PiXL Gateway: Progression – Chemistry

Year 12-13 Chemistry

Contents:

I. Chemistry Vocabulary

SCIENCE - CHEMISTRY:

Currently, within the Chemistry section of the app, we have the following units:

- Energetics and thermodynamics
- Acid-base equilibria
- Redox
- Kinetics
- Organic chemistry

Energetics and thermodynamics Keywords and Definitions

Word	Definition
enthalpy	Enthalpy is a measure of the heat content of a substance, or a system.
pascal	The pascal is the unit for pressure.
kelvin	The kelvin is a unit for temperature, abbreviated to K.
standard conditions	In chemistry, standard conditions are 100kPa and 298K.
Hess's Law	Hess's Law states the total enthalpy change is independent of the route taken.
calorimetry	Calorimetry is a method of finding out how much heat is given out by a reaction.
lattice enthalpy	Lattice enthalpy is a measure of the strength of the forces between the ions in an ionic solid.
theoretical	In science, the word theoretical means based in or calculated through theory rather than practice.
experimental	In science, the word experimental means relating to scientific experiments.
polarisation	In this topic, polarisation means to produce a polarised molecule by distorting the distribution of charge.
polarising power	The term polarising power means the ability of an atom, ion or group of atoms to attract electrons towards itself.
polarisability	The term polarisability is the tendency of an atom, ion or group of atoms to form a distorted charge cloud.
cation	A cation is a positively charged ion.
anion	An anion is a negatively charged ion.
ionisation	The word ionisation means the formation of ions.
atomisation	The word atomisation means the process of forming free gaseous ions from a solid, liquid or solution.
gaseous	The word gaseous means relating to, or having the characteristics of, a gas.
bond enthalpy	The term bond enthalpy refers to the energy required to break a bond.
electron affinity	The term electron affinity means the ability of an atom to accept an electron.
absolute zero	Absolute zero is the lowest internal energy of solid matter in its ground state.

aqueous	The word aqueous means dissolved in water.
entropy	Entropy is a measure of the disorder of a system.
disordered	In science, the word disordered means an absence of symmetry.
spontaneous	In science, the word spontaneous refers to a process which will occur without any energy input from the surroundings.
exothermic	The word exothermic refers to reactions which give out energy, specifically in the form of heat.
endothermic	The word endothermic refers to reactions which absorb heat energy.
system	In chemistry, the system refers to the set of substances and energy that is being studied.
surroundings	In chemistry, the word surroundings refers to everything except the set of substances and energy being studied: everything outside of the system.
feasible	In science, the word feasible means thermodynamically possible.
Born-Haber cycle	A Born-Haber cycle is used to calculate lattice enthalpies.
hydration	In chemistry, the term hydration refers to a chemical reaction where water is one of the reactants.

Acid-base equilibria Keywords and Definitions

Word	Definition
Bronsted-Lowry acid	A Bronsted-Lowry acid is a chemical species that donates one or more hydrogen ions (protons) in a reaction.
donor	In chemistry, a donor is a molecule which donates a proton or hydrogen ion.
Bronsted-Lowry base	A Bronsted-Lowry base is a proton (hydrogen ion) acceptor.
acceptor	In this topic, an acceptor is a molecule which accepts a proton or hydrogen ion.
proton	In this topic, a proton is referred to as a hydrogen ion.
salt	In science, a salt is a compound made when the hydrogen in an acid is replaced by a metal.
pH	The pH is an indication of the concentration of aqueous hydrogen ions in solution.
logarithmic	A logarithmic scale is an index or power.
ion	An ion is an electrically charged atom, or group of atoms, formed by the loss or gain of electrons.
aqueous	The word aqueous means dissolved in water.
strong	In chemistry, the word strong means the molecule completely or almost completely dissociates in water.
weak	In chemistry, the word weak means the molecule partially dissociates in water.

dissociate	In chemistry, the word dissociate means to separate or split into smaller atoms, ions or molecules.
monoprotic	A monoprotic acid donates one mole of protons per mole of acid.
diprotic	A diprotic acid donates two moles of protons per mole of acid.
equimolar	The word equimolar means the same amount of moles.
titration	Titration is a method for determining the concentration of an unknown substance using neutralisation.
indicator	In chemistry, an indicator is a substance which undergoes an observable colour change when the pH changes.
buffer	A buffer is a solution which resists sudden, large pH change.
neutralisation	Neutralisation is a reaction between an acid and a base.
enthalpy	Enthalpy is a measure of the heat content of a substance.

Redox Keywords and Definitions

Word	Definition
oxidation	Oxidation is the the process of electron loss.
reduction	Reduction is the process of electron gain.
ion	An ion is an electrically charged atom, or group of atoms, formed by the loss or gain of electrons.
oxidising agent	An oxidising agent is a substance which gains electrons in a reaction.
reducing agent	A reducing agent is a substance which loses electrons.
disproportionation	A disproportionation reaction is a type of reaction where an element in a single species is simultaneously oxidised and reduced.
redox	A redox reaction is a type of reaction involving the transfer of electrons.
cation	A cation is a positively charged ion.
anion	An anion is a negatively charged ion.
half-cell	A half-cell is a structure which contains an electrode immersed in an electrolyte.
spectator ion	A spectator ion is an ion which is unchanged on both sides of a chemical equation.
standard electrode potential	A standard electrode potential is a value for a half cell compared to a hydrogen electrode.
aqueous	The word aqueous means dissolved in water.
emf	The emf of a cell is the maximum potential difference between half cells.

titration	Titration is a method for determining the concentration of an unknown substance using neutralisation.
cell	In chemistry, a cell is something which converts chemical energy into electrical energy.
electrochemical	The term electrochemical refers to the relationship between chemical reactions and electricity.
conventional representation	Conventional representation is how something is normally presented.

Kinetics Keywords and Definitions

Word	Definition
activation energy	The activation energy is the energy required for a reaction to take place.
Maxwell-Boltzmann distribution	A Maxwell-Boltzmann distribution shows the distribution of molecular energies in gases.
distribution	The word distribution means shared out or spread over an area.
catalyst	A catalyst is a substance which increases the rate of a reaction by providing an alternative pathway with a lower activation energy.
alternative	The word alternative means different, another possibility or choice.
route	In chemistry, the route means the direction or pathway followed by a chemical reaction, or chosen in order to synthesise a particular molecule.
homogeneous	In homogeneous catalysis, the reactant and catalyst are in the same state or phase.
heterogeneous	In heterogeneous catalysis, the reactant and catalyst are in different states or phases.
phase	In chemistry, the word phase means a distinct and homogeneous form of matter.
rate of reaction	The rate of reaction is how quickly a reaction happens.
sufficient	The word sufficient means enough.
gradient	In science, the word gradient can relate to the steepness of a graph, where it is a measure of the rate of change, or the difference in concentration between two sites.
tangent	In science, a tangent is a straight line that touches a curve at a point and is used to find the gradient.
initial	In science, the word initial means occurring at the beginning.
rate equation	The rate equation is an equation which describes the effect of changing concentration on the rate of a reaction.
order	The order of a reaction is the power to which a reactant is raised in the rate equation.
with respect to	The phrase with respect to means in relation to or compared to.
half-life	In chemistry, the half-life of a reaction is the time it takes for the concentration to fall to half its original value.

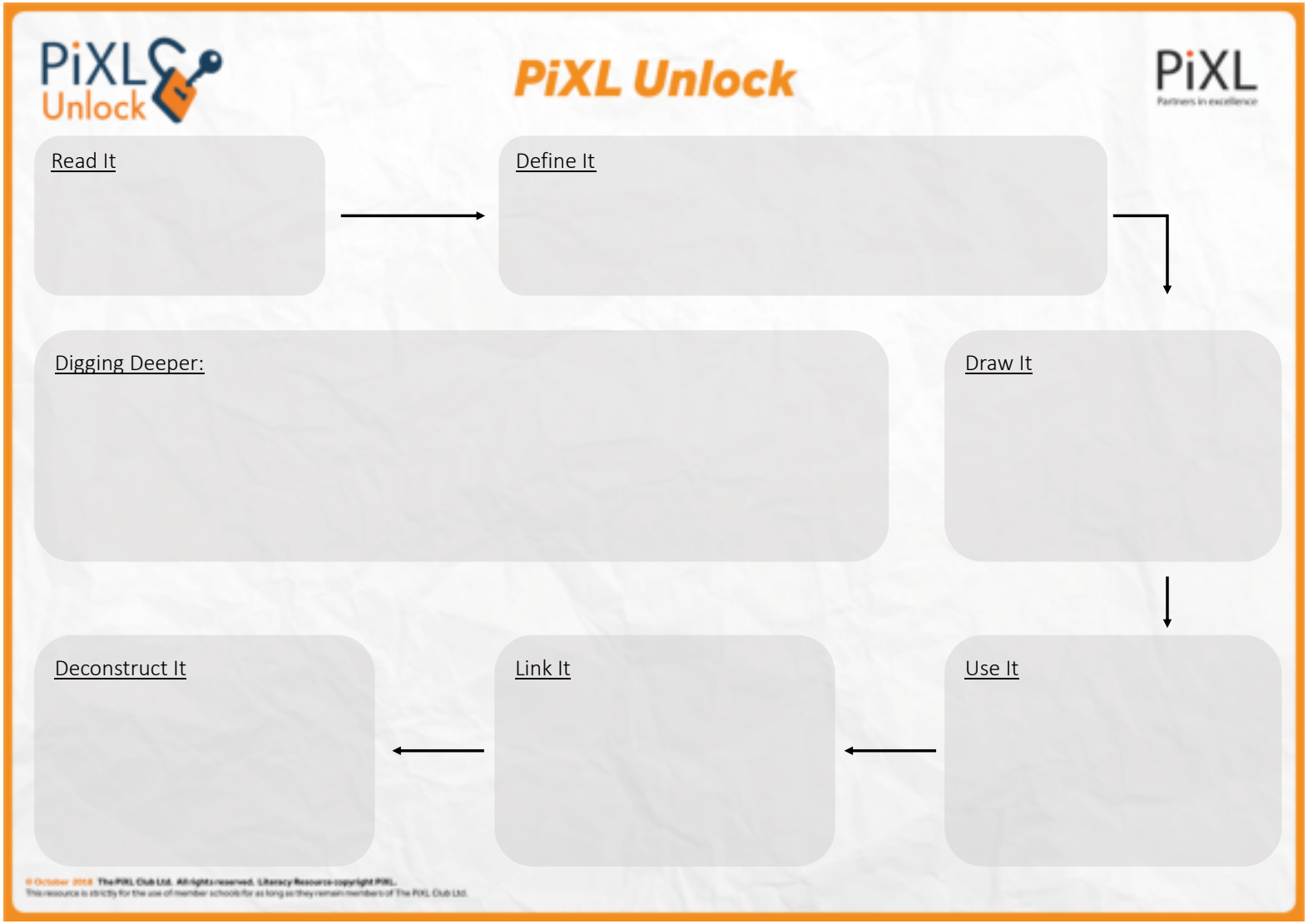
rate-determining step	The rate-determining step is the slowest step of a chemical reaction which determines the rate of the overall reaction.
evolved	In chemistry, the term evolved means given off.
titration	Titration is a method for determining the concentration of an unknown substance using neutralisation.
colorimetry	Colorimetry is a method to determine concentration using light intensity.
mechanism	In chemistry, a mechanism is a step by step sequence of reactions within an overall reaction.

Organic Chemistry Keywords and Definitions

Word	Definition
hydrocarbon	A hydrocarbon is a compound of hydrogen and carbon only.
empirical formula	The empirical formula is the simplest whole number molar ratio of the amount of elements in a compound.
molecular formula	The molecular formula shows the number of atoms of each element in a compound.
homologous series	A homologous series is a series of compounds with the same functional group.
functional group	A functional group is a group of atoms on a molecule which are responsible for characteristic chemical reactions.
nomenclature	Nomenclature is a series of rules to generate systematic names for chemicals.
addition reaction	In an addition reaction, two or more molecules combine to form a larger one.
elimination reaction	An elimination reaction involves the loss of a small molecule during a reaction.
substitution reaction	During a substitution reaction, one functional group is replaced by another during a chemical reaction.
isomerism	The word isomerism relates to molecules containing the same kinds and numbers of atoms in different structural arrangements.
alkane	An alkane is a hydrocarbon which contains only single bonds between carbons.
intermolecular	The word intermolecular means between molecules.
radical	A radical is a molecule with at least one unpaired electron.
unpaired	In chemistry, the word unpaired normally relates to electrons and indicates an electron which is by itself and not in a pair.
mechanism	In chemistry, a mechanism is a step by step sequence of reactions within an overall reaction.
homolytic fission	The term homolytic fission is a process involving the equal breaking of a covalent bond.
alkene	An alkene is a hydrocarbon with one or more double bonds between carbons.

electrophile	An electrophile is an electron pair acceptor.
catalyst	A catalyst is a substance which increases the rate of a reaction by providing an alternative pathway with a lower activation energy.
alcohol	An alcohol is an organic molecule containing the -OH functional group.
heterolytic fission	The term heterolytic fission is a process resulting in an unequal breaking of a covalent bond.
carbocation	A carbocation is a positive ion with the charge centred on a carbon atom.
intermediate	In chemistry, an intermediate is a molecule that is formed from the reactants, which reacts further to form the products.
nucleophile	A nucleophile is an electron pair donor.
hydrolysis	Hydrolysis is a reaction involving the breaking of a bond in a molecule using water.
ketone	A ketone is an organic molecule containing the -CO- functional group.
carboxylic acid	A carboxylic acid is an organic molecule containing the -COOH functional group.
aldehyde	An aldehyde is an organic molecule containing the -CHO functional group.
ester	An ester is an organic molecule containing the -COOR functional group.
amine	An amine is an organic molecule containing the $-NH_2$ functional group.
aromatic	In chemistry, the word aromatic means a cyclic, planar molecule.
cyclic	In chemistry, the word cyclic means having a molecular structure with one or more closed rings of atoms.
chirality	The word chirality means asymmetric in a way that the structure and its mirror-image are non-superimposable molecules.
chiral centre	A chiral centre is a carbon atom attached to four different atoms or groups.
asymmetric	The word asymmetric means lacking in symmetry.
symmetric	The word symmetric means made up of exactly similar parts facing each other or around an axis.
non super-imposable	The term non super-imposable means the objects are not superimposable, in chemistry they are mirror images of each other.
racemic mixture	A racemic mixture contains equal mixture of enantiomers.
enantiomer	An enantiomer is a one of a pair of molecules which are mirror images of each other, or optical isomers.
isomer	In chemistry, an isomer is one of two or more compounds with the same formula but a different arrangement of atoms.

II. The PiXL Unlock Template



III. Summer Reading list

- The Chemistry of Life (Steven Rose)
- Chemistry (Brock)
- Principles of Biochemistry (White, Handler and Smith)
- Chemistry for Changing Times (Hill, McCreary and Kolb)
- Materials Science (Ramsden)
- The Periodic Kingdom (Atkins)
- Mendeleyev's Dream – the search for the elements (Strathern)
- Periodic Tables – The Curious Life of the Elements (Aldersty and Williams)
- The Disappearing Spoon (Kean)
- 50 Ideas you really need to know about Chemistry (Birch)
- The Periodic Table – a field guide to the elements (Parsons and Dixon)

IV. Links to TED Talks/Articles/Documentaries/Books/Journals

1. **TED talk – Ink made of air pollution.**

   What if we could capture pollution in the air around us and turn it into something useful?
   https://www.ted.com/talks/sheperd_doeleman_inside_the_black_hole_image_that_made_history?language=en#t-39680

2. **TED talk – A new class of drug that could prevent depression and PTSD.**

   Current treatments for depression and PTSD only suppress symptoms. This talk discusses how an accidentally discovered drug could prevent the negative effects of stress.
   https://www.ted.com/talks/rebecca_brachman_a_new_class_of_drug_that_could_prevent_depression_and_ptsd?language=en

3. **BBC Sounds – Britain's labs - Bristol Centre for nanoscience**

   Researchers are working on nano-diamonds as a way of creating new solar panels that work well in temperate climates.
   https://www.bbc.co.uk/sounds/play/b00shrmz

4. **BBC Sounds – The chemistry of addiction.**

   Discover how the brain deals with drugs and who might become an addict.
   https://www.bbc.co.uk/programmes/b009tw3t

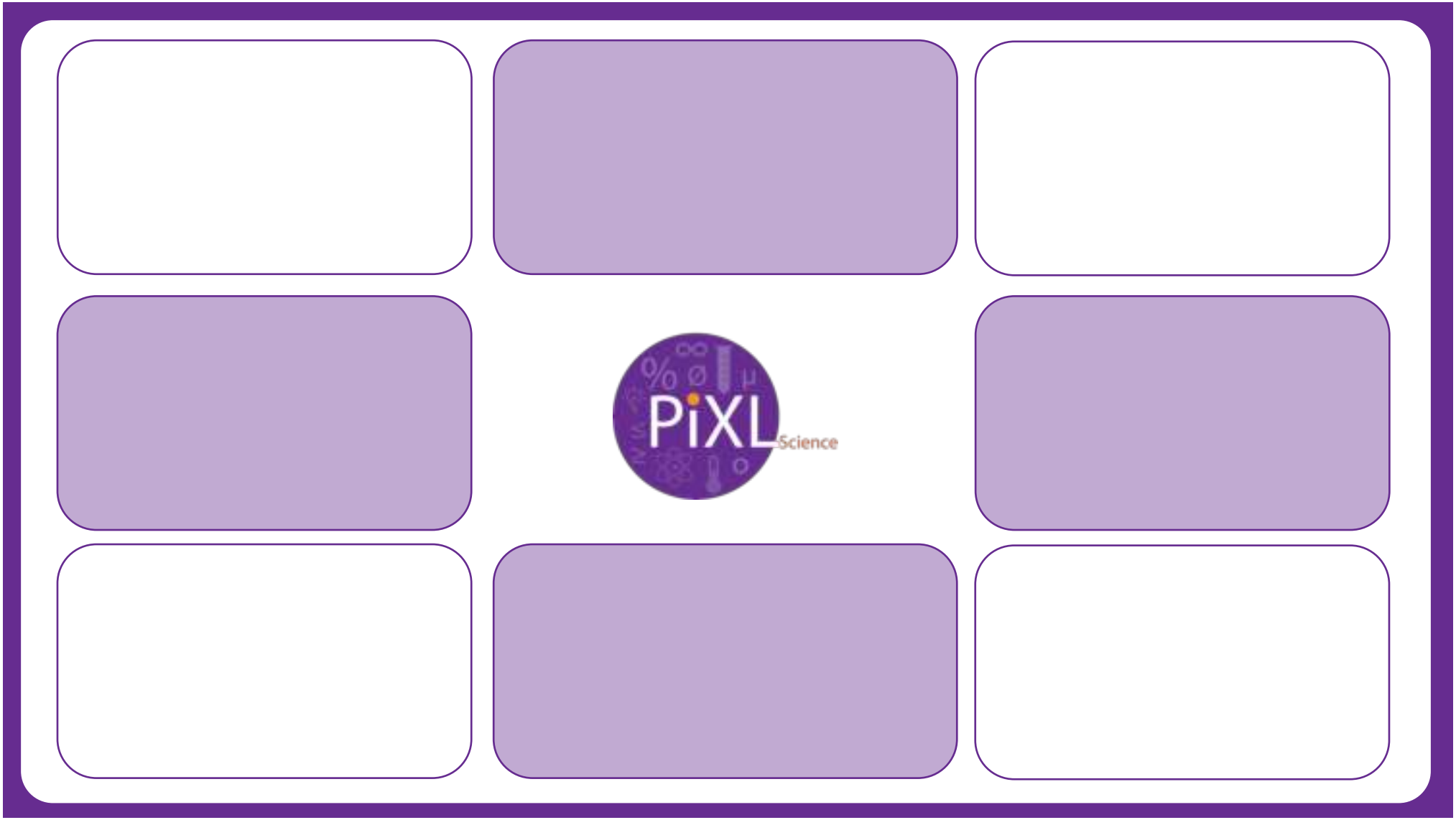
5. **Article in Nature – Dynamic polymer network points the way to truly recyclable plastics.**

   Thermoset plastics have many uses, but cannot be reshaped or recycled. New crosslinks allow thermoset plastics to be recycled.
   https://www.nature.com/articles/d41586-019-01209-3

6. **Careers – Royal Society of Chemistry - Next steps with chemistry**

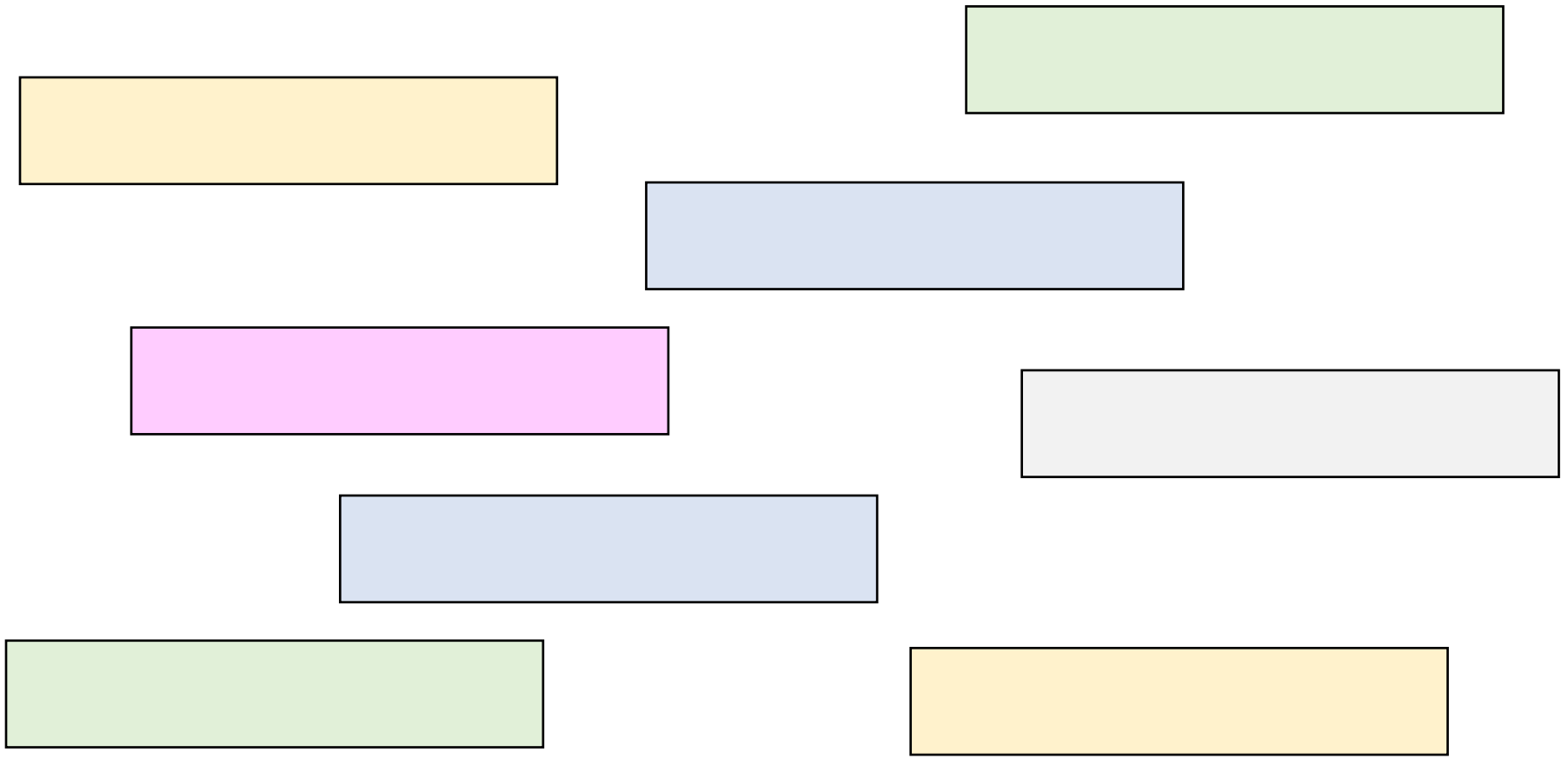
   Wondering where to go next? This site contains a number of different resources showcasing careers available to those studying chemistry to A-Level.
   http://www.rsc.org/careers/future/student-home-page

V. Knowledge Organiser Template

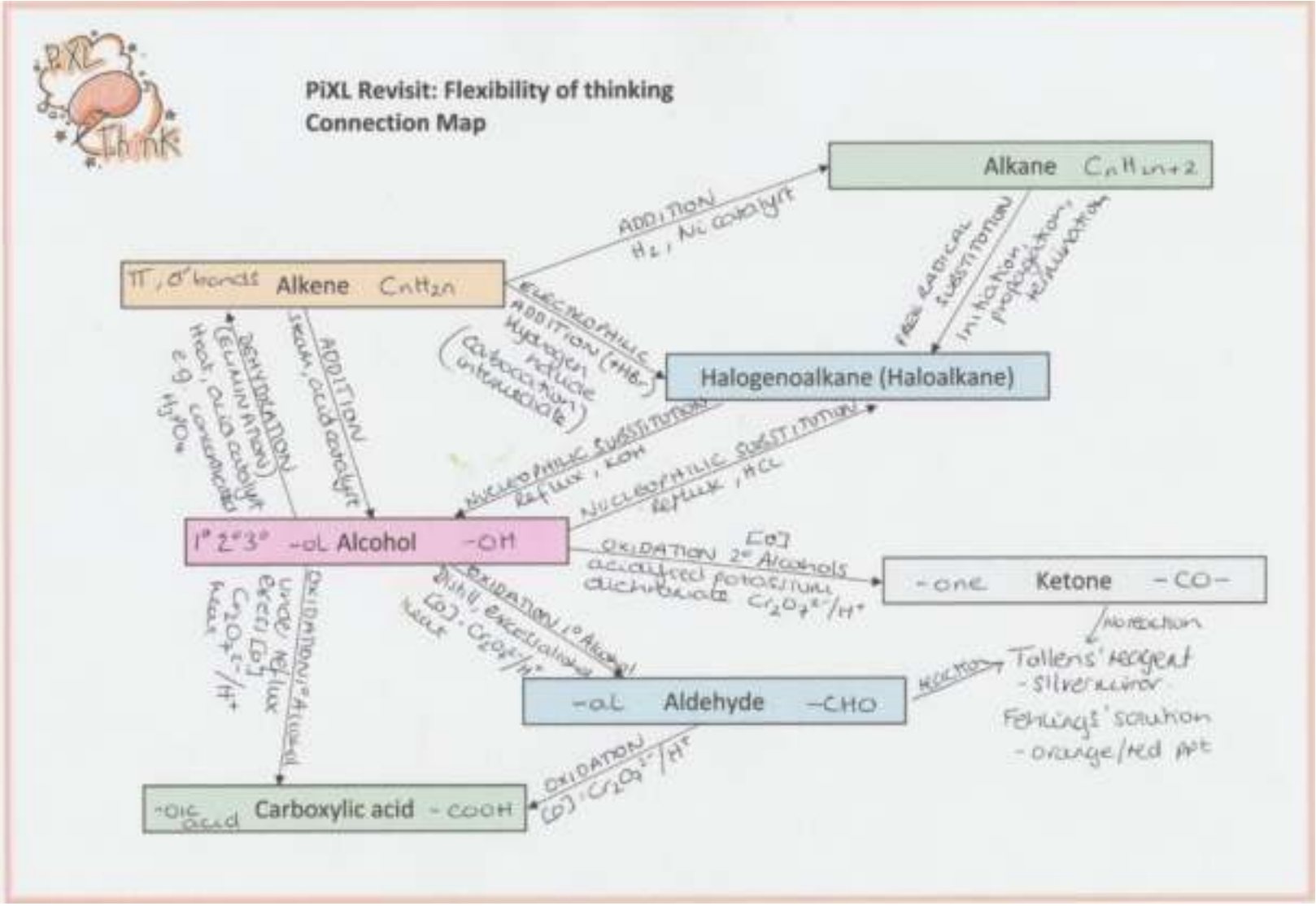


VI. Thinking Hard Revisit Template

Flexibility of thinking Connection Map



VII. A Model of the Thinking Hard Revisit document



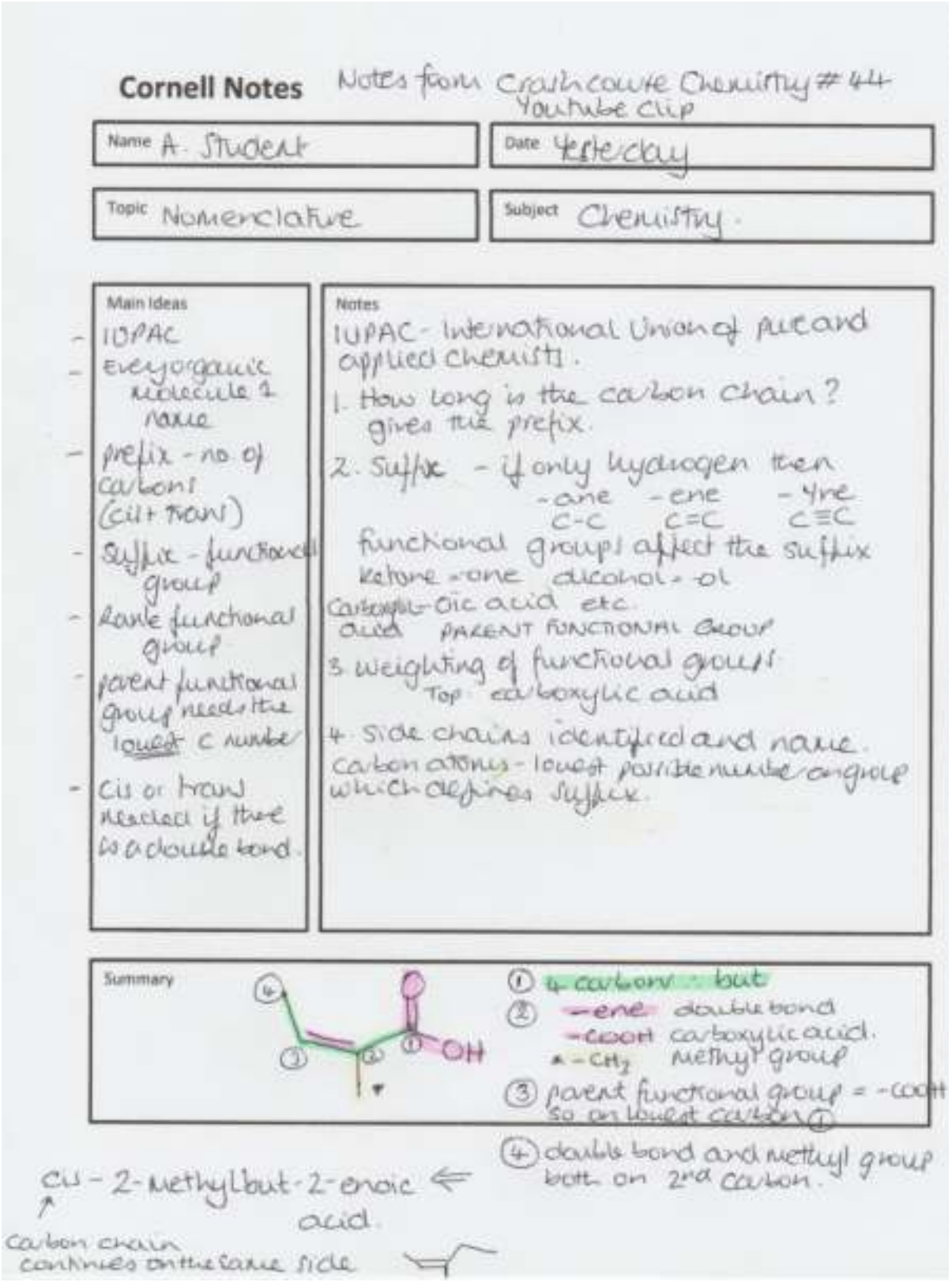
VIII. Cornell Notes Template

Name	Date
Topic	Subject

Main Ideas	Notes

Summary

IX. A Model of the Cornell Notes document



Cornell Notes Notes from Crashcourse Chemistry #44 Youtube clip

Name A. Student | Date Yesterday

Topic Nomenclature | Subject Chemistry.

Main Ideas

- IUPAC
- Every organic molecule has a name
- prefix - no of carbons (cis + trans)
- Suffix - functional group
- Rank functional group
- parent functional group needs the lowest C number
- cis or trans needed if there is a double bond.

Notes

IUPAC - International Union of pure and applied chemistry.

1. How long is the carbon chain? gives the prefix.
2. Suffix - if only hydrogen then
   - -ane C-C
   - -ene C=C
   - -yne C≡C

   functional groups affect the suffix
   ketone -one alcohol - ol
   Carboxylic acid -oic acid etc.
   PARENT FUNCTIONAL GROUP
3. weighting of functional groups
   Top carboxylic acid
4. Side chains identified and name. carbon atoms - lowest possible number on group which defines suffix.

Summary

① 4 carbons : but
② -ene double bond
-COOH carboxylic acid.
▲ $-CH_3$ Methyl group
③ parent functional group = -COOH so on lowest carbon ①
④ double bond and methyl group both on 2nd carbon.

cis - 2-Methylbut-2-enoic acid ⇐

carbon chain continues on the same side