Year 12 Chemistry - Lesson Plan 1/3
Mapping the Territory: Visualising Functional Group Interconversions

Mr Haynes

Module 7: Organic Chemistry (Approx. Week 4/5)

Lesson Overview

- **Lesson Title:** Mapping the Territory: Visualising Functional Group Interconversions
- **Duration:** 60 minutes
- **Focus Inquiry Question:** How are different classes of organic compounds interconverted through reaction pathways? (Introduction)
- **Placement:** Assumes students have learned basic nomenclature and reactions connecting Alkanes, Alkenes, Haloalkanes, Alcohols (e.g., Alkene Additions, Alkane/Haloalkane Subs, Alcohol Dehydration/Sub).

Syllabus Alignment & Knowledge Nodes Targeted

- **Outcomes:** CH12-14 (Analyses structure, predicts reactions - single steps), CH11/12-7 (Communicates understanding - using representations)
- **Content:** Implicit review of reactions covered to date. Introduction to representing reaction networks.
- **Knowledge Nodes (Focus on Connections):** CHM_M7_RPROD_N1 (Alkene Add), CHM_M7_RPRO (Alkane Sub), CHM_M7_ALC_N7 (Haloalk->Alc Sub), CHM_M7_ALC_N5 (Alc->Haloalk Sub), CHM_M7_ALC_N4 (Alc Dehyd).

Student Learning Objectives (Aligned with Nodes & Cognitive Strategies)

Students will be able to:

- Explain the concept of a "reaction map" for organic chemistry. [Understand]
- Identify key functional groups (nodes) and known reaction pathways (chords/links) using the chord-diagram visualisation tool. [Apply - S2 Visualisation]
- Use the tool's features (hover, filter) to retrieve information about specific known reactions (type, reagents/conditions). [Apply - S2]
- Relate the visual representation on the map to symbolic reaction equations learned previously. [Analyse - S2 Dual Coding]
- Begin constructing a mental schema of interconnected reactions. [Understand - S3 Concept Mapping Intro]

Literacy Use terminology for functional groups and basic reaction types correctly.

Lesson Structure & Activities

Introduction (10 mins)

- **Teacher Activity:** Display Inquiry Question. Quick recap quiz (retrieval practice): "Name the product when HBr adds to propene." "What condition is needed to substitute Cl onto methane?". Introduce the idea that reactions form a network/map, not just a list. State lesson objective: Learning to use a visual tool to explore this map.
- **Student Activity:** Answer recap questions. Listen to introduction.
- **Pedagogy Focus:** Activate Prior Knowledge, Set Context, Retrieval Practice (supports S4).

Exploration: Introducing the Visualisation Tool (25 mins)

- **Teacher Activity:** Introduce and demonstrate the interactive Chord Diagram visualisation tool (projected). Explain: Nodes = Functional Groups, Chords = Reactions. Show how chord colour relates to reaction type (using legend/checkboxes). Demonstrate hover-over feature for reaction details (reagents/conditions). Focus *only* on nodes/reactions students have already learned (e.g., Alkene, Alcohol, Haloalkane connections). Explicitly link tool view to a written equation shown previously. [S1 Explicit Instruction, S2 Visualisation]
- **Student Activity:** Observe demonstration. Ask clarifying questions about the tool.
- **Pedagogy Focus:** Tool Introduction, Linking Visual Representation to Symbolic (Dual Coding S2), Managing Cognitive Load (showing only known parts first).
- **ICT Integration:** Chord Diagram Tool, Projector.

Guided Exploration & Consolidation (25 mins)

- **Teacher Activity:** Distribute Worksheet 1 and provide link/access to the visualisation tool. Guide students (working individually or pairs on devices) through Worksheet 1 tasks. Circulate, check understanding, and assist with tool usage. Lead brief class discussion on findings (e.g., "What reaction types connect Alcohols and Alkenes according to the map?"). Consolidate the idea of the map as a growing organiser for their knowledge. Assign Exit Ticket. [S3 Concept Mapping Intro, S2 Visualisation]
- **Student Activity:** Use the visualisation tool on devices to complete Worksheet 1 tasks (e.g., identifying connections, retrieving reagent info via hover, filtering). Participate in discussion. Complete Exit Ticket.
- **Pedagogy Focus:** Active Learning, Guided Inquiry using Visualisation Tool, Reinforcing Connections, Formative Assessment.
- **ICT Integration:** Chord Diagram Tool (Student Use), Devices.

Resources Required

- Interactive Chord Diagram Visualisation Tool.
- Projector.
- Student devices with internet access (recommended 1:1 or 1:2).
- Worksheet 1 (separate file - see below).
- Exit Ticket questions (prepared separately, e.g., "Using the visualizer, what reagent is shown for converting an Alkene to an Alcohol?").

Assessment

- **Formative:** Teacher observation of student engagement and tool use. Responses during class discussion. Review of Worksheet 1 answers. Analysis of Exit Ticket responses (checking basic tool interpretation).

Differentiation

- **Support:** Provide a simplified version of Worksheet 1 with more direct prompts. Pair students for tool exploration. Pre-fill parts of the map diagram on the worksheet.
- **Extension:** Ask students to predict what other connections might exist based on functional group similarities. Challenge students to find a reaction on the map they haven't learned yet and hypothesise about its type.

Lesson 1: Mapping the Territory

Visualising Functional Group Interconversions

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Module 7: Organic Chemistry

Outline

Introduction: Why Map Reactions?

Focus Inquiry Question: How are different classes of organic compounds interconverted through reaction pathways?

- **Recap Quiz:** (Teacher to ask 1-2 quick questions on recent reactions, e.g., alkene addition product, alkane substitution condition).
- Organic reactions don't exist in isolation – they form an **interconnected network**.
- Learning the connections is key to understanding organic chemistry and planning syntheses.
- **Today's Goal:** Learn to use a visual tool (Chord Diagram) to explore this reaction network based on what we've learned so far.

Understanding the Visualisation

This tool helps us see the "map" of organic reactions.

Key Features:

- **Nodes** (Outer Segments): Represent Functional Groups (e.g., Alkane, Alkene, Alcohol).
- **Chords** (Inner Bands): Represent Reactions linking functional groups.
- **Colour Coding:** Indicates Reaction Type (Check legend/checkboxes - e.g., Addition, Substitution).
- **Hover/Click:** Reveals details for a specific reaction (Reagents, Conditions).
- **Filtering:** Checkboxes allow focusing on specific reaction types.

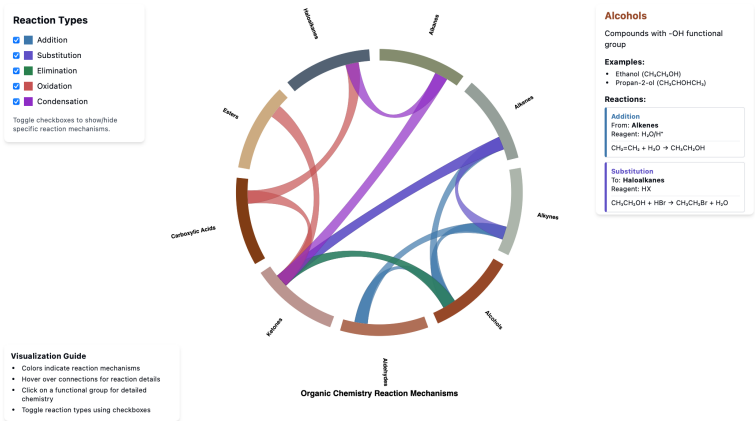

Figure: Chord Diagram Example

Using the Tool for Known Reactions

Now, let's use the tool to map out the reactions we've already covered.
Activity Prep (Refer to Activity Sheet 1 / Worksheet 1):

- Access the Chord Diagram tool on your device.
- **Your Task:** Use the tool to find the connections between Alkanes, Alkenes, Haloalkanes, and Alcohols.
- For each connection (reaction):
  - Identify the reaction type (using colour/filter).
  - Find the reagents/conditions (using hover).
  - Record your findings on Worksheet 1.
- **Focus:** Connecting the visual map to the reactions you already know.

(Teacher circulates to assist with tool usage and understanding)

Mapping the Territory: Key Takeaways

- Organic reactions form an interconnected network or "map".
- The Chord Diagram tool helps visualise this network:
  - Nodes = Functional Groups
  - Chords = Reactions (coloured by type)
  - Hover = Reagents/Conditions
- This tool helps organise our knowledge and see the bigger picture.

Next Steps:

- Complete Worksheet 1.
- Complete Exit Ticket (check tool interpretation).
- **Preview Lesson 2:** Using the map to plan short synthesis pathways (connecting reactions).

Thank you!

Questions?

Year 12 Chemistry - Activity Sheet 1
Guided Exploration: Reaction Visualisation Tool

Organic Chemistry

Module 7 - Lesson 1

Aim

To familiarise yourself with the interactive Chord Diagram Visualisation tool and use it to identify known organic reaction pathways and their key details.

Tool Access

Use the link or application provided by your teacher to access the Chord Diagram tool on your device.

Part A: Tool Familiarisation

- Identify the main components: Outer segments (Nodes), Inner bands (Chords/Links).
- Locate the legend or checkboxes that explain the colour-coding for reaction types (e.g., Addition, Substitution, Elimination, Oxidation, Condensation).
- Practice hovering your mouse cursor over different Nodes and Chords. Observe what information appears (e.g., Functional group name, Reaction details like reagents/conditions).
- Practice using the checkboxes (if available) to filter the view and show only certain reaction types.

Part B: Guided Exploration (Complete relevant sections on Worksheet 1)

Task 1: Focus on Alkenes

1. Click on or interact with the 'Alkene' node.
2. Observe the chords connecting to it.
3. For the connection representing the reaction of an Alkene to form an Alcohol:
    - Identify the reaction type using the colour code / filter.
    - Hover to find the specific reagents/conditions (e.g., Hydration conditions). Record these on Worksheet 1.
4. Repeat for the connection representing the reaction of an Alkene to form a Haloalkane (via HX addition). Record the reaction type and typical reagent (e.g., HBr) on Worksheet 1.
5. Repeat for the connection representing the reaction of an Alkene to form a Haloalkane (via X2 addition). Record the reaction type and typical reagent (e.g., Br_2).

Task 2: Focus on Alcohols

1. Click on or interact with the 'Alcohol' node.
2. Find the chord representing the conversion of an Alcohol back to an Alkene.
    - Identify the reaction type (Dehydration/Elimination).
    - Hover to find the specific reagents/conditions. Record these on Worksheet 1.
3. Find the chord representing the conversion of an Alcohol to a Haloalkane.
    - Identify the reaction type (Substitution).
    - Hover to find the typical reagent. Record this on Worksheet 1.

Task 3: Focus on Haloalkanes

1. Click on or interact with the 'Haloalkane' node.
2. Find the chord representing the conversion of a Haloalkane to an Alcohol.
    - Identify the reaction type (Substitution).
    - Hover to find the typical reagent/conditions. Record these on Worksheet 1.
3. Does the map (based on reactions learned so far) show a direct conversion from an Alkane to a Haloalkane? Identify the reaction type and condition required.

Task 4: Synthesise (Worksheet 1, Q6) Use your findings to draw the connections between the four main functional groups studied so far (Alkanes, Alkenes, Haloalkanes, Alcohols) on Worksheet 1.

Year 12 Chemistry - Worksheet 1
Mapping the Territory: Visualising Reactions

Student Name: _____ ID: _____

Module 7 - Lesson 1

Part 1: The Reaction Map Concept

1. In your own words, what is a "reaction map" in organic chemistry? Why might it be useful?

2. The chord diagram tool uses nodes and chords/links. What does each represent?

- Nodes (Outer segments): _____
- Chords / Links (Inner connecting bands): _____

Part 2: Exploring Known Connections with the Tool

Instructions: Use the interactive Chord Diagram Visualisation tool provided by your teacher to answer the following questions. Focus on the reactions you have already learned (connecting Alkanes, Alkenes, Haloalkanes, Alcohols).

3. Find the node for **Alkenes**.

a) List the functional groups that Alkenes are shown to be directly connected to via reactions *you have learned so far*.

b) Select one of these connections (e.g., Alkene → Alcohol). What is the reaction type indicated by the chord colour/filter?

c) Hover over this specific chord/link. What reagent(s) and/or conditions are displayed for this transformation (e.g., H_2O / H^+)?

4. Find the node for **Alcohols**.

a) According to the map (based on reactions learned), can an Alcohol be directly converted back to an Alkene? (Yes/No)

b) If yes, what is the reaction type and the key reagent/condition shown when you hover over that link?

c) According to the map (based on reactions learned), can an Alcohol be directly converted to a Haloalkane? (Yes/No)

d) If yes, what reagent is shown for this transformation?

5. Find the connection between **Haloalkanes** and **Alcohols**.

a) What reagent is needed to convert a Haloalkane to an Alcohol according to the tool?

b) What type of reaction is this (use colour/filter)?

6. Based on your exploration, draw a simple diagram below showing only the nodes for Alkane, Alkene, Haloalkane, and Alcohol, and draw arrows representing the direct, one-step reactions you have identified between them using the tool. Label each arrow with the reaction type (e.g., Addition, Substitution, Dehydration). [S3 Concept Mapping]