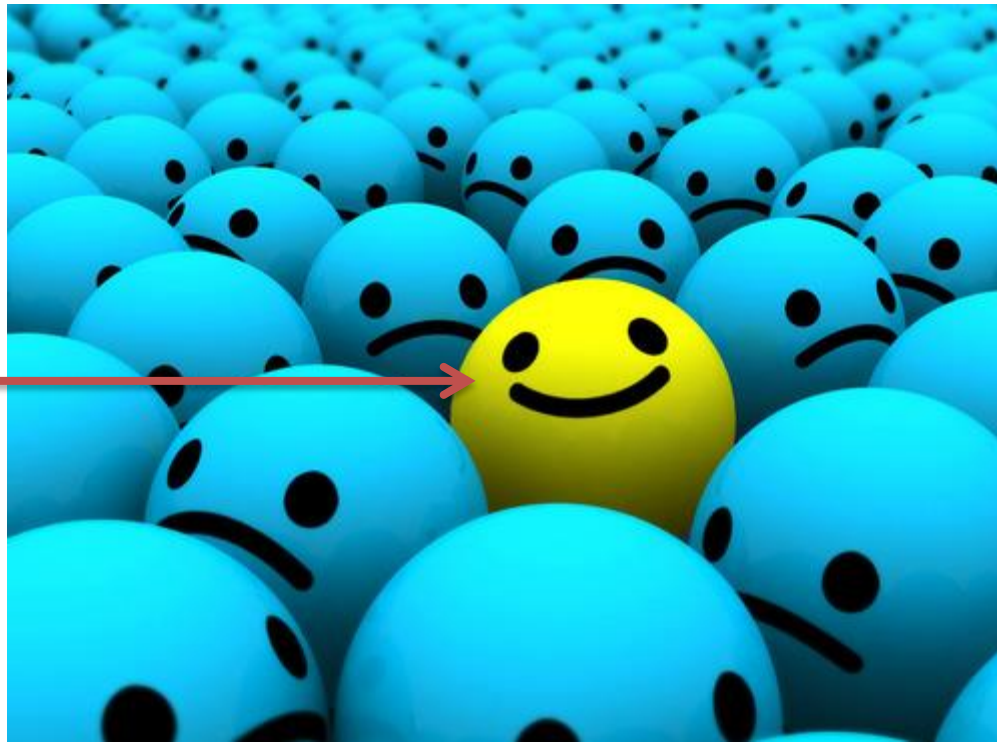
C3…in a nutshell!

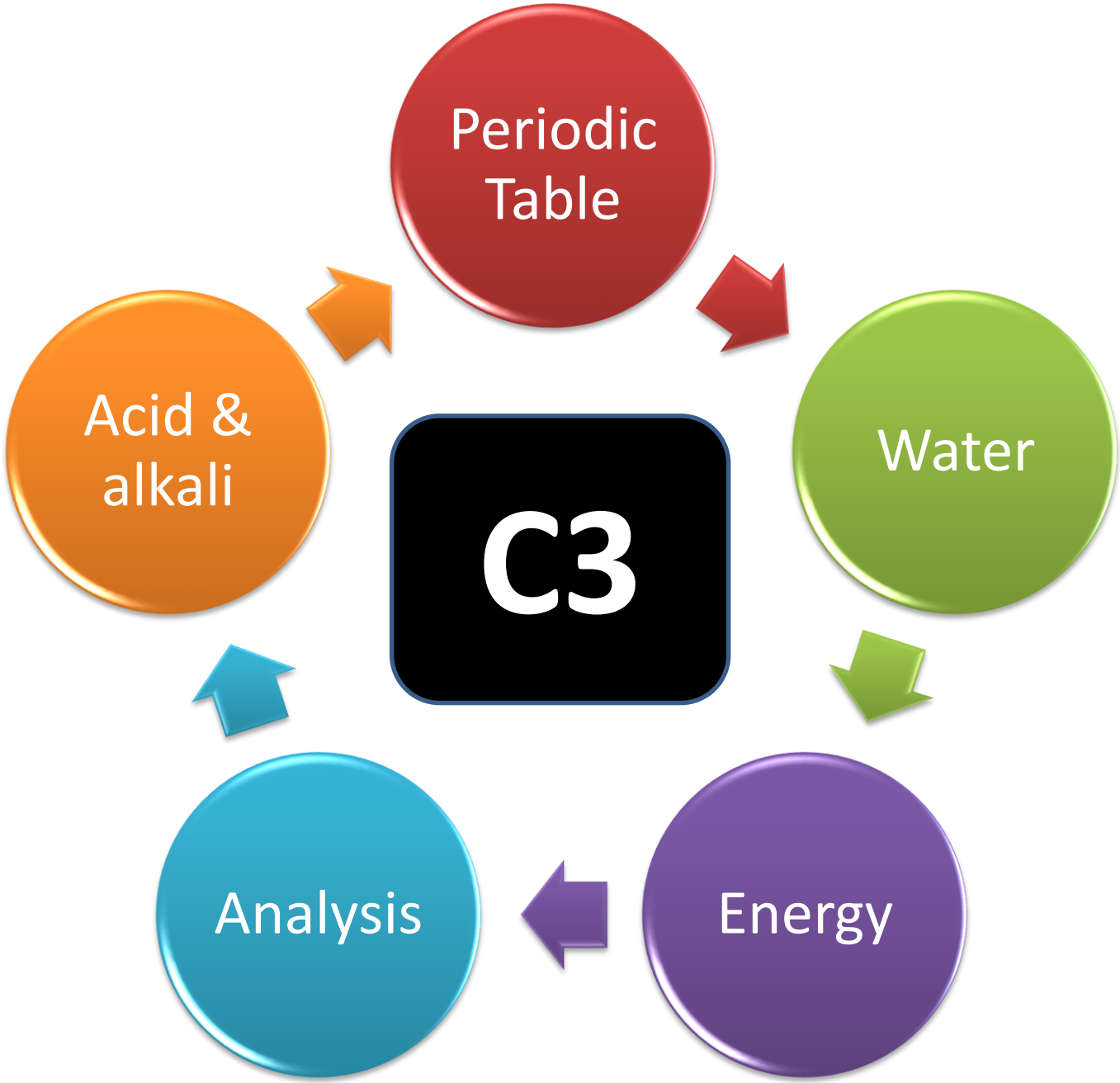
I will email you a copy of this. So don't copy notes for the sake of it! Just write down any extra bits you want

Just remember….

CHEMISTRY IS GREAT!!!

This is you!



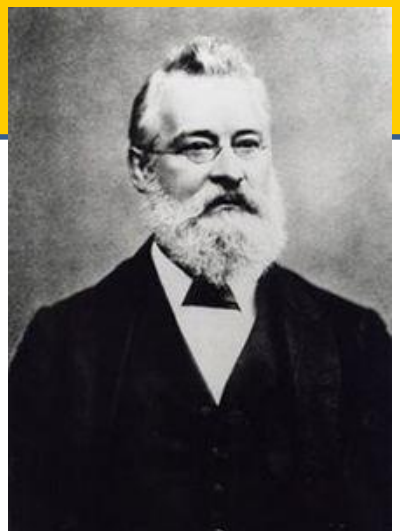

Periodic Table
Water
Energy
Analysis
Acid & alkali
C3

Periodic Table

Early Periodic Table

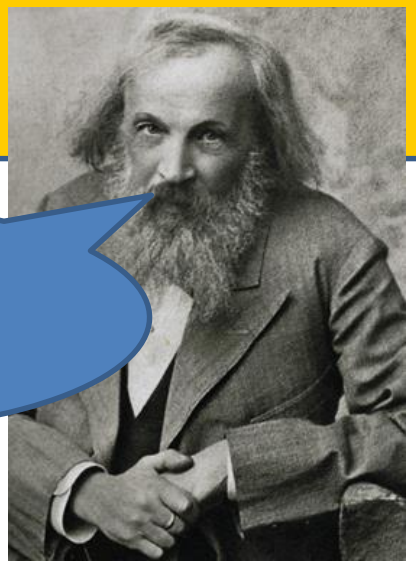
NEWLANDS:

- Built on Dalton's Law of Octaves (every 8th element had similar properties)
- Arranged by atomic mass
- Two elements in same box



MENDELEEV:

- Arranged by atomic mass
- Similar properties
- Left gaps for elements yet to be discovered

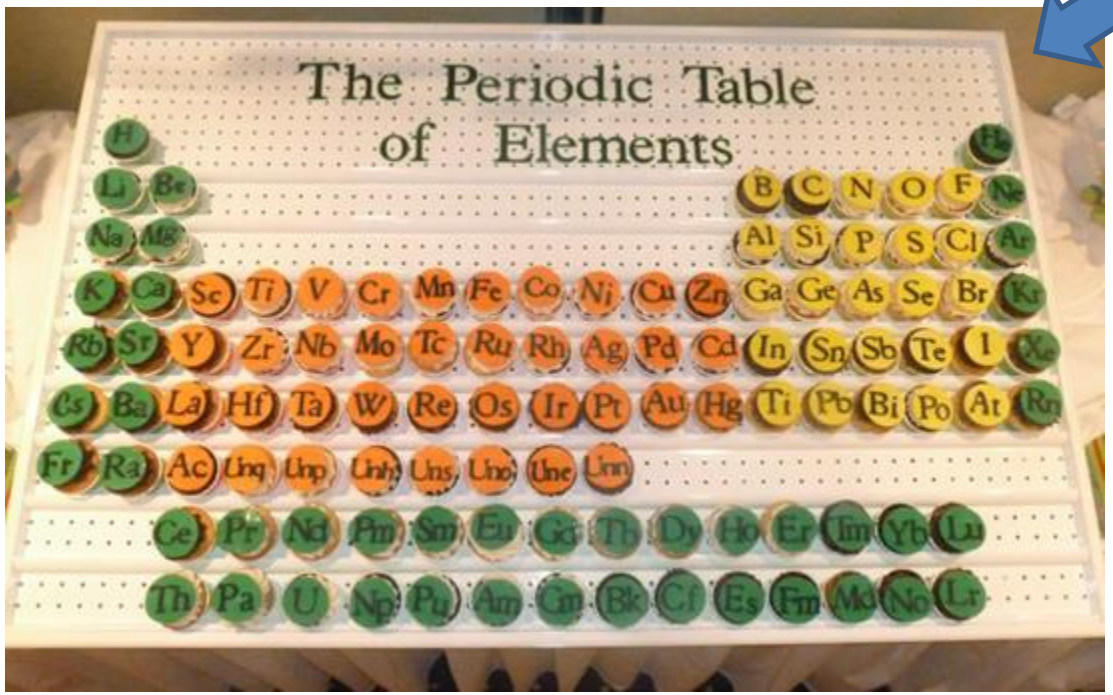


You silly man!!!

Periodic Table

Modern Periodic Table

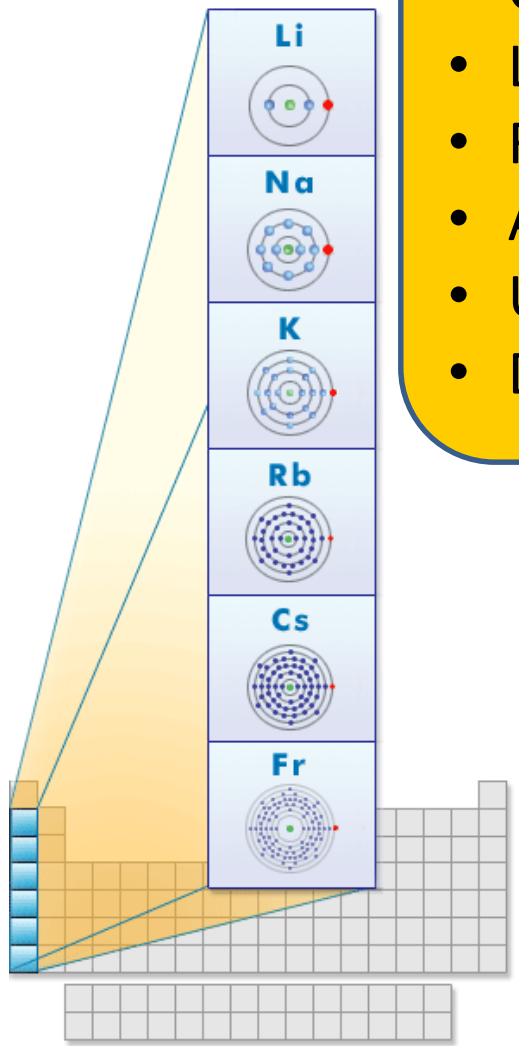
YUMMY!!



- Metals/Non-metals
- Arranged by proton number
- Groups – number of electrons on outer shell
- Periods – number of shells

Periodic Table

Group 1 – Alkali Metals



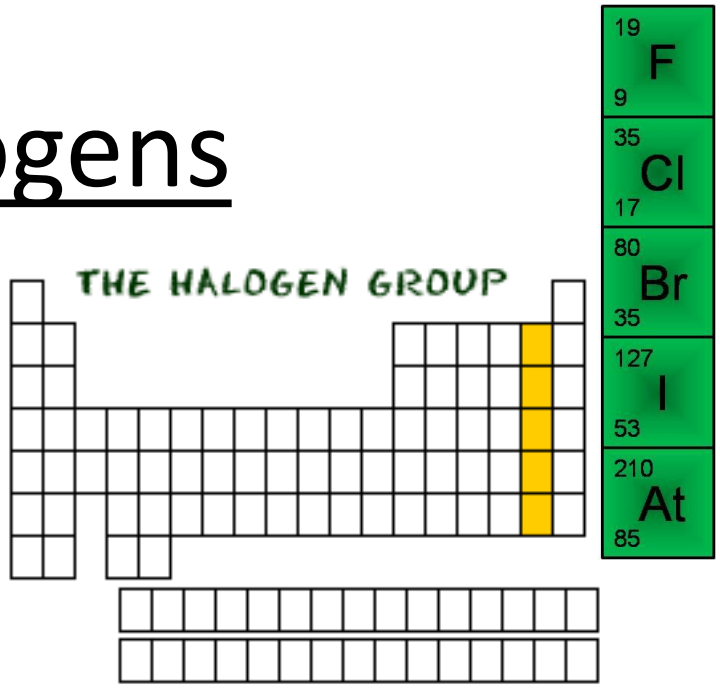
- Group 1 metals → 1+ ion
- Li, Na, K – less dense than water
- Reaction with water --> make H_2
- Alkali metals….metal hydroxide
- Universal indicator – purple
- Down group – lower mpt/bpt

Stored in oil, as reacts with oxygen in air

- Reactivity INCREASES down the group
- Larger atom
- Outer electron further away from +ve nucleus
- EASIER to lose due to SHIELDING effect of other electrons
- Less electrostatic force

Periodic Table

Group 7 – Halogens



- Group 7 non-metals → 1- ion
- Coloured vapours
- Diatomic molecules
- Down the group – higher mpt/bpt
- Forms ionic compounds with Grp1

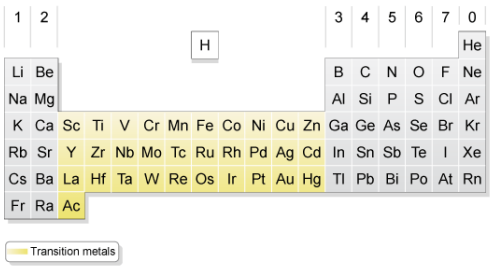
HALOGEN DISPLACEMENT

A more reactive halogen will displace a less reactive one from a compound

- Reactivity DECREASES down the group
- Larger atom
- Outer shell further away from +ve nucleus
- HARDER to gain an electron due to SHIELDING effect of other electrons
- Less electrostatic force to attract electron

Periodic Table

Transition Metals



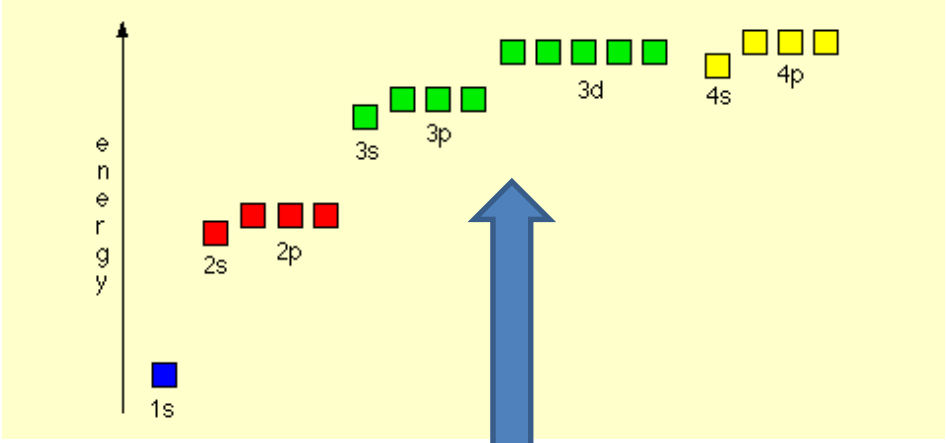
Compared with Group 1…

- Higher mpt
- Higher density
- Stronger/harder
- Much less reactive

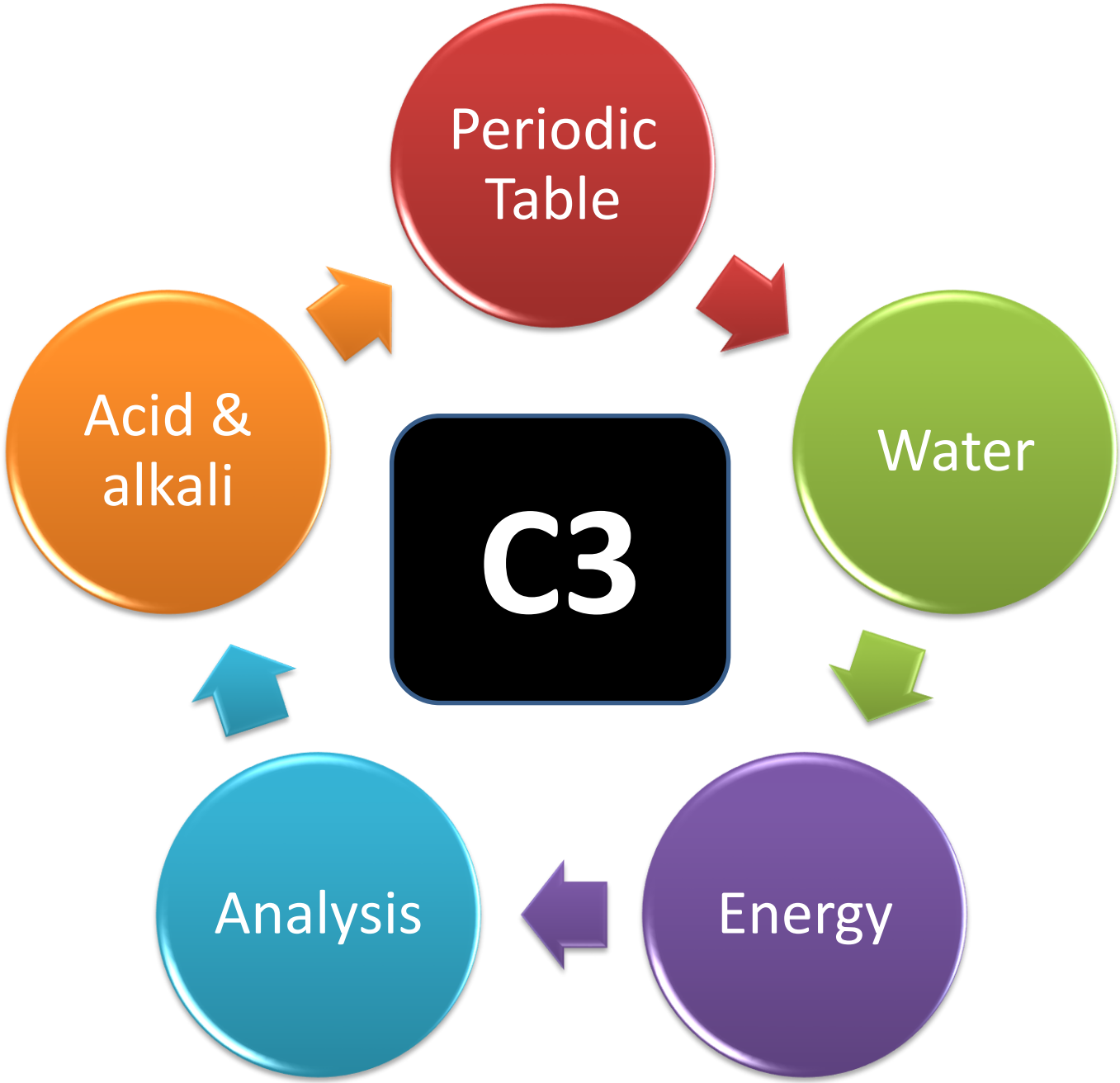
Used for catalysts

Form coloured compounds

Ions with diff charges



- Similar properties because they fill an inner 3rd shell (3d shell). This can hold 18 electrons, once 2 electrons fill the 4th energy level.
- Usually have same number of electrons on outer shell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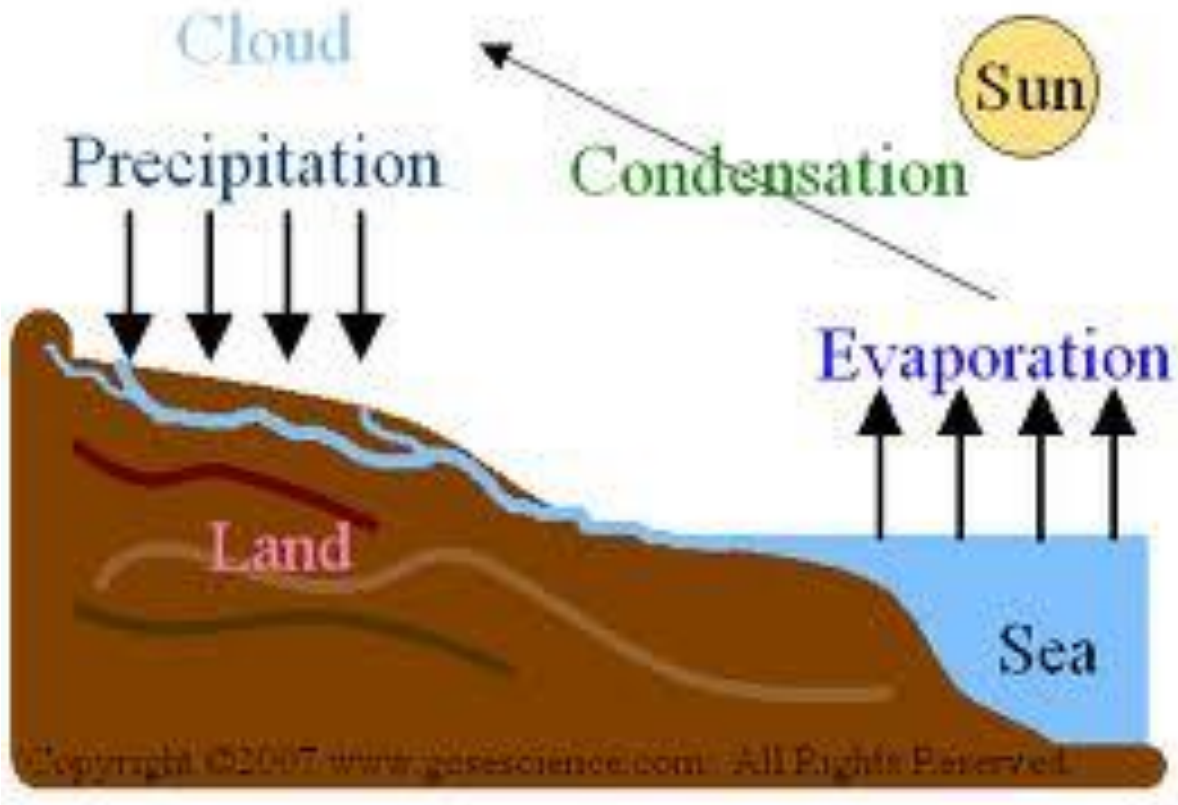
Water

Water Cycle

- Water evaporates due to Sun's thermal energy.
- Condenses to form clouds
- Precipitation (rain/snow/sleet) occurs.

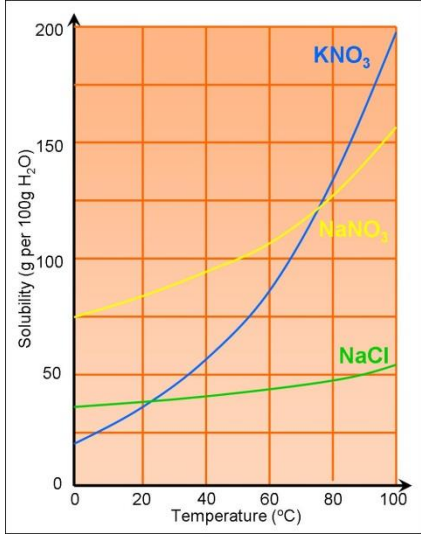
Ionic compounds are **soluble,** but covalent ones are not.



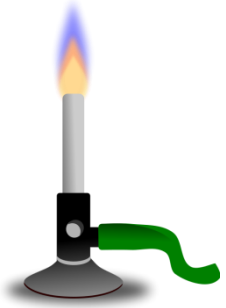
Water

Solubility

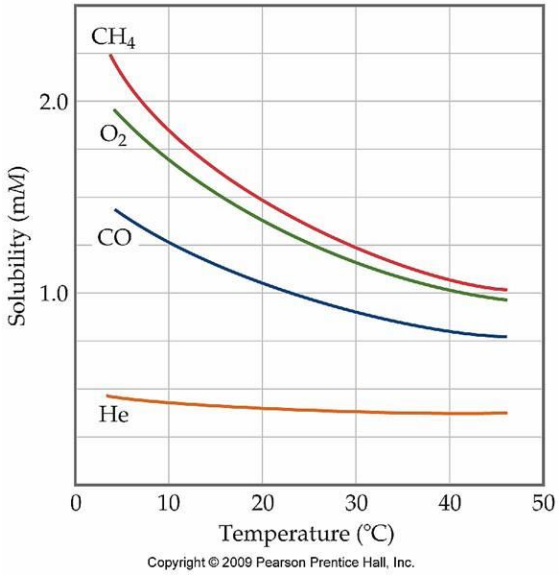
Saturated Solution → maximum amount of solute that can be dissolved in a solvent at a given temperature.



Heat up solvent….more solid solute will be dissolved

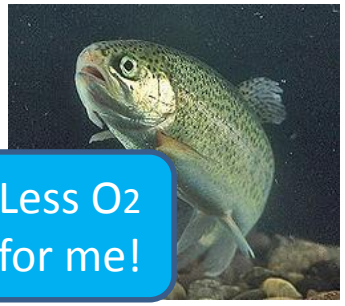


Leave to cool….solid solute will crystallise out of solution



GASES:
Increase temperature….solubility DECREASES
Increase pressure…solubility INCREASES

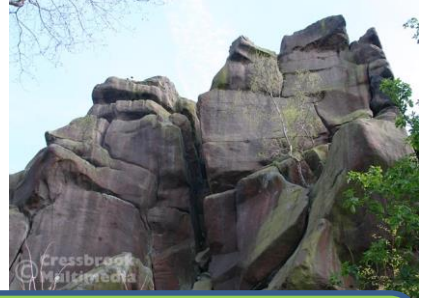
Hot water from cooling towers → THERMAL POLLUTION



Less O_2 for me!

Water

Hard Water



Contains Mg2+ and Ca2+ ions, dissolved when water passes through rocks

Soft water → easy lather
Hard water → less lather

SCUM
When hard water reacts with soap.

SCALE
When hard water is heated.

+ve
- Ca for bones/teeth

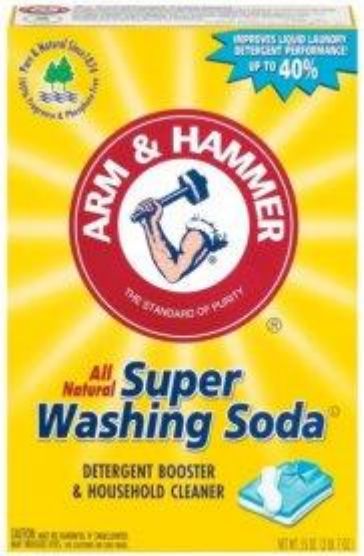
-ve
- Kettles furrow up → less efficient

SCALE is basically limescale which is Calcium Carbonate which is a solid ppt and forms on metal appliances reducing efficiency.

Water

Removing Hard Water

Use washing soda



Add Sodium Carbonate

Precipitates out the Ca and Mg ions to form insoluble carbonates

Ion Exchange (water softener)

Filled with resin.

Contain Sodium/Hydrogen Ions

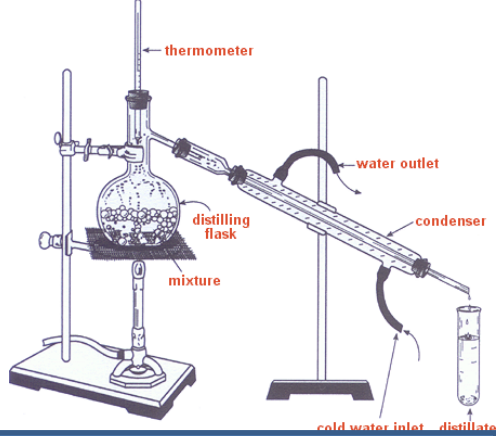
As the water is passed through the resin, the Na/H ions are EXCHANGED with the Ca/Mg ions.

Needs to be topped up with Na ions so NaCl is poured in to replenish.

Water

Water Treatment

Made safe to drink by removing solids and micro-organisms



Distillation = PURE WATER

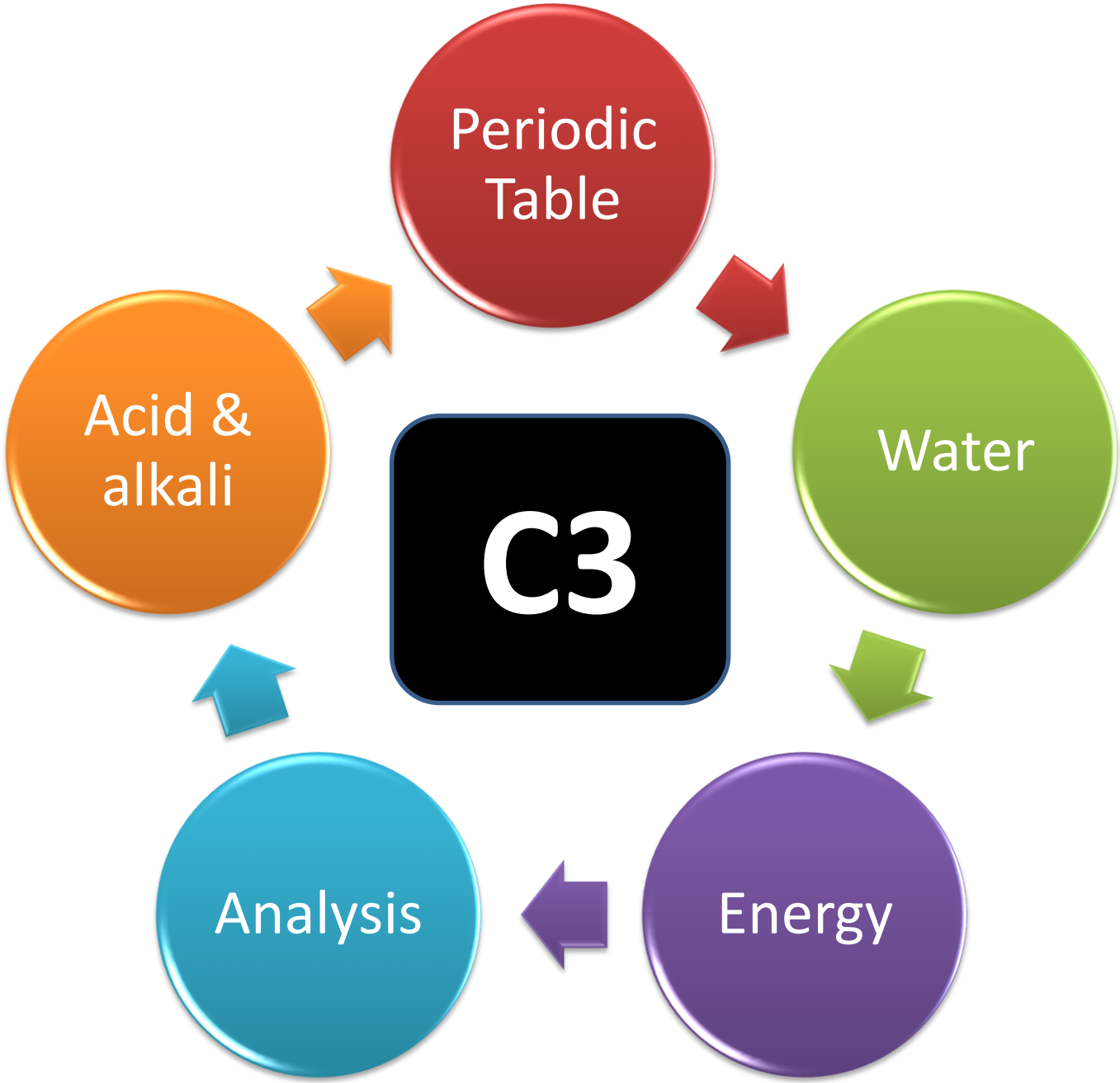
Water source → Filter solids

Sedimentation of small particles using Aluminium sulphate

Filter of fine sand

Chlorine → used to disinfect

Carbon → reduces Cl levels
Ion exchange resin
Silver → discourage bacterial growth on filter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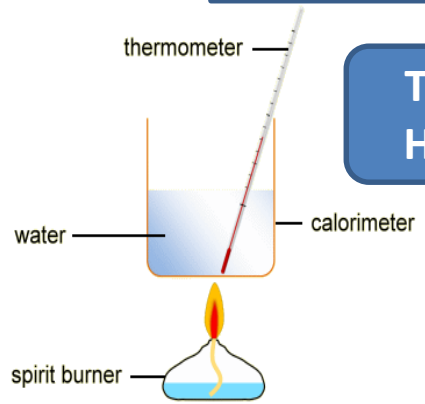
Energy

Energy from fuels

4.2J raises temp of 1 g of water by 1 degree

Calorimeter



Think HSW!

A + B → C

If 0.1 mole of reactants. Total mass of A and B is 100g.

Temp start is 19.6, temp max is 26.1

Work out diff….6.5

Energy change = mass x 4.2 x temp change

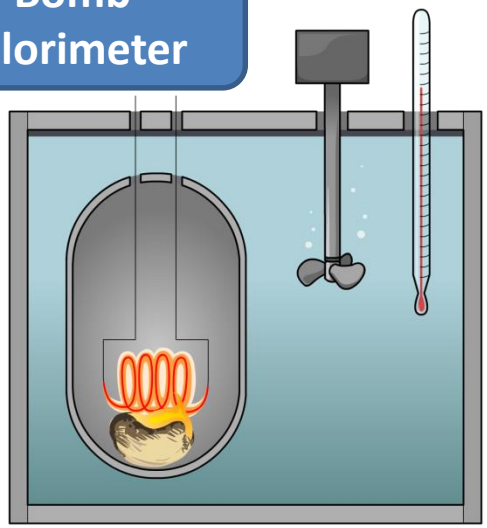
(Don't need to learn this, you would get this)

So for 0.1 moles = 2730J

For 1 mole 2730 x 10 27300J (27.3kJ)

…..exothermic reaction (as temp rise) = -27.3kJ/mol

Bomb calorimeter



Food high in carbs and fats have lots of energy!! → more than body needs → obesity

Energy

Energy changes

Reaction = bond breaking (endo) and bond making (exo)

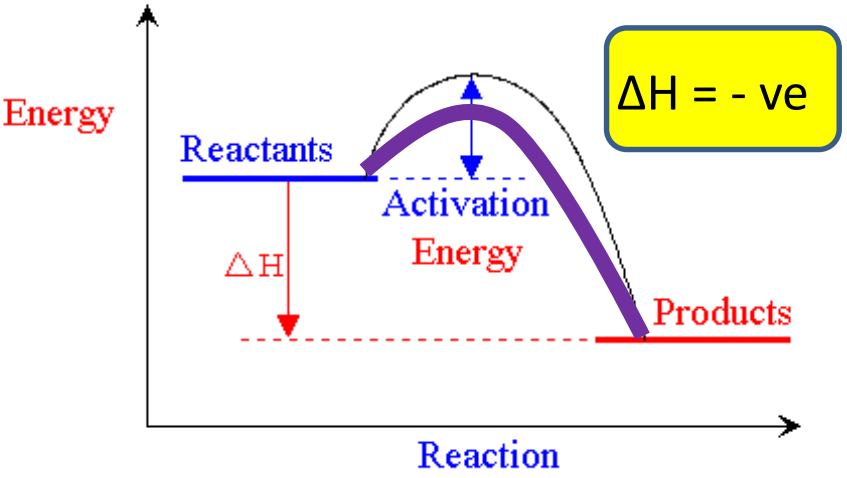
EXOTHERMIC

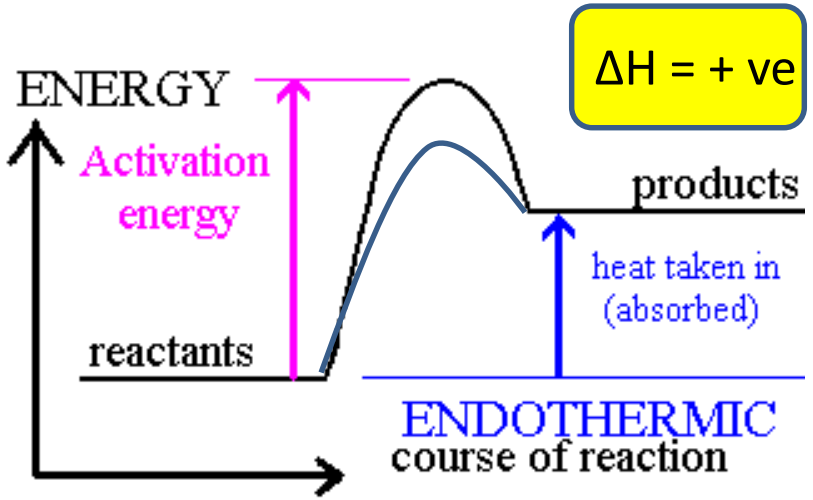
Energy required to break bonds in less than energy released when new bonds are formed

CATALYST….
Lowers activation energy

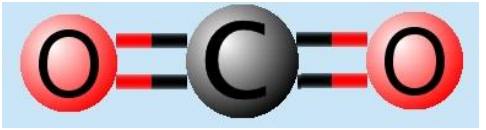
ENDOTHERMIC

Energy required to break bonds in greater than energy released when new bonds are formed



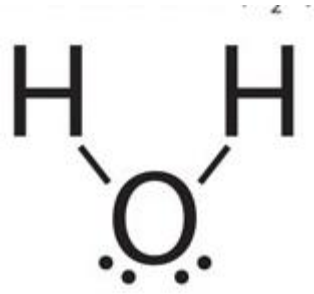


Energy



Bond energies

Identify the bonds…..stick diagrams!



$$CH_{4(g)} + 2O_{2(g)} \rightarrow 2H_2O_{(l)} + CO_{2(g)}$$

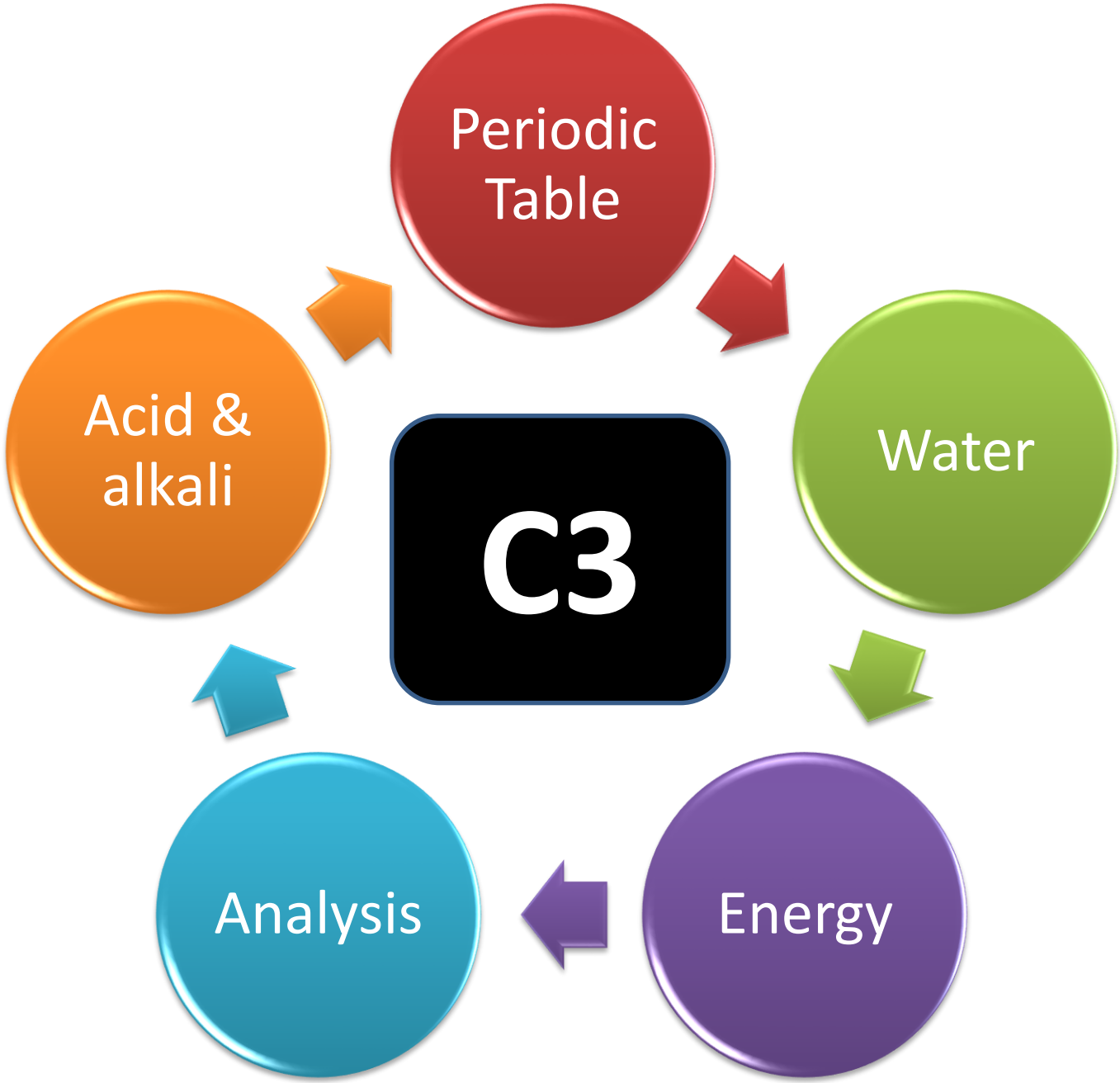
Bond	Bond energy kJ/mol
H-H	436
Cl-Cl	242
H-Cl	431
O-H	464
C-C	347
C-O	335
O=O	498

Add up on the bonds in the reactants.
This is bond energy needed to break the bonds

Add up on the bonds in the products.
This is bond energy needed to make new bonds.

REMEMBER… making new bonds is an exothermic reaction…so it is always a –ve number

ΔH = bond breaking + (- bond making)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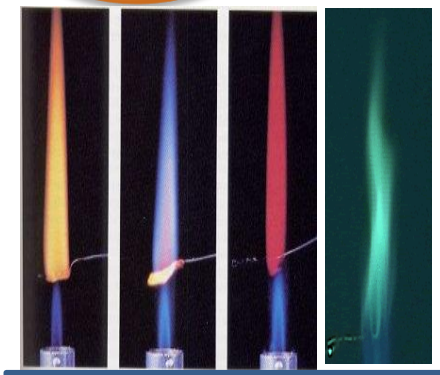
Analysis

Positive Ions



FLAME TESTS

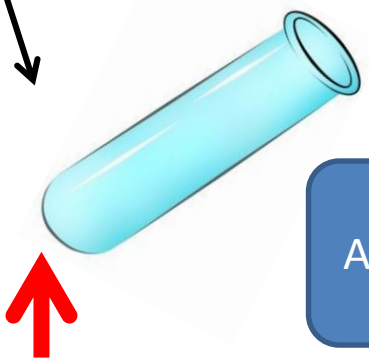
metal	flame test colour
barium	apple green
calcium	brick red
potassium	lilac
lithium	bright red
sodium	orange

Add Sodium Hydroxide

Cu 2+

Fe 2+

Fe 3+

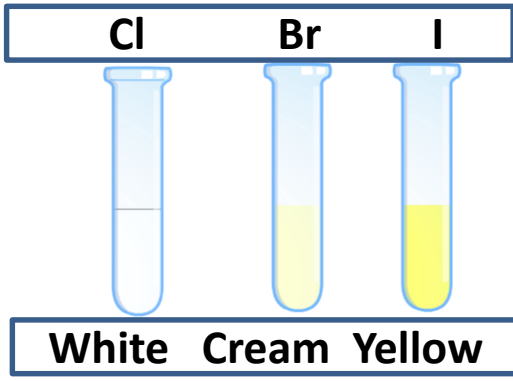


Add NaOH, gently warm. Ammonium gas turn red litmus paper blue

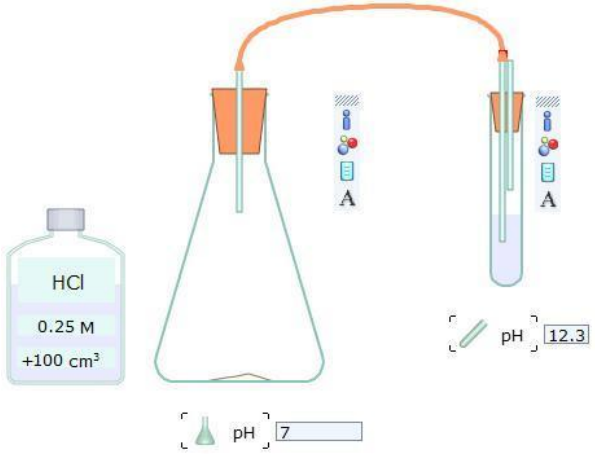
Analysis

Negative Ions

Halides → Add nitric acid and silver nitrate



Carbonates → add acid → bubbles → if they turn limewater cloudy



SULPHATES
(add HCl to removes any carbonate ions)
Add Barium Chloride → white ppt

Copper Carbonate → Copper Oxide

Zinc Carbonate → Copper Oxide

NITRATES

Test for ammonia first → negative result
Add ALUMINIUM (this reduces the nitrate ion to Ammonium ions)
Test again for ammonia gas → positive result

Analysis

Organic Compounds

BURN or CHAR when heated

Unsaturated compounds , have a double/triple bond.
Test using bromine water….goes from orange to colourless

COMBUSTION ANALYSIS (empirical formula)

Complete Combustion → products are always water (H_2O) and Carbon Dioxide (CO_2)

Moles = Mass / Mr

(They will give you the mass and Mr in the question)

	CO_2	H_2O
Moles	44g /44	18g / 18
	1 mole	1 mole (x 2)
Ratio	1	2

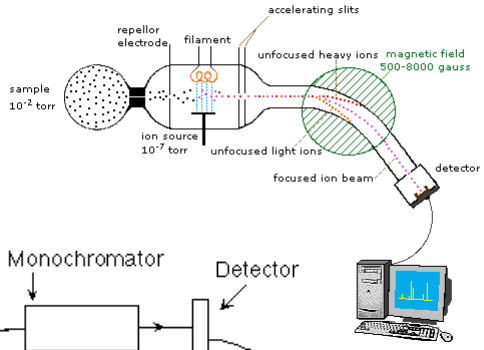
= CH_2

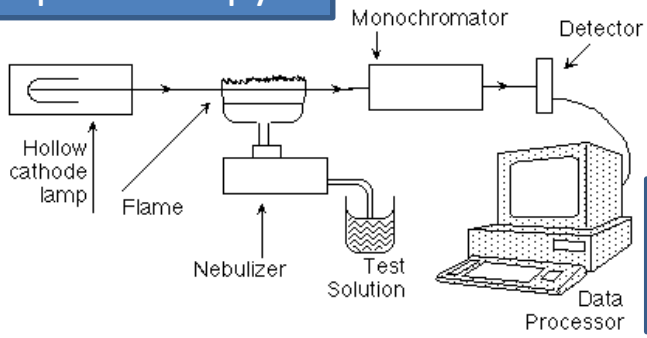
Analysis

Instrumental Analysis

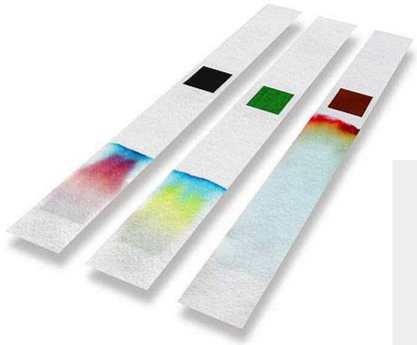
All due to advancements of computers

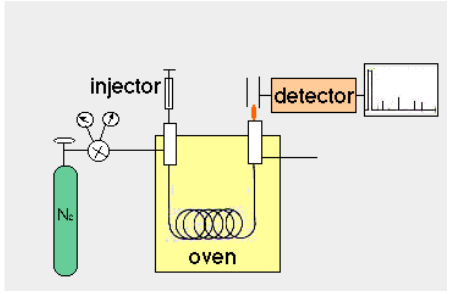
Mass Spectrometer and Atomic Absorption Spectroscopy





Identify elements





Chromatography can separate compounds in mixtures

Highly accurate, quick and enables small quantities to be tested

Expensive, specialist training needed, only interpreted by comparison of known specimans

Acids & Alkalis

Strong/Weak Acids/Alkalis

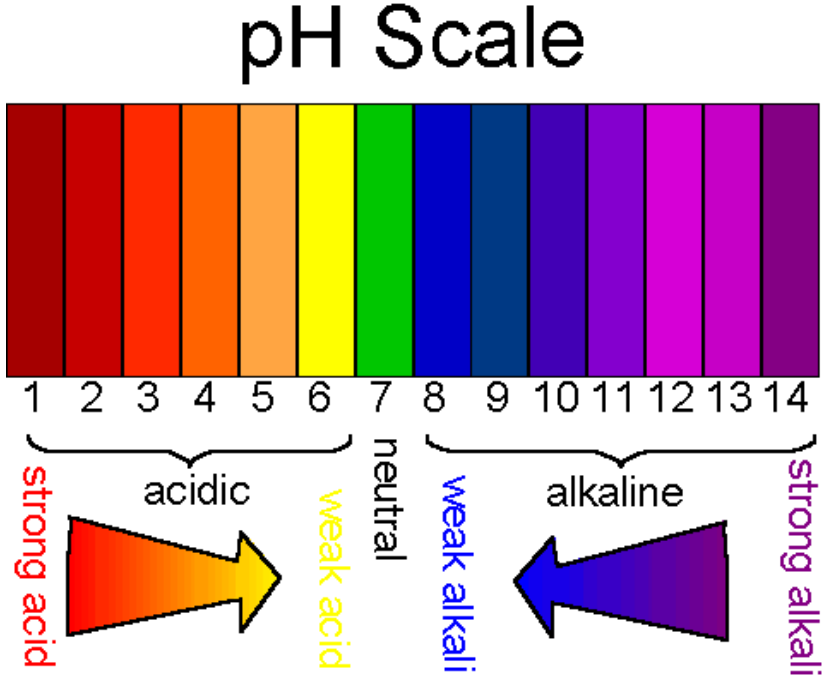
TESTING whether strong or weak…use Universal Indicator

STRONG ACIDS fully dissociate into their ions

$HCl \rightarrow H^+ + Cl^-$

WEAK ACIDS partially dissociate into their ions

$CH_3COOH \leftrightarrow H^+ + CH_3COO^-$



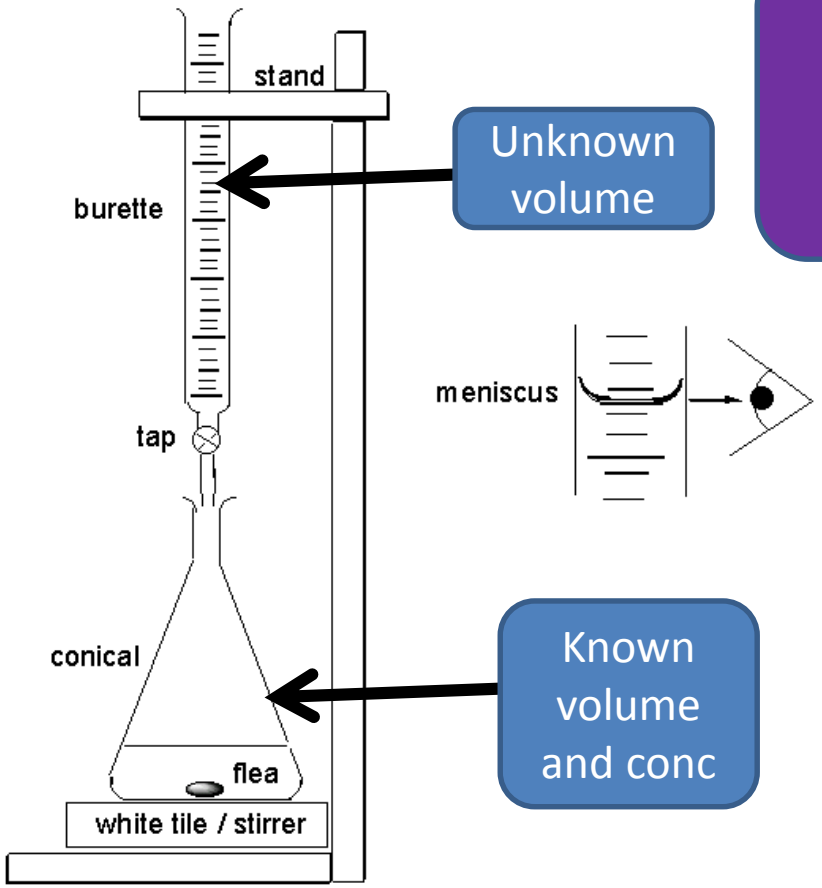
Same for alkalis, just OH- ions

Acids & Alkalis

NEUTRAL – pH7

Titration

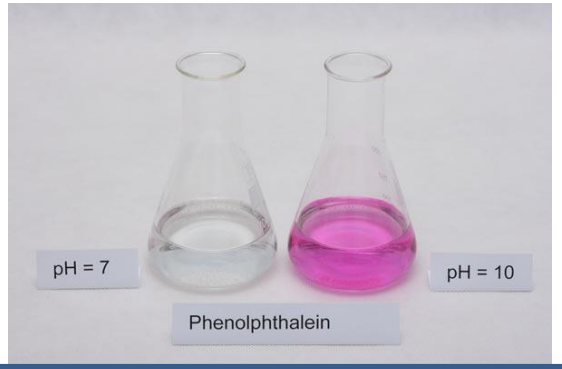
Used to determine accurately how much alkali is needed to react completely with a known volume of acid (or vice-versa)



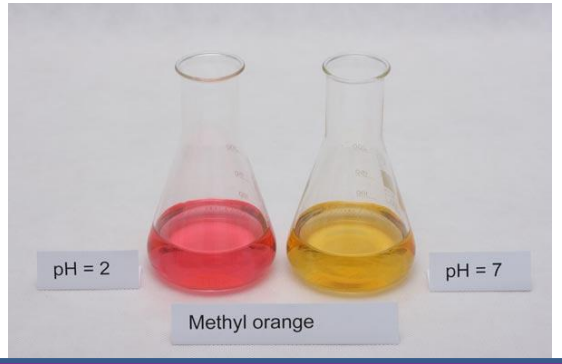
Unknown volume

Known volume and conc

END POINT
Acid-base reaction is complete



Phenolphthalein → STRONG ALKALI and WEAK ACID



Methyl Orange→ STRONG ACID and WEAK Alkali

Acids & Alkalis

Write what you know from the question.

Titration Calculations

$2NaOH + H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O$

V = 30cm³ Conc = ?

V = 20cm³ Conc = 0.5

1. Convert vol into dm3 by dividing by 1000.
2. Calculate moles of substance of known vol and conc

MOLES = Vol x Conc

3. Look at the equation for the ratio. Here, it is 2:1

So we calculate moles of acid here and then multiply this by 2

4. Now rearrange the formula to allow you to work out the unknown

If they want you to work out the g/mol

All you do is multiply the RFM (they give you this!) by the concentration you calculated

Acids & Alkalis

Theories

Arrhenius

Acid - produces hydrogen ions, H^+ in water solution.
Base - produces hydroxide ions, OH^- in water solution.

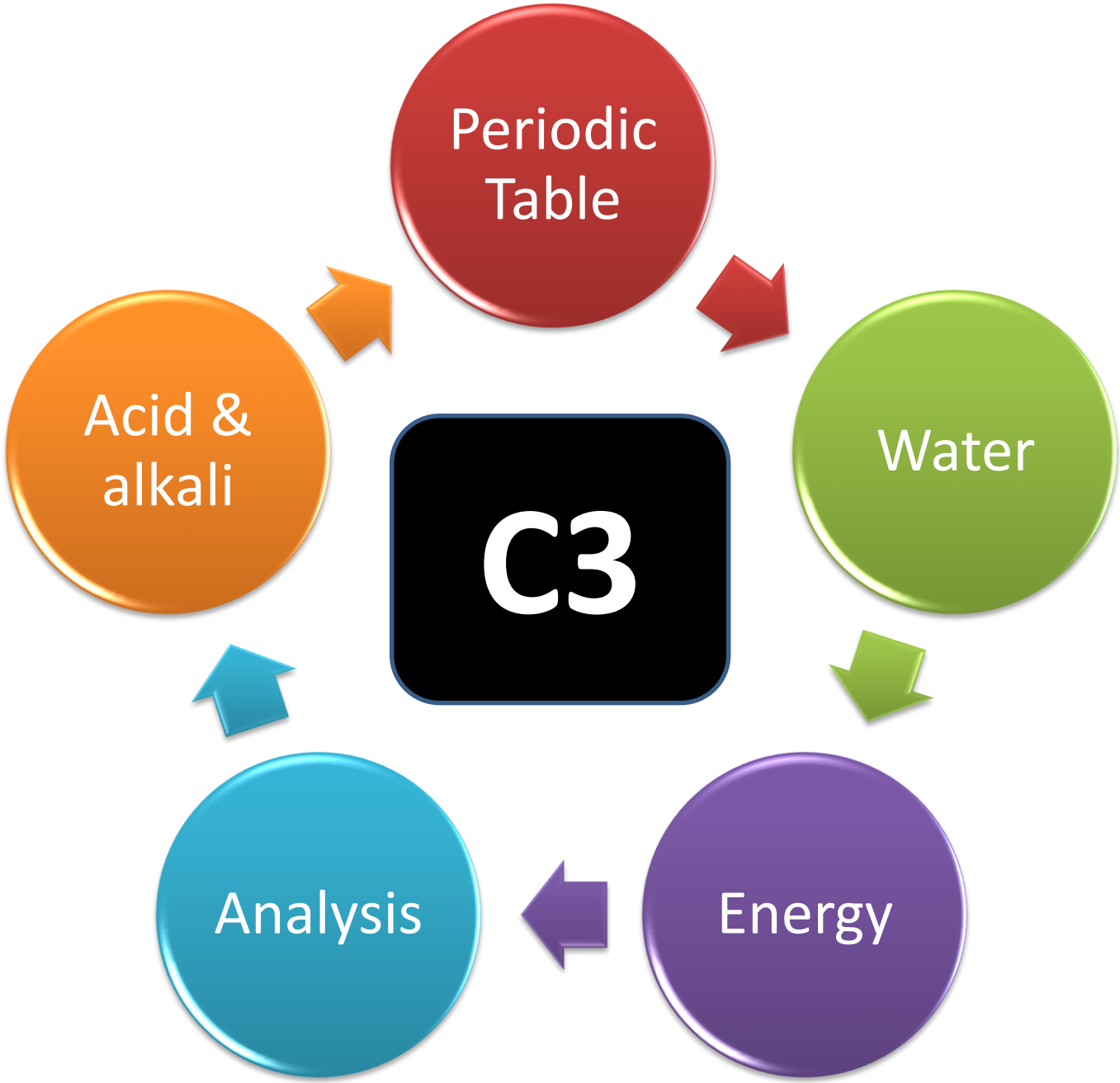
H+

Losing it's electron… means it's just a proton

My ideas were rejected as they were new and I was just a student

Acid – proton donor
Base – proton acceptor

We are well known and built upon Arrhenius ideas so our ideas were readily accepted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