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# Exploring Chemistry Transferable Practical Skills: Insights from the National Practical Skills Inventory

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# Workshop Outline



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- Aims of the Workshop
- Background to the National Skills Inventory
- Summary of Chemistry Teaching in Practice Meeting (CTiP) Outputs
- Selected practical skills for discussion
- Example - breaking down a practical skill into micro transferrable skills
- Discussion
- Summary and next steps



# Aims of the Workshop



- Consider how practical skills can be broken down into micro-transferrable practical skills.
  - Why do this?
    - If students have demonstrated competency of a set of micro-transferrable practical skills, then they may not need to use a piece of expensive or niche equipment.
    - Students can demonstrate competency of a practical skill as a culmination of micro-transferrable practical skills – introduces flexibility in approach (may be helpful for students with disabilities).
    - Students will be better equipped to articulate and showcase their skills at job interviews.



# National Skills Inventory - Background



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- 'Future of Labs' Conferences at Oxford in 2015, 2017 & 2020
- Set of educators from 37 national institutions and RSC met
- Discussed the potential practical skills that a chemistry student could be exposed as part of their degree
- 104 individual skills were identified.
- Split into three skill-level categories:
  - Basic
  - Core
  - Advanced/optional



# RSC HEG Satellite Meeting, August 2023 & Chemistry Teaching in Practice Meeting, January 2024



- We wanted to find out more specific details about the particular practical skills carried out around the country.
- Are there particular skills that we teach but are outdated/redundant?
- What particular skills do we wish we taught, but don't?  
Who within our network may have that experience?
- Differences between different types of institution, departmental expertise?
- Opportunities for institutions to carve out USP.



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# Summary of RSC HEG Survey responses

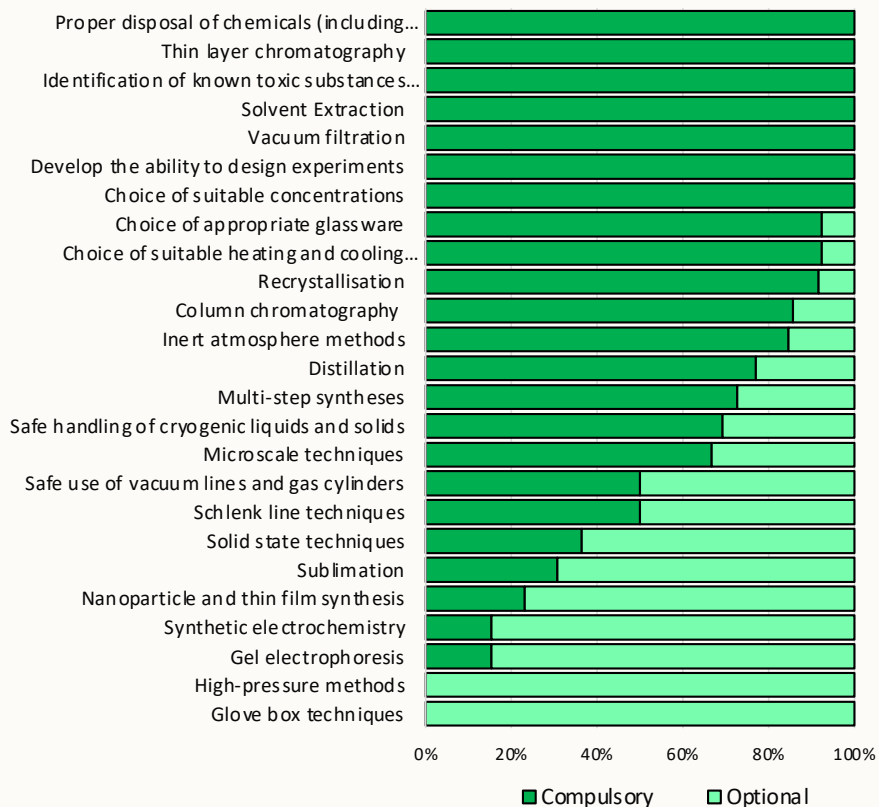




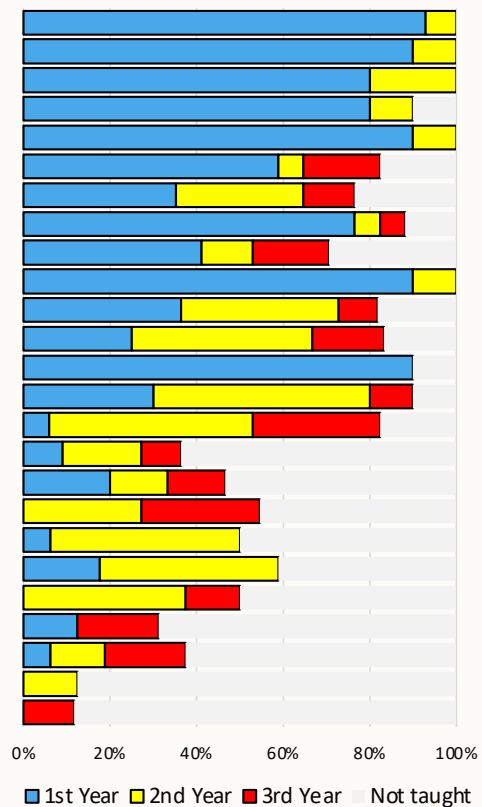
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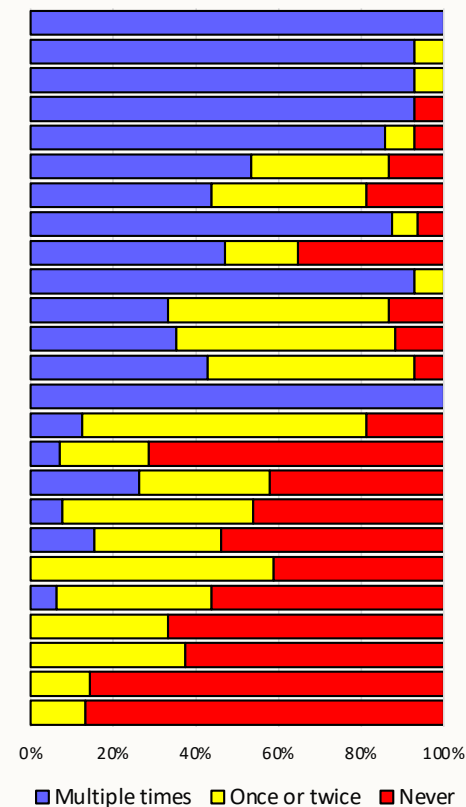
### Importance of Teaching



### Year First Introduced



### How Frequently Encountered?



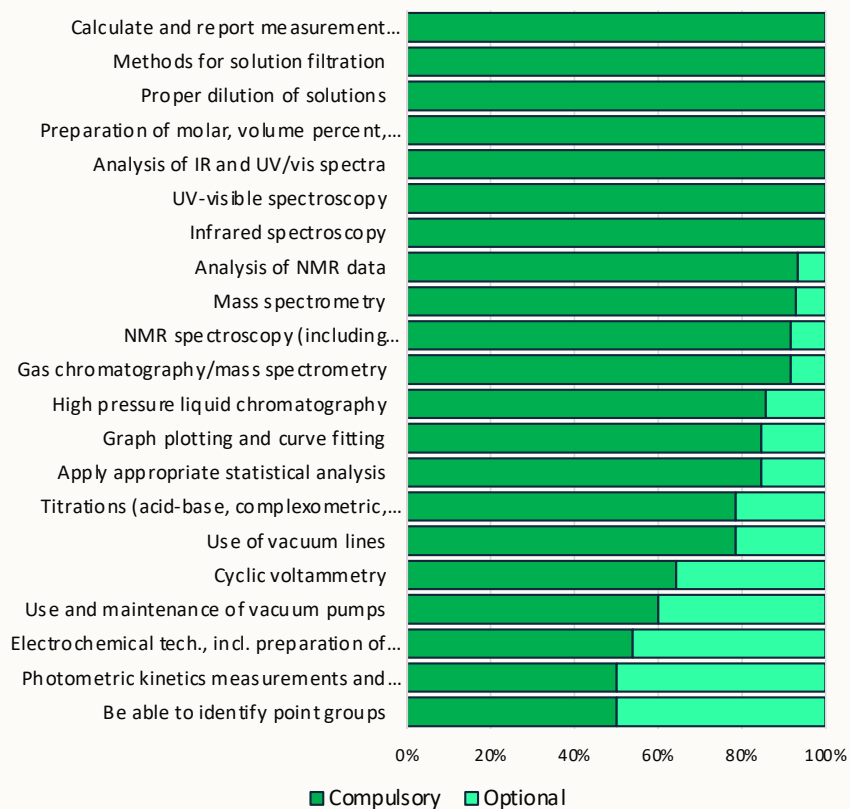


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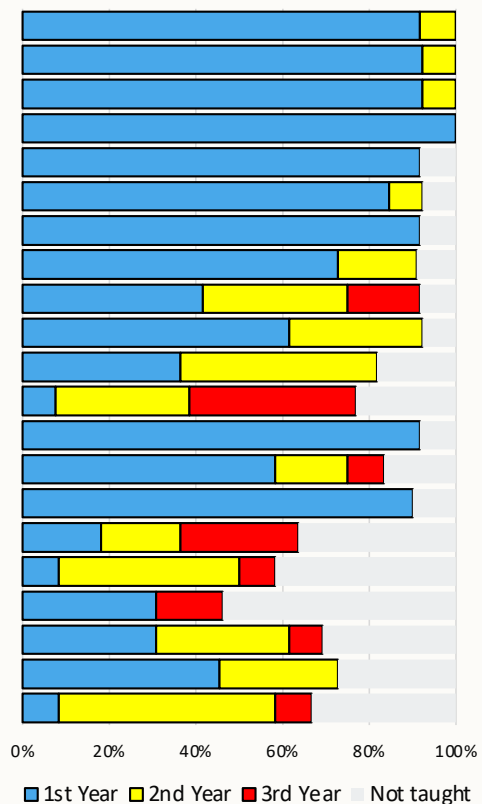


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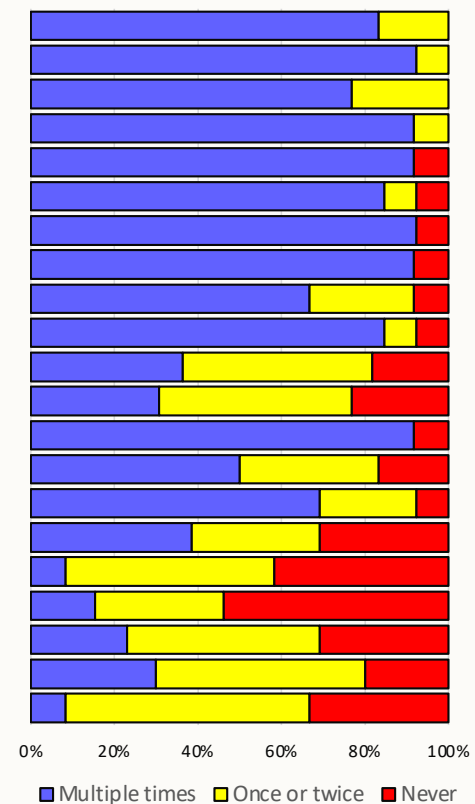
### Importance of Teaching



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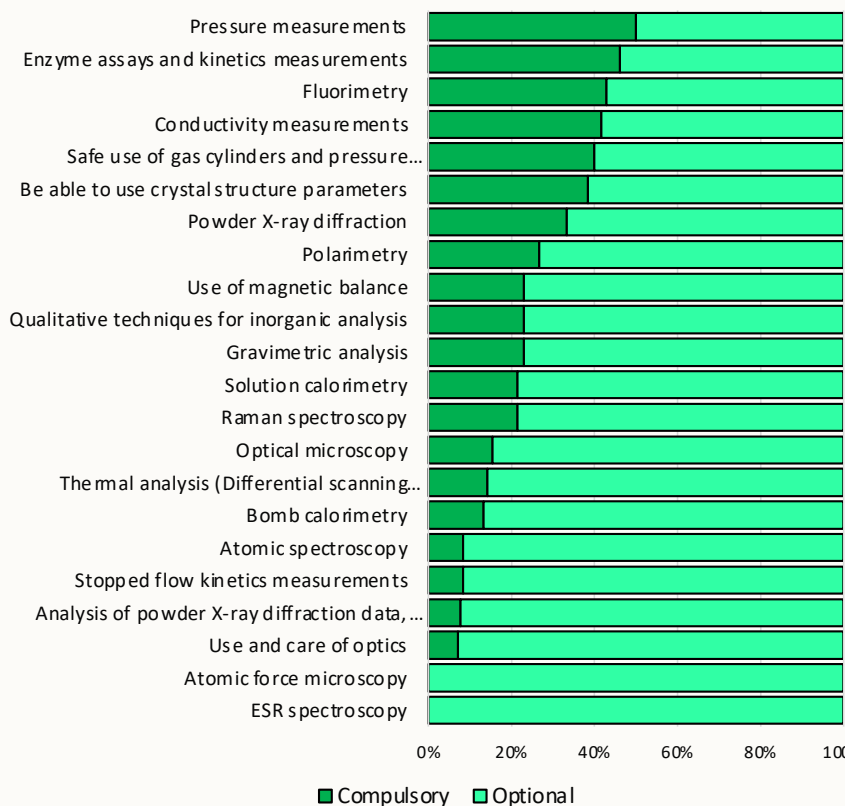




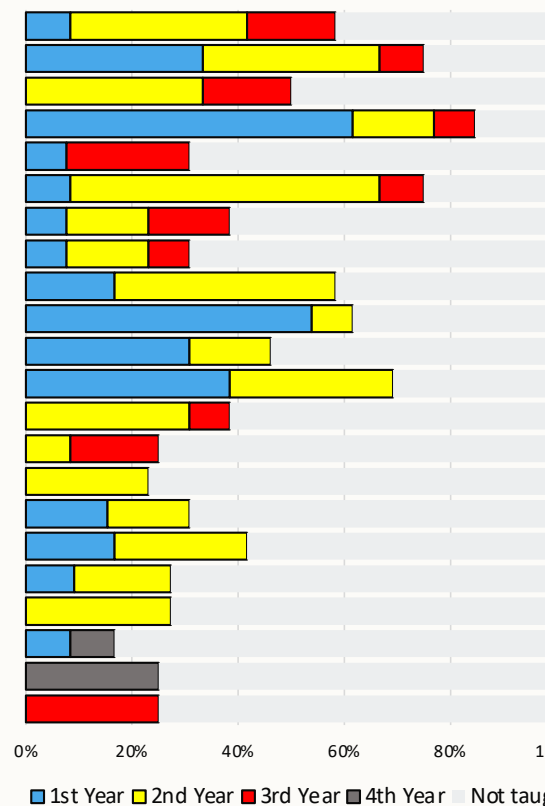
# Measurement II



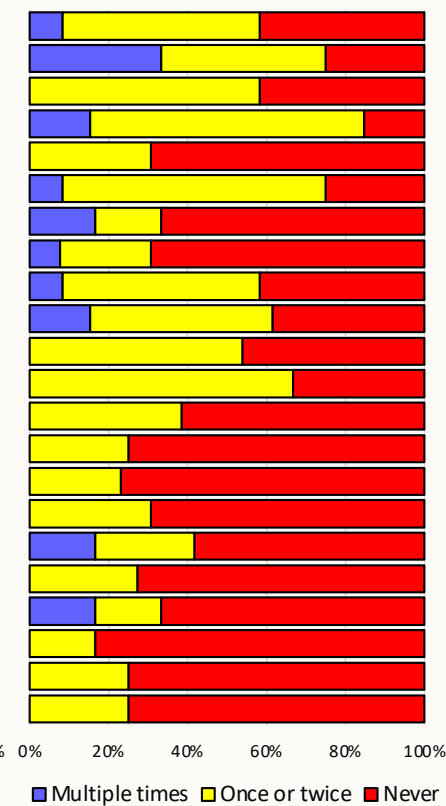
### Importance of Teaching



### Year First Introduced



### How Frequently Encountered?





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# Selected practical skills for discussion today



# Practical Skills for Discussion



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## Synthetic

- Thin layer chromatography
- Column chromatography
- Proper disposal of chemicals (including organic solvents)
- Recrystallisation
- Distillation
- COSHH and risk assessment
- Solvent extraction
- Choice of suitable heating and cooling methods
- Choice of suitable concentrations
- Inert atmosphere methods
- Safe use of vacuum lines and gas cylinders



# Practical Skills for Discussion



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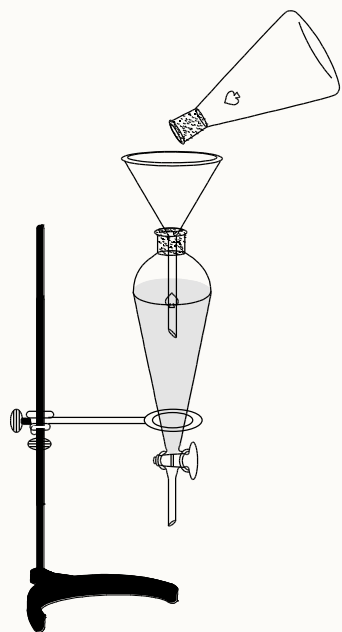
## Measurement

- Preparation of molar, volume percent, and mass/volume solutions
- Calculate and report measurement uncertainties
- Graph plotting and curve fitting
- Acquiring and analysing Infrared and UV/visible spectroscopy
- Acquiring and analysing NMR spectroscopy (including multinuclear, and solid state)
- Qualitative techniques for identification
- Apply appropriate statistical analysis
- Titrations (acid-base, complexometric, redox, ppt)
- High pressure liquid chromatography
- Gas chromatography/mass spectrometry
- Enzyme assays and kinetic measurements
- Calorimetry

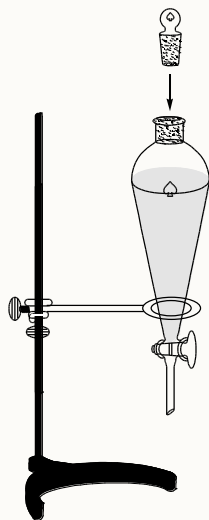


# Example – Solvent Extraction

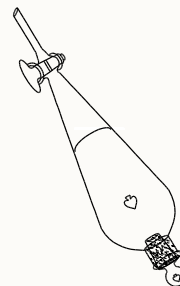
Consider the micro transferrable skills required to carry out a solvent extraction



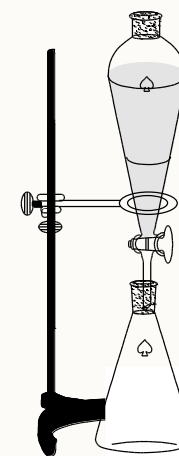
step 1



step 2



step 3



step 4



## Example – Solvent Extraction



Consider the micro transferrable skills required to carry out a solvent extraction

- Glassware manipulations:
  - Transfer to a separating funnel (e.g. use a funnel, careful decanting & rinsing)
- Ventilation (safety, esp. with acid + carbonate)
- Suitable separation of the phases
- Drying the organic extract
- Choice of organic solvent (miscibility with aq. Phase, suitable product solubility, b.p., safety, cost)
- Identification of phases & which phase contains desired product
- pH adjustment
- Dealing with emulsions
- Sufficient drying of organic extract



## Structure of Discussion



- Discussion will be broken into 2 x 15-minute blocks.
- On each table there will be a set of skills for discussion
  - Use post-it notes to add micro transferrable skills
  - Don't duplicate micro transferrable skills for a particular skill, if you agree with what's already noted, please tick the note so we can gauge agreement.
  - Please circulate around the tables and consider all skills.
- After 15 minutes we'll distribute another set of skills for discussion



## Feedback



- Can each table list some of the common micro transferrable skills.



## Next Steps



Collate and share the outputs at the next 'Chemistry Teaching in Practice' meeting in January 2025.

Please don't hesitate to get in contact via email if you have any feedback:

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***Thank you for your contributions today.***