

Evolution of Chemistry Undergraduate Courses

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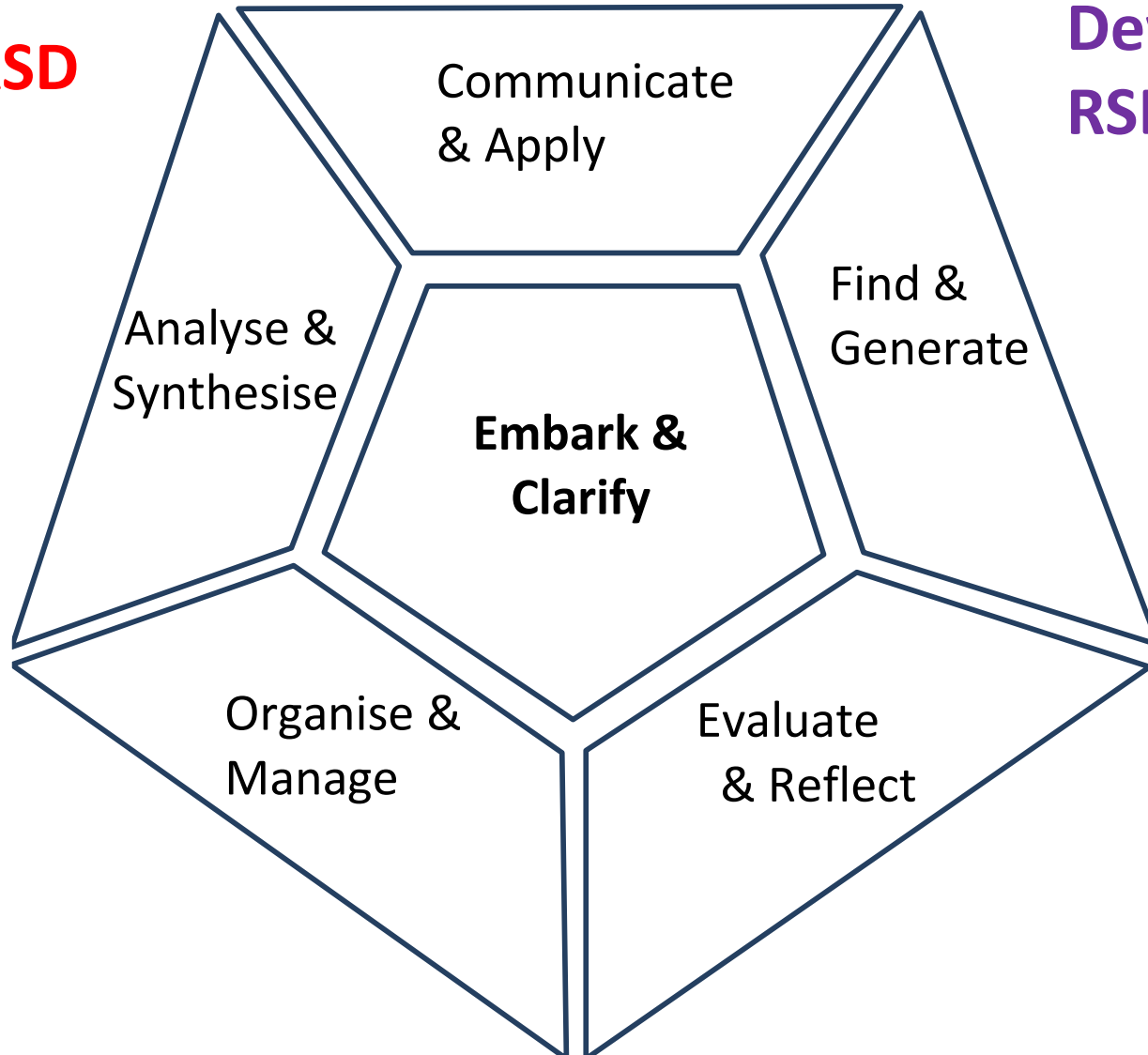
Chemistry Courses before RSD

- Chemistry courses **already** had these facets incorporated.
- These were not clearly stated/identified.
- Students were expected to acquire the **hidden** skills through laboratory work and assignments.
- Guidance was given through oral communication and comments on marked lab reports.

Research Skills Development- Facets

Adopted RSD

**Developed
RSD rubrics**



**Without
changing
content of
the course**

**Marking
the lab
report.**

Research Facet	Report components	Unsatisfactory Incomplete and not fully accurate or comprehensive	Satisfactory Complete, accurate and comprehensive	Highly satisfactory Complete, accurate, comprehensive, and innovative
Embark and clarify (20 marks)	Pre-Lab(15mks) Title(1 mk) Introduction(3 mks) Aim as last sentence in introduction(1 mk)	<input type="checkbox"/> Incomplete or major errors <input type="checkbox"/> None or incorrect title <input type="checkbox"/> Reproduces the given introduction. <input type="checkbox"/> Misses the purpose or not stated	<input type="checkbox"/> Pre-lab complete but not fully accurate <input type="checkbox"/> Reproduces given title <input type="checkbox"/> Paraphrased given introduction <input type="checkbox"/> Aim stated but is not accurate	<input type="checkbox"/> Complete and accurate <input type="checkbox"/> Rephrased title <input type="checkbox"/> Rephrased, clear and concise <input type="checkbox"/> Uses literature and given introduction.
Find and Generate (6 marks)	Procedure(4mks) Data (2mks)	<input type="checkbox"/> Reproduced procedure as given. <input type="checkbox"/> Incomplete data table	<input type="checkbox"/> Reproduces given procedure in past tense. <input type="checkbox"/> Data table without units	<input type="checkbox"/> Paraphrased given procedure (in past tense). <input type="checkbox"/> Data table with correct units
Evaluate and Reflect (30marks)	% Calculation(20 mks) Volume of distillate (10mks)	<input type="checkbox"/> % yield calculated incorrectly. <input type="checkbox"/> Volume not given.	<input type="checkbox"/> % yield correctly calculated without writing the formula. <input type="checkbox"/> Volume given with no units	<input type="checkbox"/> % yield calculated with correct formula <input type="checkbox"/> Volume given with units.
Analyze and Synthesize (26 marks)	Data analysis and comparison(6mks) Bromine test (2 mks) Post-Lab question(14 mks) Experimentation limitations (4 marks)	<input type="checkbox"/> Poor explanation of data. <input type="checkbox"/> Unable to explain bromine test. <input type="checkbox"/> Attempts the question but mostly incorrect. <input type="checkbox"/> Possible experimental limitations not mentioned	<input type="checkbox"/> Reasonable explanation of data. <input type="checkbox"/> Able to explain bromine test <input type="checkbox"/> Answer the question with some correct answers. <input type="checkbox"/> Possible experimental limitations mentioned but not discussed	<input type="checkbox"/> Full and accurate justification of all data. <input type="checkbox"/> Able to explain bromine test with correct reasons <input type="checkbox"/> Questions correctly answered. <input type="checkbox"/> Possible experimental limitations mentioned and discussed

<p><i>Communicate and Apply Ethically</i></p> <p>(12 marks)</p>	<p>Citations(3mks)</p> <p>Text reproduction(3mks)</p> <p>Report clarity and argument(3mks)</p> <p>Grammar and spelling(3mks)</p>	<p><input type="checkbox"/> Not all sources cited (manual, texts, other students)</p> <p><input type="checkbox"/> Font and spacing inconsistent</p> <p><input type="checkbox"/> Tables and figures not labeled.</p> <p><input type="checkbox"/> Arguments are not easily traceable/ clear</p> <p><input type="checkbox"/> Typo-graphical and grammatical errors</p>	<p><input type="checkbox"/> References are all cited but with some formatting errors</p> <p><input type="checkbox"/> Font and spacing are mostly consistent.</p> <p><input type="checkbox"/> Tables and figures are labeled but not discussed.</p> <p><input type="checkbox"/> Arguments are traceable but not always clear to follow.</p> <p><input type="checkbox"/> Some incidence of typo-graphical and grammatical errors</p>	<p><input type="checkbox"/> All references cited with consistent formatting and without errors</p> <p><input type="checkbox"/> Font and spacing are consistent.</p> <p><input type="checkbox"/> Tables and figures are correctly labeled and discussed in the report</p> <p><input type="checkbox"/> Arguments are presented clearly.</p> <p><input type="checkbox"/> Easy to read and follow.</p> <p><input type="checkbox"/> No typo-graphical and grammatical errors</p>
<p><i>Organize and Manage</i></p> <p>(6 marks)</p>	<p>Structure of report(3mks)</p> <p>Data representation (2mks)</p> <p>Management(1 mks)</p>	<p><input type="checkbox"/> Required structure not used.</p> <p><input type="checkbox"/> Not tabulated appropriately.</p> <p><input type="checkbox"/> Late <2 days</p>	<p><input type="checkbox"/> Title, aims, method, results and discussion are evident.</p> <p><input type="checkbox"/> Data appropriately tabulated without correct units</p> <p><input type="checkbox"/> Submitted within the same day</p>	<p><input type="checkbox"/> Structure correct, highly coherent.</p> <p><input type="checkbox"/> Appropriately tabulated with correct units.</p> <p><input type="checkbox"/> Submitted on time during class</p>

Total= /100

RSD- for ALL Levels in Chemistry

- Major emphasis on ALL RSD facets
- Lab exercises promotes:
 - Team and Individual work
 - Data generation and analysis
 - Critical thinking
 - Pacific consciousness
 - Ethics and discipline (lab attendance submission of reports on time)
 - Professionalism
 - ICT skills

Enhancing RSD

1. Mentoring students

Before

- Graduate Assistance used to supervise first year and second year Chemistry students in the lab.

Now

- Senior academic/experienced staff supervise the laboratory classes.
- facilitate guided development of important hands-on research laboratory skills.

Enhancing RSD

2. Communication Skills

Before

- Relevant information/ requirements and a sample lab report is provided.

After

- First written lab report is checked and guided questions are written on the marked report to help develop the research skills.
- Oral skills is developed in some courses (CH105, CH301, CH311, SC356)

Enhancing RSD

3. ICT skills- Chemical software

- Students are introduced to chemical software programs

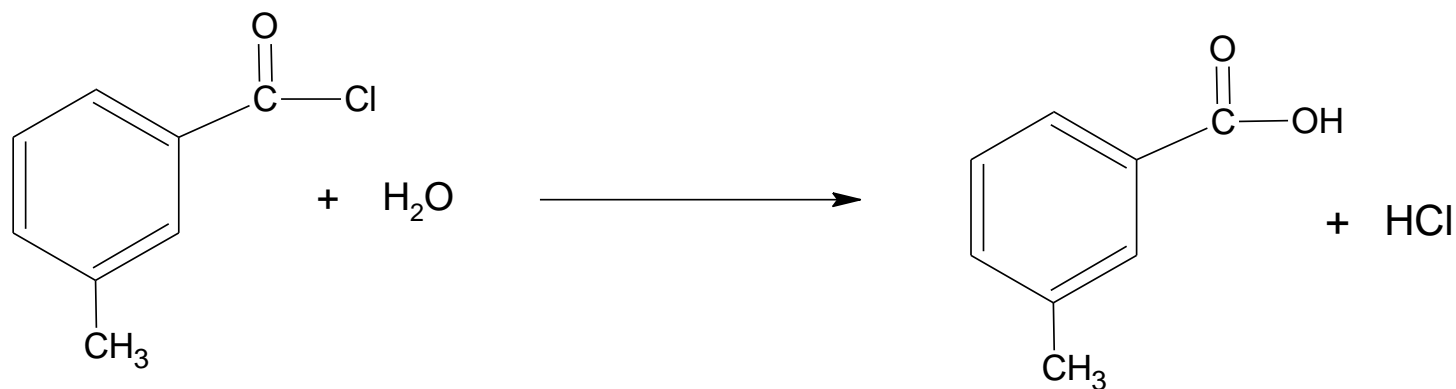
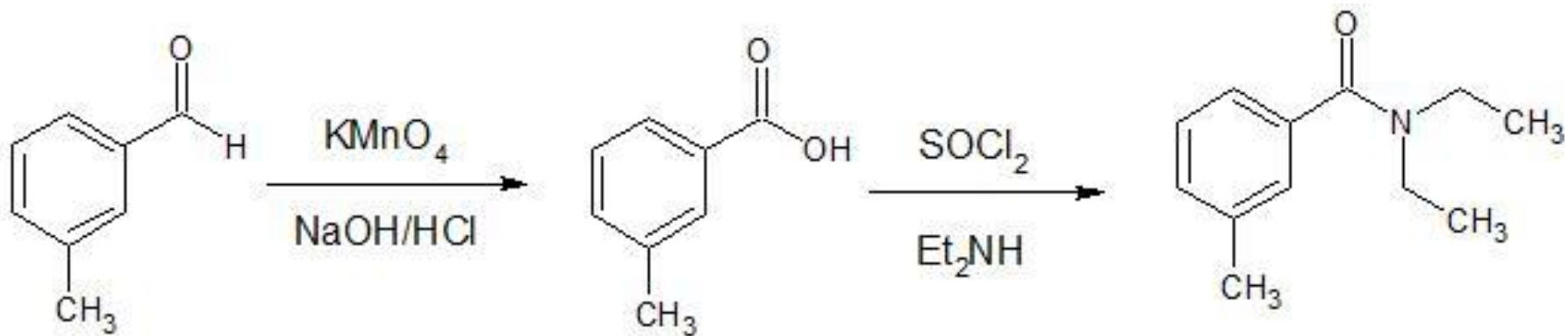
(Knowitall, ChemSketch, ChemDraw)

100 Level- draw simple organic molecules.

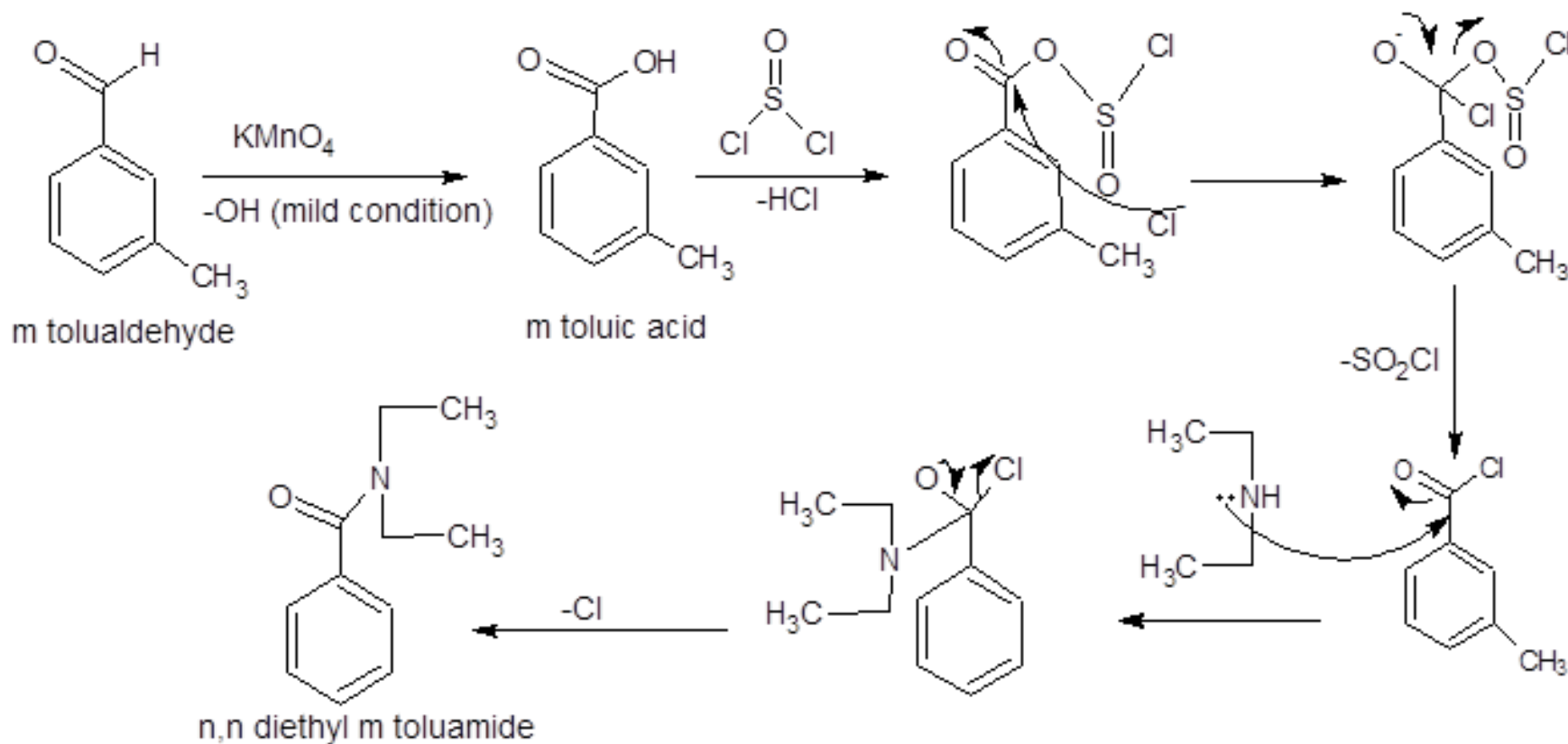
200 Level- write a full reaction.

300 Level- write the mechanism for the reaction.

Enhancing RSD (ICT- software program)

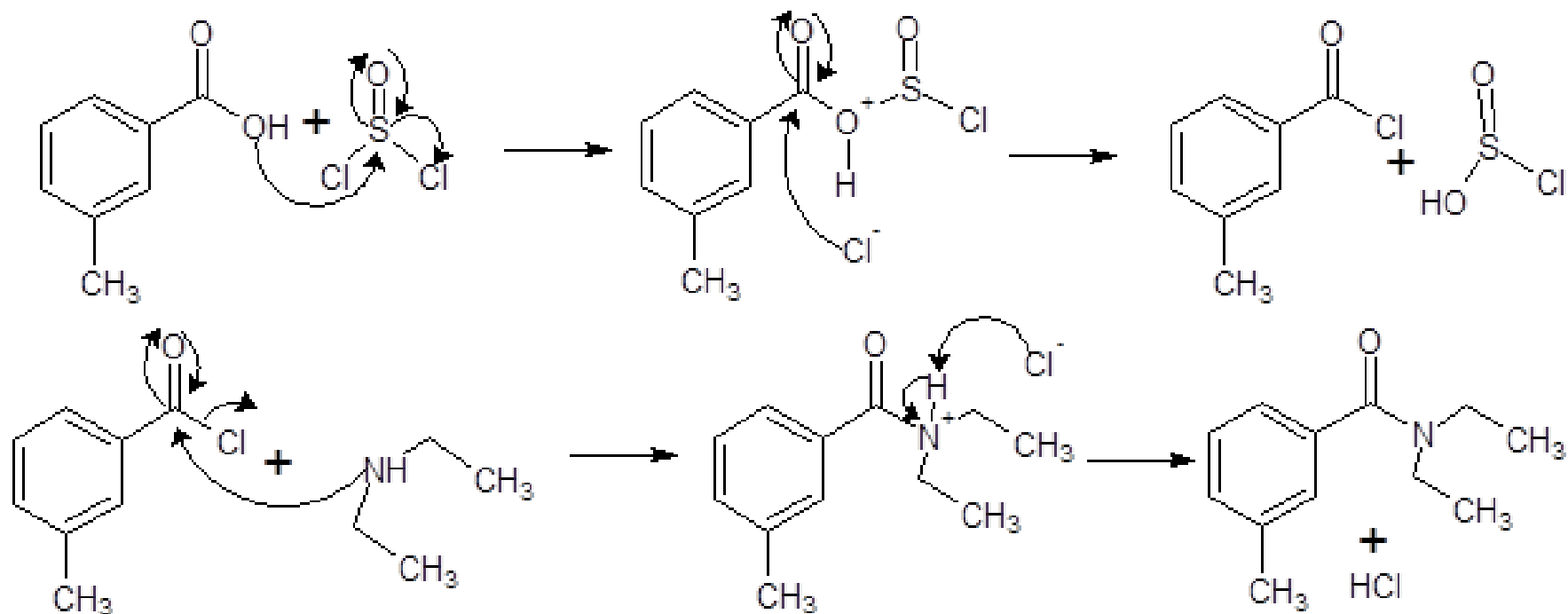


CH303: Preparation of *N, N*-diethyl-*m*-toluamide (DEET-mosquito repellent)



JEFICA TUISAWAU (S11122932)

CH303: Preparation of *N, N*-diethy-*m*-toluamide (DEET-mosquito repellent)



SMITH MARU ID#: s11115153

Enhancing RSD

4. Variety in Assessments

- video production (CH105, CH203 and CH414)
- laboratory tests (oral and written- CH101, CH301, CH311)
- Post lab questions and tutorial question to reflect inquiry learning (all courses)

Advantages of RSD

Students generally:

- understand the rubrics better after the feedback.
- show creativity.
- show originality.
- Literature search.
- better communication skill.
- overall performance in lab based assessments have increased (even if they miss a few lab or do not submit write up).

CH201 Student Views

“The rubric was very explicit and clear, so I don’t think that there is any room for further improvement.”

“Think the current rubrics exercise is better enough.”

“The rubrics was well organized which helped and guided us to write proper lab reports with thorough research and explanation. However, the rubrics should indicate how many citations and references is needed in the lab report.”



Thank You

CH201		Marking Rubric		Experiment: <i>Amino Acids</i>	
Research Facet	Report components	Unsatisfactory Incomplete and not fully accurate or comprehensive	Satisfactory Complete, accurate and comprehensive	Highly satisfactory Complete, accurate, comprehensive, and innovative	
Embark and clarify (20 marks)	Pre-Lab (15 mks)	<input type="checkbox"/> Incomplete or major errors	<input type="checkbox"/> Pre-lab complete but not fully accurate	<input type="checkbox"/> Complete and accurate	
	Title (1 mk)	<input type="checkbox"/> None or incorrect title	<input type="checkbox"/> Reproduces given title	<input type="checkbox"/> Rephrased title	
	Aim (1 mk)	<input type="checkbox"/> Misses the purpose or not stated	<input type="checkbox"/> Aim stated but is not accurate	<input type="checkbox"/> Rephrased, clear and concise	
	Introduction (3 mks)	<input type="checkbox"/> Reproduces the given introduction.	<input type="checkbox"/> Paraphrased given introduction	<input type="checkbox"/> Uses literature and given introduction.	
Find and Generate (6 marks)	Procedure (4 mks)	<input type="checkbox"/> Reproduced procedure as given.	<input type="checkbox"/> Reproduces given procedure in past tense.	<input type="checkbox"/> Paraphrased given procedure (in past tense).	
	Data (2mks)	<input type="checkbox"/> Chromatograph not included.	<input type="checkbox"/> Includes a chromatograph but is not clear	<input type="checkbox"/> Includes a clear chromatogram (photo or redrawn)	
Evaluate and Reflect (30 marks)	Calculation (20 mks)	<input type="checkbox"/> Rf values calculated incorrectly.	<input type="checkbox"/> Rf values correctly calculated for some amino acids.	<input type="checkbox"/> Rf values correctly calculated for all amino acids and the unknowns.	
	Colors of spots identified (10 mks)	<input type="checkbox"/> Colors of spots not given.	<input type="checkbox"/> Colors of spots given but not for all amino acids.	<input type="checkbox"/> Colors of spots given for both unknown and the known amino acids.	
Analyze and Synthesize (26 marks)	Data analysis and comparison (6 mks)	<input type="checkbox"/> Poor explanation of data.	<input type="checkbox"/> Reasonable explanation of data.	<input type="checkbox"/> Full and accurate justification of all data.	
	Identification of unknowns (2 mks)	<input type="checkbox"/> Unable to identify the unknown amino acids.	<input type="checkbox"/> Attempt to identify the unknown amino acids.	<input type="checkbox"/> Identifies the unknowns correctly.	
	Post-Lab question (18 mks)	<input type="checkbox"/> Attempts the question but mostly incorrect. <input type="checkbox"/> Possible experimental limitations not mentioned	<input type="checkbox"/> Answer the question with some correct answers. <input type="checkbox"/> Possible experimental limitations mentioned but not discussed	<input type="checkbox"/> Questions correctly answered. <input type="checkbox"/> Possible experimental limitations mentioned and discussed	

<p><i>Communicate and Apply Ethically</i></p> <p>(12 marks)</p>	<p>Citations (3 mks)</p> <p>Text reproduction (3 mks)</p> <p>Report clarity and argument (3 mks)</p> <p>Grammar and spelling (3 mks)</p>	<p><input type="checkbox"/> Not all sources cited (manual, texts, other students)</p> <p><input type="checkbox"/> Font and spacing inconsistent.</p> <p><input type="checkbox"/> Tables and figures not labelled.</p> <p><input type="checkbox"/> Arguments are not easily traceable/ clear</p> <p><input type="checkbox"/> Typo-graphical and grammatical errors</p>	<p><input type="checkbox"/> References are all cited but with some formatting errors</p> <p><input type="checkbox"/> Font and spacing are mostly consistent.</p> <p><input type="checkbox"/> Tables and figures are labelled but not discussed.</p> <p><input type="checkbox"/> Arguments are traceable but not always clear to follow.</p> <p><input type="checkbox"/> Some incidence of typo-graphical and grammatical errors</p>	<p><input type="checkbox"/> All references cited with consistent formatting and without errors</p> <p><input type="checkbox"/> Font and spacing are consistent.</p> <p><input type="checkbox"/> Tables and figures are correctly labelled and discussed in the report</p> <p><input type="checkbox"/> Arguments are presented clearly.</p> <p><input type="checkbox"/> Easy to read and follow.</p> <p><input type="checkbox"/> No typo-graphical and grammatical errors</p>
<p><i>Organize and Manage</i></p> <p>(6 marks)</p>	<p>Structure of report (3 mks)</p> <p>Data representation (2 mks)</p> <p>Management (1 mks)</p>	<p><input type="checkbox"/> Required structure not used.</p> <p><input type="checkbox"/> Not tabulated appropriately.</p> <p><input type="checkbox"/> Late < 2 days</p>	<p><input type="checkbox"/> Title, aims, method, results and discussion are evident.</p> <p><input type="checkbox"/> Data appropriately tabulated without correct units</p> <p><input type="checkbox"/> Submitted within the same day</p>	<p><input type="checkbox"/> Structure correct, highly coherent.</p> <p><input type="checkbox"/> Appropriately tabulated with correct units.</p> <p><input type="checkbox"/> Submitted on time during class</p>

Total= /100

RSD- Marking Rubric for CH303

CH303		Marking Rubric		
		Experiment: DEET SYNTHESIS		
Research Facet	Report components	Unsatisfactory Incomplete and not fully accurate or comprehensive	Satisfactory Complete, accurate and comprehensive	Highly satisfactory Complete, accurate, comprehensive, and innovative
Embark and clarify (7 marks)	Literature Search (2mks)	<input type="checkbox"/> Less than 3 journals	<input type="checkbox"/> Evidence (3-6 journals)	<input type="checkbox"/> Evidence (6-8 journals)
	Title (1mk)	<input type="checkbox"/> Incorrect title or reproduces title	<input type="checkbox"/> Somewhat relevant title	<input type="checkbox"/> Relevant title
	Aim (1mk)	<input type="checkbox"/> Misses the purpose or not stated	<input type="checkbox"/> Aim stated but is not accurate	<input type="checkbox"/> Rephrased, clear and accurate aim
	Introduction (3mks)	<input type="checkbox"/> Reproduces given introduction.	<input type="checkbox"/> Paraphrased given introduction with relevant literature with reference to the Pacific.	<input type="checkbox"/> Uses literature to write clear and relevant introduction with reference to the Pacific.
Find and Generate (6 marks)	Procedure (4mks)	<input type="checkbox"/> Reproduced procedure as given.	<input type="checkbox"/> Reproduces given procedure in past tense.	<input type="checkbox"/> Paraphrased given procedure (in past tense).
	Data (2mks)	<input type="checkbox"/> Not all results included. <input type="checkbox"/> Spectroscopic data not included.	<input type="checkbox"/> All results included but not in correct format. <input type="checkbox"/> Includes a spectroscopic data but not in correct format.	<input type="checkbox"/> All results included in correct format. <input type="checkbox"/> Includes a spectroscopic data in correct format
Evaluate and Reflect (10 marks)	Calculation (5mks)	<input type="checkbox"/> Moles, Mr, limiting reagent, yield calculated mostly incorrectly.	<input type="checkbox"/> Moles, Mr, limiting reagent, yield calculated with some inaccuracies.	<input type="checkbox"/> Moles, Mr, limiting reagent, yield etc calculated correctly.
	Spectral information (5mks)	<input type="checkbox"/> Spectral information incorrectly extracted.	<input type="checkbox"/> Relevant spectral information extracted.	<input type="checkbox"/> Spectral information correctly extracted.

<p><i>Analyze and Synthesize</i> (24 marks)</p>	<p>Data analysis and comparison (6mks)</p> <p>Mechanisms of reactions (10mks)</p> <p>Post-Lab question (6mks)</p> <p>Limitations of the experiment (2mks)</p>	<p><input type="checkbox"/> Poor explanation of experimental and spectral data.</p> <p><input type="checkbox"/> Mechanisms of not all reactions shown with no explanation.</p> <p><input type="checkbox"/> Attempts the question but mostly incorrect.</p> <p><input type="checkbox"/> Possible experimental limitations not mentioned</p>	<p><input type="checkbox"/> Reasonable explanation of experimental and spectral data.</p> <p><input type="checkbox"/> Mechanisms of some reactions shown and with clear explanation.</p> <p><input type="checkbox"/> Answer the question with some correct answers.</p> <p><input type="checkbox"/> Possible experimental limitations mentioned but not discussed</p>	<p><input type="checkbox"/> Full and accurate justification of all data.</p> <p><input type="checkbox"/> Mechanisms of all reactions shown and explained clearly.</p> <p><input type="checkbox"/> Questions correctly answered.</p> <p><input type="checkbox"/> Possible experimental limitations mentioned and discussed</p>
<p><i>Communicate and Apply Ethically</i> (8 marks)</p>	<p>Citations (2mks)</p> <p>Text reproduction (2mks)</p> <p>Report clarity and argument (2mks)</p> <p>Grammar and spelling (2mks)</p>	<p><input type="checkbox"/> Not all sources cited</p> <p><input type="checkbox"/> Font and spacing inconsistent. <input type="checkbox"/> Tables and figures not labelled.</p> <p><input type="checkbox"/> Arguments are not easily traceable/clear</p> <p><input type="checkbox"/> Typo-graphical and grammatical errors</p>	<p><input type="checkbox"/> References are all cited but with some formatting errors</p> <p><input type="checkbox"/> Font and spacing are mostly consistent. <input type="checkbox"/> Tables and figures are labelled but not discussed.</p> <p><input type="checkbox"/> Arguments are traceable but not always clear to follow.</p> <p><input type="checkbox"/> Some incidence of typo-graphical and grammatical errors</p>	<p><input type="checkbox"/> All references cited with consistent formatting without errors.</p> <p><input type="checkbox"/> Font and spacing are consistent. <input type="checkbox"/> Tables and figures are correctly labelled and discussed in the report.</p> <p><input type="checkbox"/> Arguments are presented clearly. <input type="checkbox"/> Easy to read and follow.</p> <p><input type="checkbox"/> No typo-graphical and grammatical errors</p>
<p><i>Organize and Manage</i> (5 marks)</p>	<p>Structure of report (2mks)</p> <p>Data representation (2mks)</p> <p>Management (1mk)</p>	<p><input type="checkbox"/> Required structure not used.</p> <p><input type="checkbox"/> Not tabulated appropriately.</p> <p><input type="checkbox"/> Late < 2 days</p>	<p><input type="checkbox"/> Title, aims, method, results and discussion are evident.</p> <p><input type="checkbox"/> Data appropriately tabulated without correct units</p> <p><input type="checkbox"/> Submitted within the same day</p>	<p><input type="checkbox"/> Correct report structure and highly coherent.</p> <p><input type="checkbox"/> Appropriately tabulated with correct units.</p> <p><input type="checkbox"/> Submitted on time during class</p>

Total= /60