

KS5 Chemistry – Independent Study

Independent Study – guided in Year 12/13
according to need.

Scheme of Learning

KS5 Chemistry

★ Following

6 members

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Y13 SoL Sept-2022.xlsx
October 13

SoL Chemistry Year 12 SharePoin...
October 13

Students use Learning Journey based on scheme of learning to plan their independent study.

Modified	Modified By	+ Add column
June 21	Iain Milne	
July 6	Iain Milne	
June 16	Iain Milne	
June 21	Iain Milne	
A few seconds ago	Iain Milne	
September 4	Iain Milne	

Student Work Standards – Essential Non-Negotiable Quick Reference Checklist (Updated Jan 2022)

In order to ensure a standard and consistent approach to student folder standards, the following basic ‘non-negotiables’ must be in place across student work to ensure effective work scrutiny. **These are the *minimum* expected standards.**

Reasonable adjustments are offered to students wishing to maintain a digital folder. Such students will be allowed to maintain work following the format outlined below so long as that work is immediately placed in their personal OneNote in **Student Notebooks** — A private space shared between the teacher and each individual student. Teachers can access any student notebook, while students can only see their own. Failure to maintain work in a digital format may mean the teacher instructs a physical folder structure to be maintained.

Indicator	Key Fundamentals – The essential practices that <u>must</u> be seen in all folders..	Yes	No
Presentation Expectations if...	All students keep independent study, classwork, and homework in folders in dated and lesson number order.		
	All classwork and homework have clear titles (with LXX number clear) and are dated. All <u>underlined</u> and labelled as c/w or h/w.		
	Independent study clearly book-ends classwork and homework. Students label such work clearly with Pre-LXX Title and Post-LXX as appropriate.		
	Classwork is on lined paper and immediately filed into students folder and all worksheets hole punched and placed into folders		
	High standards of presentation are maintained over time. Work reflects the school’s ambitious intentions for the course of study		
Feedback Expectations if...	Clear diagnostic feedback is given to significant pieces of work set at least twice a half term via a TEAMS assignment or assessment carried out in class. A summary printout may be inserted into student folders of Teams homework feedback.		

Folder Standards

Hold students to account on folder standards

Evidence of independent study should be on Teams and in students folders.

Curriculum Content: Teach the Spec content

- Lessons follow on from PRE-READING students have undertaken in preparation for the lesson as part of their independent study.

The screenshot shows a OneNote window titled 'Class Notebook' with the user 'Iain Milne'. The notebook is 'K55 Chemistry Notebook'. The left sidebar shows a table of contents with 'L60 Stereoisomerism - ...' selected. The main page is titled 'L60 Stereoisomerism - Optical' and contains the following content:

The Big Picture:
Topic Overview

Spec Link

Prior Knowledge

Content

- Optical isomerism is a form of stereoisomerism and occurs as a result of chirality in molecules, limited to molecules with a single chiral centre.
- An asymmetric carbon atom is chiral and gives rise to optical isomers (enantiomers), which exist as non super-imposable mirror images and differ in their effect on plane polarised light.
- A mixture of equal amounts of enantiomers is called a racemic mixture (racemate).
- Aldehydes and unsymmetrical ketones form mixtures of enantiomers when they react with KCN followed by dilute acid.

Students should be able to:

- draw the structural formulas and displayed formulas of enantiomers
- understand how racemic mixtures (racemates) are formed and why they are optically inactive.

Opportunities for skills development

MS 4.1, 4.2 and 4.3
Students could be asked to recognise the presence of a chiral centre in a given structure in 2D or 3D forms. They could also be asked to draw the 3D representation of chiral centres in various species.
Students understand the origin of optical isomerism.

AT a and k
PS 1.2
Passing polarised light through a solution of sucrose.

From <https://www.aga.org.uk/subjects/science/as-and-a-level/chemistry-7404-7405/subject-content/organic-chemistry#Aldehydes_and_ketones_A-level_only>

Textbook <https://www.kerboodle.com/app>

Independent Study

- Student to produce, at least, one page work on Pre-reading for a numbered lesson and later the following week complete at least one page of work for a post lesson review as their independent study.
- All students must be told what the next weeks lesson is on via their Curriculum Journey. Often this will be the next numbered lesson in the curriculum journey and students should be directed to the resources on SharePoint (IM KS5 Chemistry). OneNote has the relevant spec link.
- Students should identify what content will be covered, included relevant notes (and definitions) for theory or worked examples for calculations.

The screenshot shows a OneNote page titled "L60 Stereoisomerism - Optical" with a date of 13 June 2022 at 13:40. The page content is structured as follows:

- The Big Picture:** Topic Overview
- Spec Link:** Optical isomerism (A-level only)
- Prior Knowledge:** Compounds that contain an asymmetric carbon atom form stereoisomers that differ in their effect on plane polarised light. This type of isomerism is called optical isomerism.
- Content:**
 - Optical isomerism is a form of stereoisomerism and occurs as a result of chirality in molecules, limited to molecules with a single chiral centre.
 - An asymmetric carbon atom is chiral and gives rise to optical isomers (enantiomers), which exist as non super-imposable mirror images and differ in their effect on plane polarised light.
 - A mixture of equal amounts of enantiomers is called a racemic mixture (racemate).
 - Aldehydes and unsymmetrical ketones form mixtures of enantiomers when they react with KCN followed by dilute acid.
- Students should be able to:**
 - draw the structural formulas and displayed formulas of enantiomers
 - understand how racemic mixtures (racemates) are formed and why they are optically inactive.
- Opportunities for skills development:**
- MS 4.1, 4.2 and 4.3:** Students could be asked to recognise the presence of a chiral centre in a given structure in 2D or 3D forms. They could also be asked to draw the 3D representation of chiral centres in various species. Students understand the origin of optical isomerism.
- AT a and k**
- PS 1.2:** Passing polarised light through a solution of sucrose.

At the bottom, there is a citation: "From <https://www.aga.org.uk/subjects/science/as-and-a-level/chemistry/7404-7405/subject-content/organic-chemistry@Aldehydes_and_ketones_A-level_only>" and a "Textbook" link to "https://www.kerboodle.com/app".

Identifying misconceptions: Using Teams to check Independent work and HW.

- Try to check HW returns prior to the next lesson
- Are students completing Pre-reading?
- Are students completing HW to standard?
- Where are the common difficulties?

Pre-reading - AP8 - creating cell

Aim: Measure the emf of two cells and then use them to predict the emf of another cell

Diagram: A hand-drawn diagram of an electrochemical cell. It shows two beakers connected by a salt bridge. The left beaker contains a copper electrode in a copper sulfate solution. The right beaker contains a zinc electrode in a zinc sulfate solution. A voltmeter is connected between the two electrodes. Labels include 'copper electrode solution', 'zinc electrode solution', 'salt bridge', 'copper', 'zinc', and 'voltmeter'.

Method:

1. Clean a piece of copper and piece of zinc using emery paper or fine grade sandpaper.
2. Degrease the metal pieces using some cotton wool and propanone.
3. Place the copper into 100cm³ beaker with about 50cm³ of 1.0mol/dm³ of CuSO₄.
4. Place the zinc into 100cm³ beaker with 50cm³ of 1.0mol/dm³ of ZnSO₄.
5. Lightly plug one end of plastic U-tube with cotton wool and fill the tube with solution 2.0mol/dm³ sodium chloride, then plug other end.
6. Join two beakers with U-tube so that the plugged ends are in separate beakers.
7. Connect a voltmeter across the two half-cells by connecting the metals using crocodile clips and lead.

comparing electrode potentials for different metals

1. Clean a piece of using emery paper or fine grade sandpaper.
2. Connect a positive terminal of a voltmeter using a crocodile clip and one of lead.
3. Cut a piece of filter paper to about same area as the copper and moisten with sodium chloride. Place it on top of the metal.
4. Hold the metal against the filter paper. Record the voltage reading including the sign.
5. Repeat with different metals and compare electrode potentials.

Diagram: A simple circuit diagram showing a voltmeter connected to two metal samples.

The chat interface shows the student's name 'Maame Duah' and a 'Feedback' section with the text 'Enter feedback'.

▼ L07 Review REDOX (3.1...

L07-WSb-QC-Redox-B

WS00 3.2.5 Redox tit...

Untitled page

SQL07 Redox and Gr...

L07-HW 3.1.11a RED...

▼ L08 electrode potential...

SQL08-Redox with tit...

L08-HW 3.1.11b elec...

L08-HW Examples

Pre-Reading Examples

▼ L09 Variable Oxidation...

L09 Pre-Reading Intr...

SQL09-E Cell

L09-WS01 Variable OS

Transition-Metals-A...

L09-HW Variable OS...

L09 HW Comments...

▼ L10 RP1-Alternative Iro...

Pre-Reading

+ Add page

Assignment Part 2: Analyzing understanding

Example 2

Mark schemes

Q1 (a) $2MnO_4^- + 16H^+ + 5SO_3^{2-} \rightarrow 2Mn^{2+} + 8H_2O + 5SO_4^{2-}$

if correct/incorrect can only score M1 and M2

(Possible because Mn) can exist in variable oxidation states

E, lowered because oppositely charged ions attract

These ions can be placed in any order

Mn²⁺ produced by MnO₄⁻ / equation

M2 may appear before M1

Mn²⁺ produced (back) to Mn⁷⁺ by MnO₄⁻ / equation

M1 and M2 can be scored in unbalanced equations

or in words (MnO₄⁻)

M1 = $SO_3^{2-} \rightarrow SO_4^{2-}$

M2 = $MnO_4^- \rightarrow Mn^{2+}$

(b) Graph marks

S-shaped curve must not be too steep and must not fall sharply to zero

Starts on concentration axis and is leveling off (can have an arrow pointing to above the parallel to time axis)

Correct axes graph marks (M1 and M2) if no axes and/or no labels

Explanation marks

Slope / rate increases as concentration of MnO₄⁻ ions / reactants increases (M1 reactants are being used up)

Using standard electrode potentials

$S_2O_8^{2-} + 2e^- \rightarrow 2SO_4^{2-}$ $E^0 = 2.01V$

$Fe^{3+} + e^- \rightarrow Fe^{2+}$ $E^0 = 0.77V$

$2Fe^{2+} \rightarrow 2Fe^{3+} + 2e^-$ $E^0 = -0.77V$

$S_2O_8^{2-} + 2Fe^{2+} \rightarrow 2Fe^{3+} + 2SO_4^{2-}$

$E^0_{cell} = E^0_{cathode} - E^0_{anode} = 2.01V - 0.77V = 1.24V$

$E^0_{cell} > 0$ so reaction is spontaneous

$E^0_{cell} < 0$ so reaction is non-spontaneous

$E^0_{cell} = 0$ so reaction is at equilibrium

Catalysed reaction

Step 1: $S_2O_8^{2-} + 2Fe^{2+} \rightarrow 2Fe^{3+} + 2SO_4^{2-}$

Step 2: $2Fe^{3+} + 2Fe^{2+} \rightarrow 2Fe^{2+} + 2Fe^{3+}$

Overall: $2Fe^{2+} + S_2O_8^{2-} \rightarrow 2Fe^{3+} + 2SO_4^{2-}$

Autocatalytic reaction between Fe^{2+} ions and Mn^{2+} ions

In this reaction, a product acts as the catalyst: Mn^{2+} is the catalyst

$2MnO_4^- + 16H^+ + 5SO_3^{2-} \rightarrow 2Mn^{2+} + 8H_2O + 5SO_4^{2-}$

Initially, uncatalysed reaction is slow because of high activation energy

Mn^{2+} acts as autocatalyst, reaction speeds up as more product is produced

Step 1: $SO_3^{2-} + Mn^{2+} \rightarrow SO_3^{-} + Mn^{3+}$

Step 2: $2Mn^{3+} + SO_3^{2-} \rightarrow 2Mn^{2+} + SO_4^{2-}$

All the above equations can be combined using half equations

$MnO_4^- + 8H^+ + 5e^- \rightarrow Mn^{2+} + 4H_2O$

$SO_3^{2-} \rightarrow SO_4^{2-} + 2e^-$

$Mn^{2+} \rightarrow Mn^{3+} + e^-$

Handwritten notes on a tablet screen, showing chemical equations and diagrams related to redox reactions.

Q1

The redox reaction in aqueous solution between univalent potassium permanganate(VII) and univalent iron(II) ions is:

$MnO_4^- + 8H^+ + 5Fe^{2+} \rightarrow Mn^{2+} + 4H_2O + 5Fe^{3+}$

Sketch the shape of the titration curve for this reaction.

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Handwritten notes on a tablet screen, showing chemical equations and diagrams related to redox reactions.

Q1

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Mark schemes

Q1 (a) $2MnO_4^- + 16H^+ + 5SO_3^{2-} \rightarrow 2Mn^{2+} + 8H_2O + 5SO_4^{2-}$

M1: OX: Mn

if correct/incorrect can only score M1 and M2

(Possible because Mn) can exist in variable oxidation states

E, lowered because oppositely charged ions attract

These ions can be placed in any order

Mn²⁺ produced by MnO₄⁻ / equation

M2 may appear before M1

Mn²⁺ produced (back) to Mn⁷⁺ by MnO₄⁻ / equation

M1 and M2 can be scored in unbalanced equations

or in words (MnO₄⁻)

M1 = $SO_3^{2-} \rightarrow SO_4^{2-}$

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Correct axes graph marks (M1 and M2) if no axes and/or no labels

Explanation marks

Slope / rate increases as concentration of MnO₄⁻ ions / reactants increases (M1 reactants are being used up)

Handwritten notes on a tablet screen, showing chemical equations and diagrams related to redox reactions.

- Use Teams HW and independent study from pre or post lesson work to inform teaching and learning
- Identify and address misconceptions
- Idea: Re-use HW question as a starter, have students learnt from their mistakes?
- Idea: Students can introduce lesson content using their independent pre-learning.