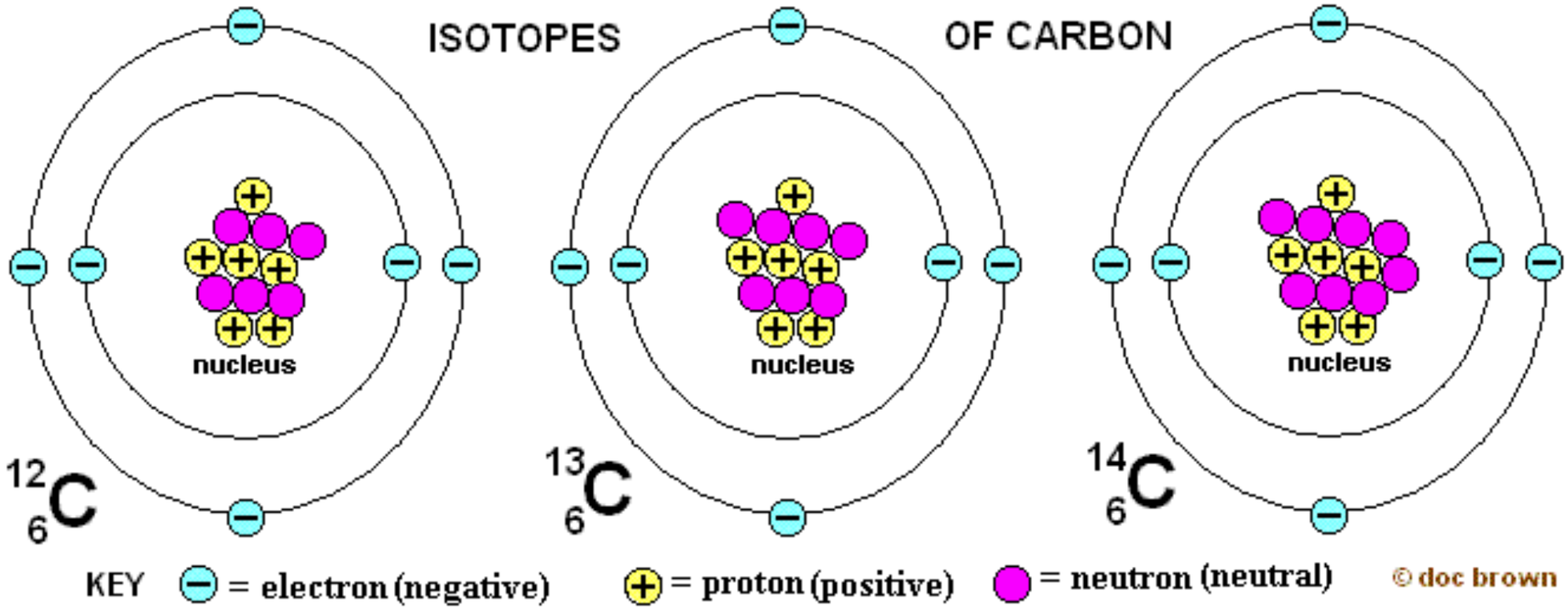
- Used for measuring the very big or the very small
- 1mm = 0.001m = 1 X10^{-3}m
- 1μM = 0.000001m = 1 X 10^{-6}m
- 1nM = 0.000000001m = 1 X10^{-9}m
- 1pM = 0.000000000001m= 1 X 10^{-12}m

Approximate radius of a atom

Each of these standard form values are to 1 significant figure

Approximate radius of a nucleus

ISOTOPES are different forms of the same element with the <u>same number of protons</u> but <u>different number of neutrons</u>



Calculate Relative Isotopic Mass by using percentages

RIM = (%1 X mass-1) + (%2 x mass-2) (%3 x mass-3) = then divide by 100

= (90 X 12) + (8 X 13) + (2 X 14) = 1212

1212/100 = 12.12

Learn the definition and practice the calculations

Before Moving On

- visit myschoolscience.com
  - Atomic Structure and the Periodic Table
- Print out the flashcards
- Read the 100% sheet and answer the questions
- Watch the videos from the links on the webpage
- Try the past paper exam questions and review your understanding though self marking from the given answers
- Complete the knowledge checklist

WORK FOR PROGRESS

It's Your Turn!

PRESS PAUSE

Working Towards

Expected

Greater Depth

- Name the 3 sub-atomic particles and give their mass and charge

- Aluminium has a mass number of 27 and atomic number of 13

  - How many protons, neutrons and electrons does it have?

  - How many electrons are in each shell

  - Why is it period 3 and group 3?

WORK FOR PROGRESS

PRESS
PAUSE

Working Towards

Expected

Greater Depth

- What is the definition of an isotope?
- What is the approximate radius of an atom?
    - How much smaller is the nucleus of an atom?
- Describe the key differences between the Plum Pudding and Nuclear models of the atom and name the scientists responsible for each model
- **Describe** and **explain** the key aspects of Rutherford's Gold Foil experiment
- Calculate the relative isotopic mass of Boron if 80% of it has a mass of 5 and 20% has a mass of 6

WORK FOR PROGRESS

Working Towards

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Greater Depth

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- Aluminium has a mass number of 27 and atomic number of 13

  - How many protons, neutrons and electrons does it have? **13P, 13E & 14N**

  - How many electrons are in each shell **2,8,3**

  - Why is it period 3 and group 3?

WORK FOR PROGRESS

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Greater Depth

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5.2