

Year 12 Chemistry - Lesson Plan 2/3

Navigating Pathways: Connecting Reactions for Short Syntheses

Mr Haynes

Module 7: Organic Chemistry (Approx. Week 6/7)

Lesson Overview

- **Lesson Title:** Navigating Pathways: Connecting Reactions for Short Syntheses
- **Duration:** 60 minutes
- **Focus Inquiry Question:** How are different classes of organic compounds interconverted through reaction pathways? (Focus on 2-3 step sequences)
- **Placement:** Assumes L1 completed. Assumes students have now learned Alcohol Oxidation (CHM_M7_ALC_N6) and Esterification (CHM_M7_ESTER_N1, CHM_M7_NOM_N11).

Syllabus Alignment & Knowledge Nodes Targeted

- **Outcomes:** CH12-14 (Predicts reactions involving carbon compounds), CH11/12-6 (Solves scientific problems - synthesis planning), CH11/12-7 (Communicates understanding).
- **Content:** Applying knowledge of multiple reaction steps in sequence. Introduction to synthesis planning logic.
- **Knowledge Nodes (Focus):** CHM_M7_ALC_N6 (Oxidation), CHM_M7_ESTER_N1 (Esterification), CHM_M7_NOM_N11 (Ester Naming). Review/Application of nodes from L1.

Student Learning Objectives (Aligned with Nodes & Cognitive Strategies)

Students will be able to:

- Identify multi-step pathways (2-3 steps) between functional groups using the chord-diagram tool. [Apply - S2 Visualisation]
- Propose a logical sequence of known reactions to achieve a simple synthetic transformation. [Analyse - CH11/12-6]
- Identify necessary reagents and conditions for each step in a proposed short synthesis. [Apply - CH12-14]
- Name reactants, intermediates, and products (including simple esters) in a short synthesis pathway. [Apply - CHM_M7_NOM_N11]
- Articulate the planning process for solving a simple synthesis problem. [Apply - S6 Metacognition]
- Update and utilise their reaction map (mental or visual) incorporating oxidation and esterification. [Apply - S3 Concept Mapping]

Literacy Describe a short synthesis pathway using correct terminology and reaction representation.

Lesson Structure & Activities

Introduction & Retrieval Practice (10 mins)

- **Teacher Activity:** Brief retrieval quiz: "Show the reagents needed to convert 1-chloropropane to propan-1-ol." "What functional group results from dehydrating an alcohol?". Briefly review the chord diagram from L1, highlighting the previously learned connections. Add new nodes/reactions (Oxidation, Esterification) to the discussion/visualisation. [S3 Update Map, supports S4]
- **Student Activity:** Answer retrieval questions. Observe map update.
- **Pedagogy Focus:** Retrieval Practice, Activation of Prior Knowledge, Integrating New Knowledge into Schema (S3).

Modelling Short Synthesis Planning (15 mins)

- **Teacher Activity:** Explicitly model solving a 2-step synthesis problem (e.g., Ethene \rightarrow Ethanoic Acid).
 - Step 1: Identify Start/End functional groups.
 - Step 2: Use the chord diagram tool to find path(s) - "Ethene to Alcohol (Addition), then Alcohol to Carboxylic Acid (Oxidation)". Identify intermediate (Ethanol).
 - Step 3: Write out the sequence, adding specific reagents/conditions for each step learned previously (hover on tool or recall).
 - Step 4: "Think aloud" the metacognitive process: "I need to get from alkene to acid. The map shows I can go via alcohol. First step is hydration... second step is oxidation of a primary alcohol..." [S1 Explicit Instruction, S2 Visualisation, S6 Metacognition]
- **Student Activity:** Follow the modelled example. Ask clarifying questions.
- **Pedagogy Focus:** Modelling Problem-Solving Process, Explicit use of Visualisation Tool for Planning, Metacognitive Scaffolding (S6).

Paired Problem Solving (25 mins)

- **Teacher Activity:** Provide pairs of students with simple 2 or 3-step synthesis problems (via Activity Sheet 2 or whiteboard). Encourage them to use the chord diagram tool *first* to plan their route, then write down the detailed steps (structures/names, reagents/conditions) on mini-whiteboards or paper. Circulate, prompt with planning questions ("What intermediate is needed?", "What reaction achieves that?", "Check the tool for reagents."). [S4 Interleaving if problems mix reaction types]
- **Student Activity:** Work in pairs. Use the visualisation tool to plan pathways for given synthesis problems. Draft the reaction sequence with structures, names, reagents, conditions. Discuss strategy with partner.
- **Pedagogy Focus:** Collaborative Learning, Applying Knowledge, Problem Solving (CH11/12-6), Active use of Visualisation Tool, Metacognitive Practice (S6 prompts).
- **ICT Integration:** Chord Diagram Tool (Student Use), Devices.

Sharing Consolidation (10 mins)

- **Teacher Activity:** Select 1-2 pairs to present their pathway for one problem on the board. Facilitate discussion – "Did anyone find a different route using the tool?". Briefly summarise the process of using the map for planning.

- **Student Activity:** Share proposed pathway if selected. Observe and comment on others' pathways. Ask questions.
- **Pedagogy Focus:** Communicating Solutions (CH11/12-7), Peer Learning, Consolidating the Planning Strategy.

Resources Required

- Interactive Chord Diagram Visualisation Tool.
- Projector / Whiteboard.
- Student devices with internet access.
- Mini-whiteboards or paper for drafting pathways.
- Activity Sheet 2 (containing 2/3-step synthesis problems - see below).

Assessment

- **Formative:** Observation of paired problem-solving process (use of tool, discussion, logic). Review of drafted pathways on mini-whiteboards/paper (checking for correct intermediates, reagents, conditions). Quality of participation in sharing session.

Differentiation

- **Support:** Provide partially completed pathways (e.g., give the intermediate). Offer a list of possible reagents to choose from. Pair students strategically.
- **Extension:** Challenge students to find the *shortest* possible route if multiple exist. Ask them to propose a synthesis for a slightly more complex target requiring 3 steps.