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**Enquiry-Based Learning:
Getting Started**

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**Natalie Rowley, School of Chemistry
21 May 2008, HEA Workshop**

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- **Vision for Birmingham Learning**
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Enquiry-Based Learning (EBL)

- **Broad umbrella term for learning approaches driven by a process of enquiry**
- **e.g. PBL, Case Studies (in conjunction with Industry?), Investigations, Individual / Group Projects, Research Activity**

www.campus.manchester.ac.uk/ceeb1

www.ebl.bham.ac.uk

- **Learner-centred model**
- **Students learn through active learning**
- **“Cognitive apprenticeship”**
 - **Karen O’Rourke (CEEEL)**

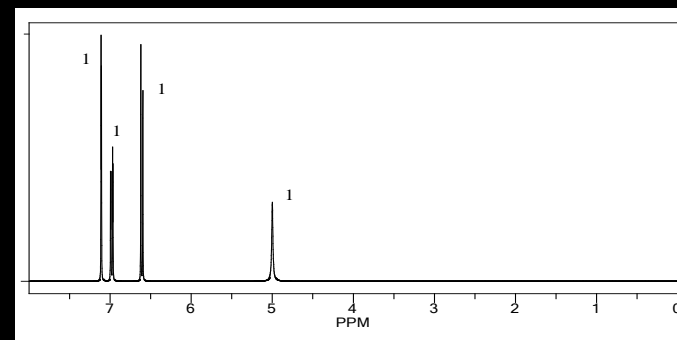
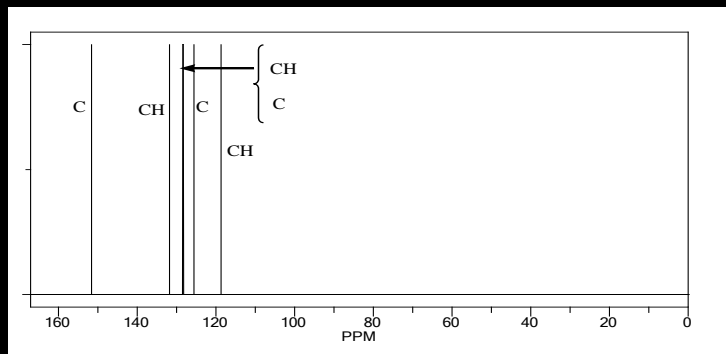
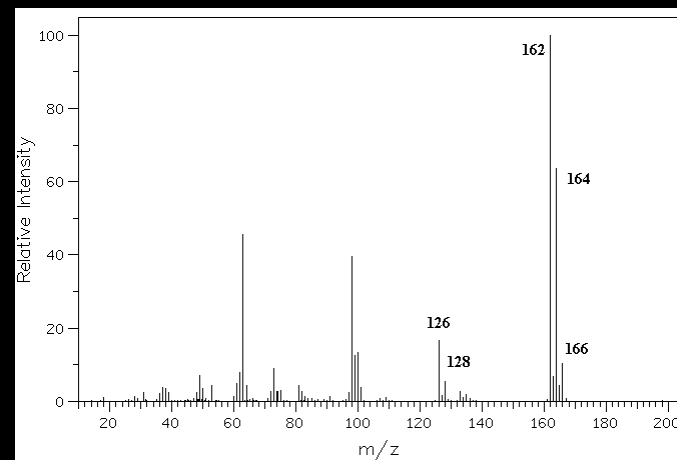
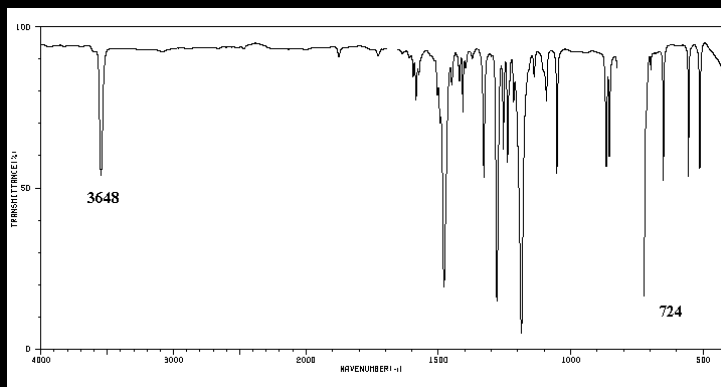
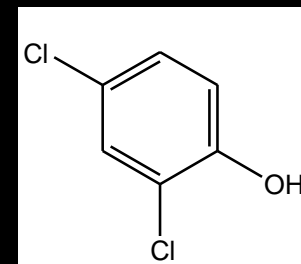
Vision for Birmingham Learning

- **Creativity**
- **Independence**
- **Team-working**
- **Goal-setting**
- **Problem-solving**

Learner Independence Project

- **Funding Tim Lucas for MPhil in Chemical Education research**
- **Collaboration with Mike McLinden and Tina Overton**

Yr 1 Spectroscopy EBL



Traditional Approach

- 6 x 1 hour lectures (theory and introduction to interpretation of spectra)
- 6 x 2 hour workshops (practise interpreting spectra – whole class, ca. 4 PG demonstrators)
- Assessed Worksheet
- End of year examination

EBL Approach

- **Ice Breaker**
- **4 scenarios – online and PG / Staff facilitation**
- **Assessed Worksheet 1**
- **5 lectures**
- **Assessed Worksheet 2**
- **End of year examination**

Ice Breaker

- **General Science quiz**
- **Group Rules**
- **Establish levels of prior knowledge**
- **Action plan for introductory task**

Waste Disposal Scenario

- In role as graduate chemists
- Chemical waste from disused lab
- Some containers not labelled
- Identify compounds to enable safe disposal, and produce group written report for next session

Down The Drain Scenario

- In role as graduate chemists
- Environmental Science Department collected samples from the river near County University – dead fish caused alarm
- 8 compounds isolated and analysed by ^{13}C , ^1H NMR, and IR spectroscopy and Mass Spectrometry
- Analysis report to be produced

Carbonyl Conundrum Scenario

- In role as graduate chemists
- Report discovered containing identity of compounds recently analysed and their spectra, but accidentally mixed up paperwork
- In groups, assign 24 spectra to 6 compounds and explain reasoning for assignments

Reaction Dilemma Scenario

- In role as graduate chemists
- Email from PG student
- Carried out reaction but not sure if obtained right product – help with analysis...
- “Real” spectra

Reaction Dilemma Scenario

- **Reaction not worked!**
- **Wrong compound been sent by supplier (different groups have different compounds, but all consistent with PG results)**
- **New sample from supplier - reaction now works as confirmed by groups' analyses**

Follow-on Lectures

- **5 x 1 hour lectures explaining how theory underpins interpretation of spectra**

Module Assessment

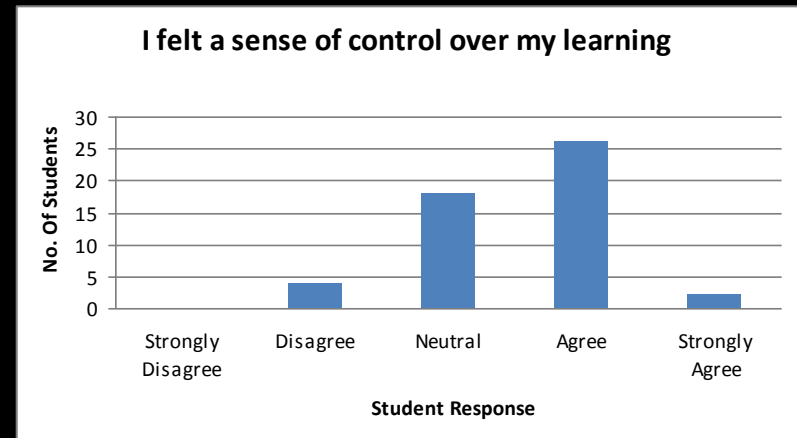
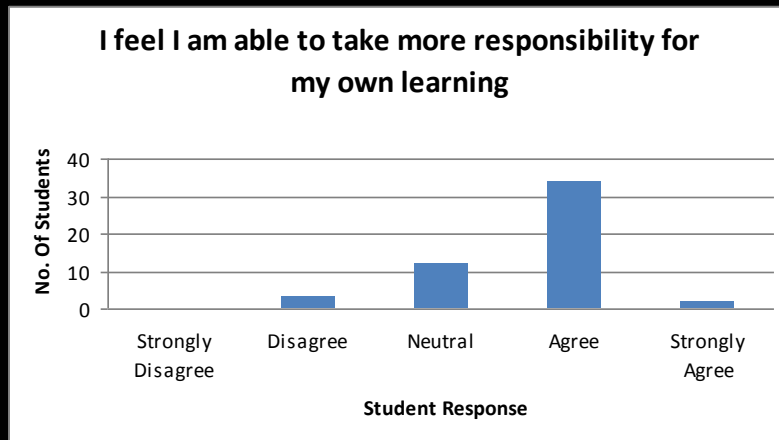
- **25% Continual Assessment:**
 - **10% EBL**
 - **15% 2 Assessed Worksheets**

- **75% End of Year Examination**

Evaluation

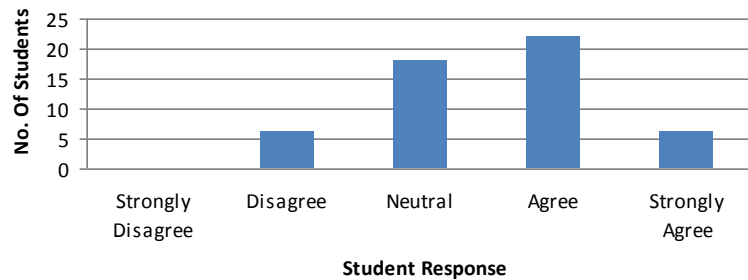
- **Self-analysis of knowledge of techniques before and after EBL and theory**
- **Questionnaires - gauging experience of and attitude towards independent learning and group work (Pre- and Post-EBL)**
- **Focus group**

Feedback – Learner Independence

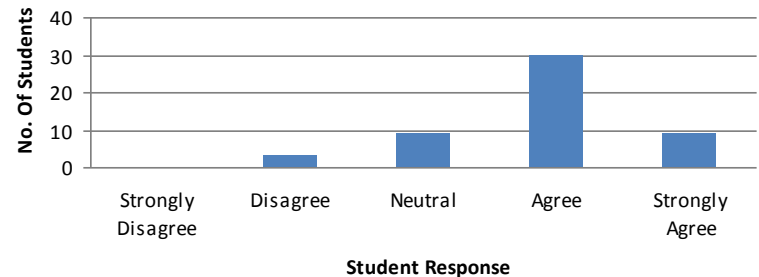


Feedback – Learner Independence

I feel I am better able to find information from different sources

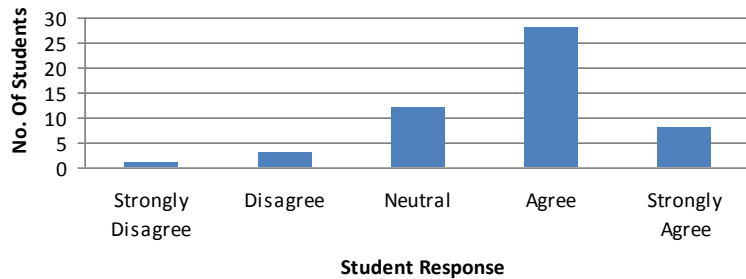


I am more confident in my ability to evaluate the information I have found

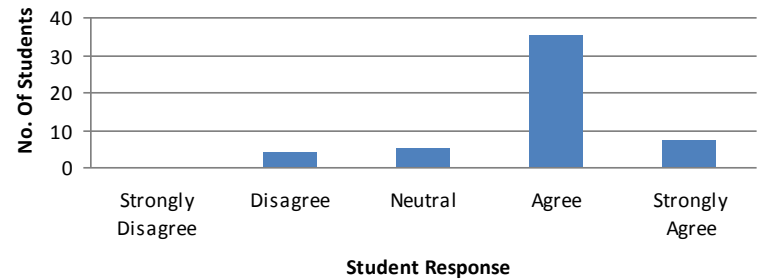


Feedback – Team Working

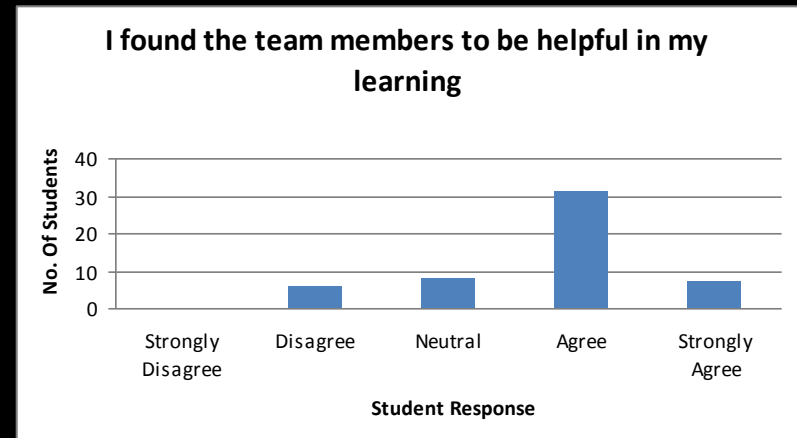
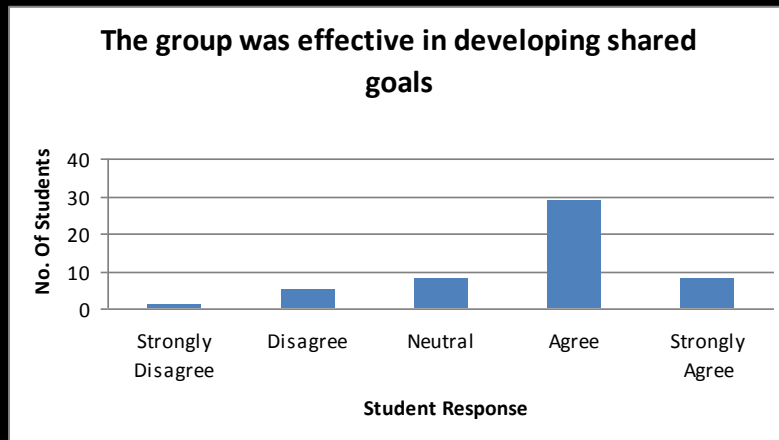
The activities helped me to develop my team working skills



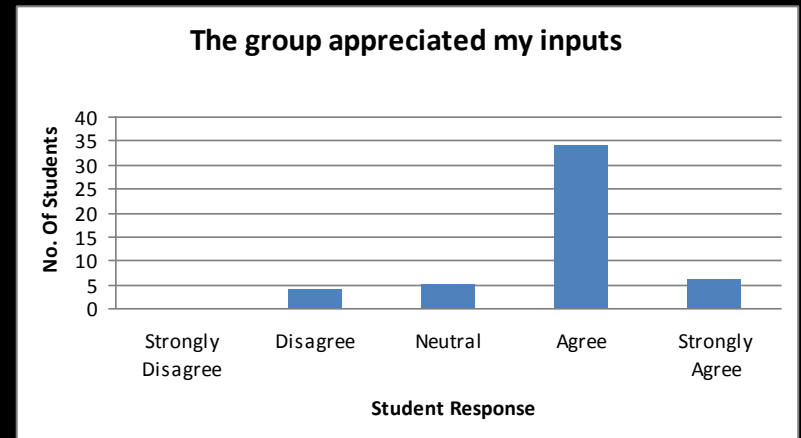
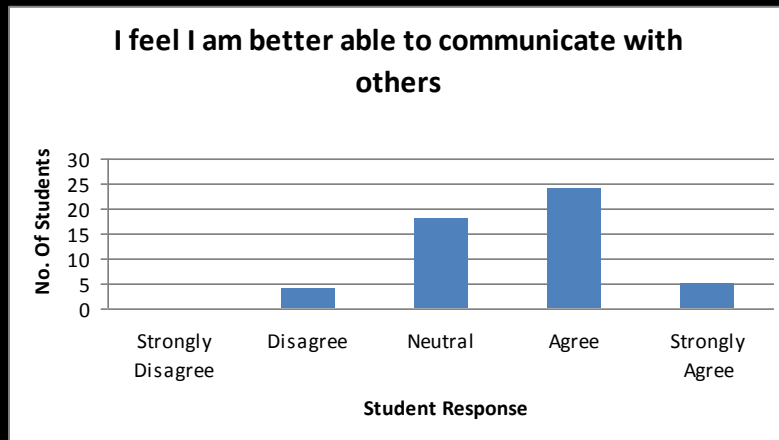
The group worked well to overcome any difficulties or problems we encountered



Feedback – Team Working

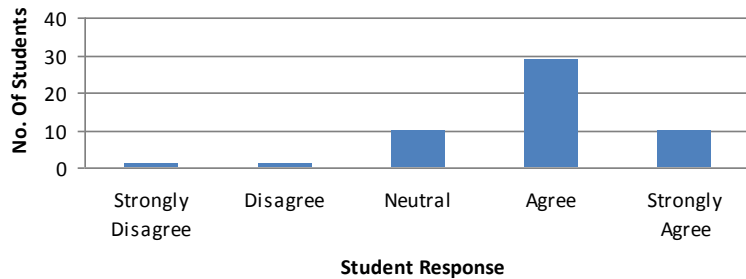


Feedback – Team Working

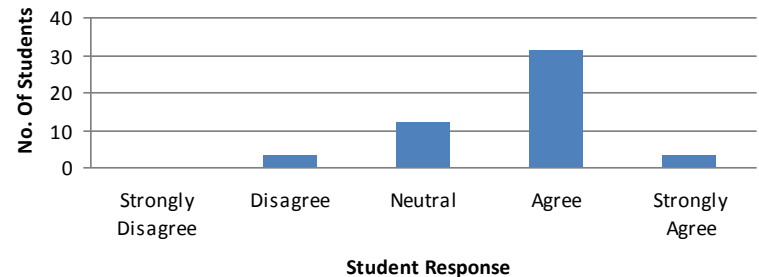


Feedback – Facilitation

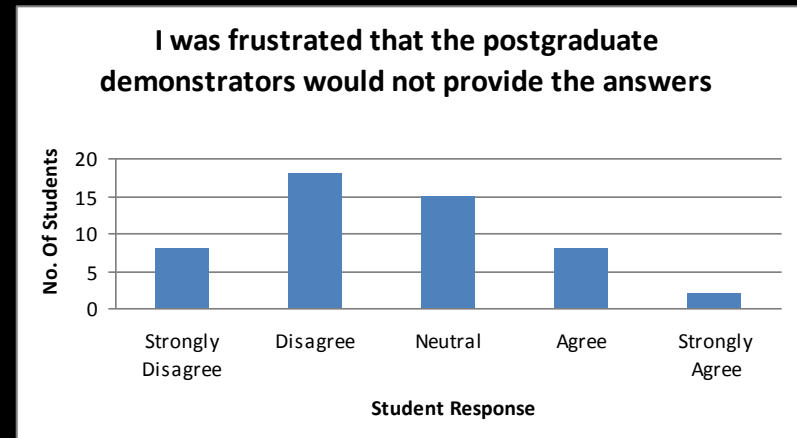
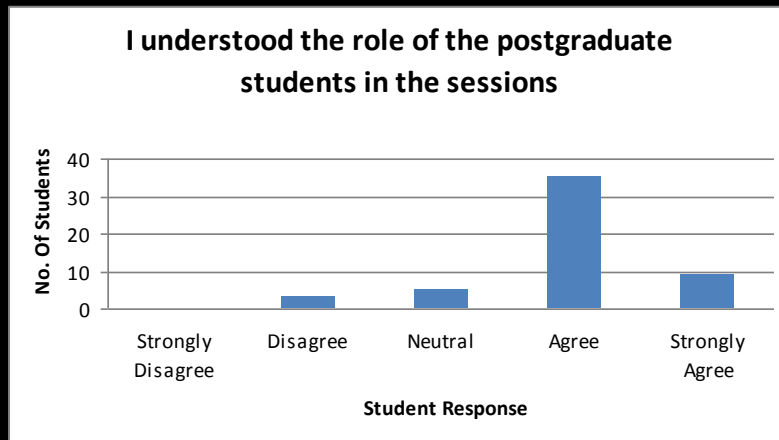
The staff focused more on encouraging me to find information than on giving me the facts



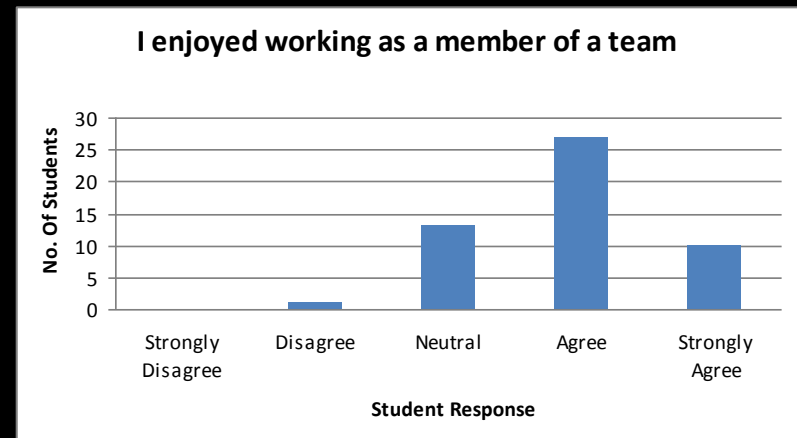
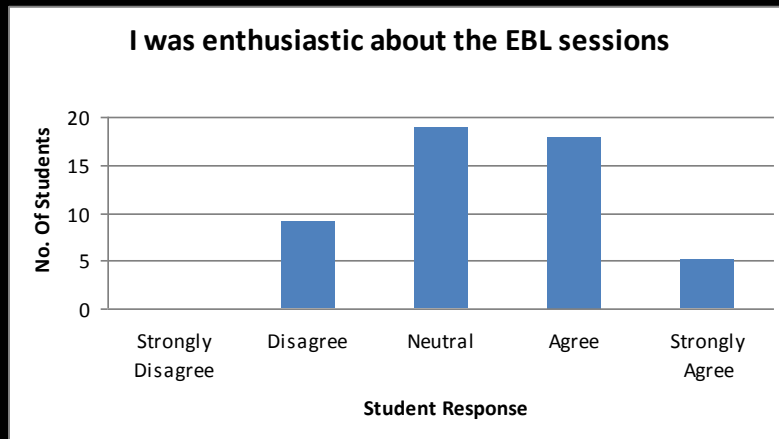
The staff gave me the support I need to learn in this module



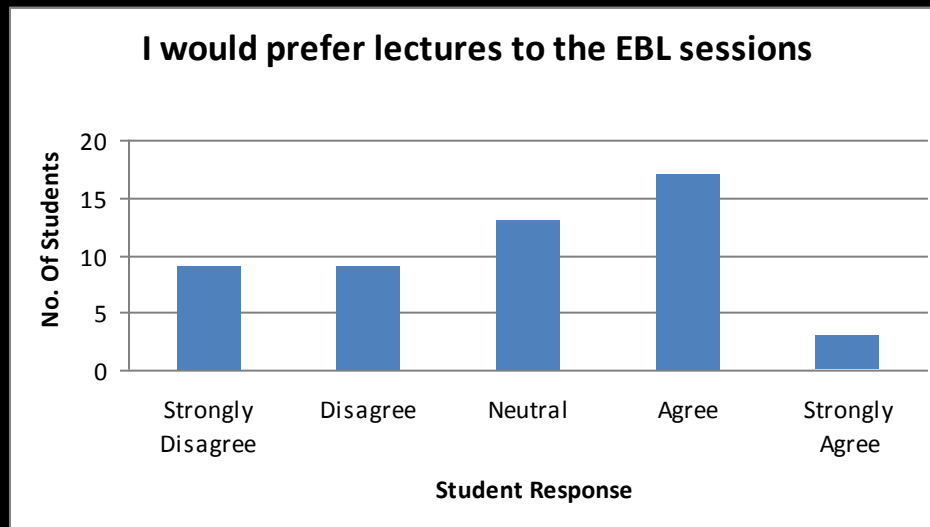
Feedback – Facilitation



Feedback – Enjoyment



Feedback – EBL vs Lectures...




Yr 2 Molecule of the Month

Limone - The industrial degreasing agent found in orange peel - Molecule of the Month - HTML - Windows Internet Explorer

http://www.chem.bris.ac.uk/motm/limonene/limoneneh.htm


Google molecule of the month

Limone - The industrial degreasing agent found in o...



LIMONENE


The industrial degreasing agent found in orange peel



Paul M. Burnham
[Hillsborough College, Sheffield, UK](#)

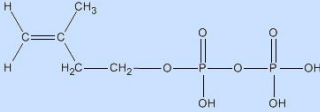
Also available: [Chime Enhanced](#), [VRML](#), and [JMol](#) versions.

Limone, a naturally occurring hydrocarbon, is a cyclic monoterpene with the molecular formula $C_{10}H_{16}$. It is commonly found in the rinds of citrus fruits such as grapefruit, lemon, lime and, in particular, oranges. Indeed, limonene constitutes 98% (by weight) of the essential oil obtained from orange peel. It is also present in the seeds of caraway and dill. The IUPAC name for limonene is 1-methyl-4-prop-1-en-2-ylcyclohexene.



BIOSYNTHESIS

The synthesis of monoterpenes in most plants starts with 3-methyl-3-butenyl pyrophosphate, shown below.



Local intranet 100%

start Microsoft ActiveSync Inbox - Microsoft Out... EBL- NMR-Civ Eng Limone - The indus... EN 10:48

Transferable Skills

- **Molecule of the Month (50% module mark)**
- **Google Docs**

- **Group Poster 25%**
- **Group Oral presentation 25%**

Work in Progress...

- **PG research**
 - **Retrosynthesis...**

Acknowledgements

- **Tim Lucas (Chemistry)**
- **Liam Cox (Chemistry)**
- **Bob Hunter (LDU)**
- **Tina Overton (Hull, Director of HEA Physical Sciences Centre)**
- **Mike McLinden (Education)**
- **Norman Reid (Centre for Science Education, Glasgow)**
- **University of Birmingham for funding**