

Integrating Practical Activities in Learning, Teaching and Assessment

- Practical works in Teaching and Learning of Chemistry
- Enriching the SBA Assessments



Dr. Kendrew K. W. Mak

Senior Lecturer

Dept. of Chemistry, CUHK

(SBA Supervisor/District Coordinator)

Practical Works in HKDSE Chemistry

- Chemistry is an experimental science
- Strengthen the teaching and learning of chemistry
- Conduct at least 8 experiments in S5-6
- To fulfill the SBA Requirements (20% of overall assessment)
- (?) Separate from the written examination
- (?) A burden to the limited available teaching hours
- Fulfill SBA $\equiv$ Chemistry practical work in school

化學科考日常應用 被指艱深 – 東方日報 4月20日

..... 不少考生均指，今年考試內容較去年艱深，且不少題目涉及化學在日常生活的應用，如安全氣囊及液晶顯示器的使用及原理、以紅外線光譜來辨別茄紅素結構等，有化學科老師建議學生多親身做實驗及應用，相信有助提升答題能力及水平。

..... 有考生亦指題目既要求考生計數，得出結果後再推論化學反應並繪圖解釋，若計數部分已有困難，便無法繪圖，變成「雙重失分」.....

化學科科主任陳錦源老師其餘題目則較複雜及生活化，要求考生應用書本上的化學原理知識，如安全氣囊一題涉及兩個化學反應，涉及計算體積及反應速率，應難倒不少考生。他形容化學科着重微觀理解，下屆學生應多親身做實驗及應用來作好準備。

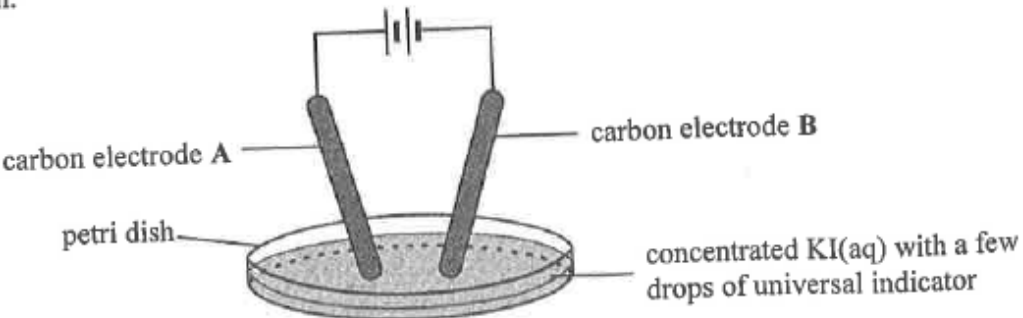
The Easy Way of Learning Chemistry

By memorizing facts and concepts?

By experiencing and making educated guesses?

2013 Chemistry DSE Paper 1B

9. The diagram below shows the set-up used in an investigation on the electrolysis of concentrated potassium iodide solution:



carbon electrode A

carbon electrode B

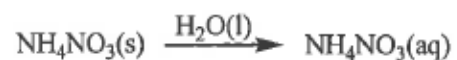
petri dish

concentrated KI(aq) with a few drops of universal indicator

(a) State and explain the expected observation around carbon electrode A during the electrolysis.

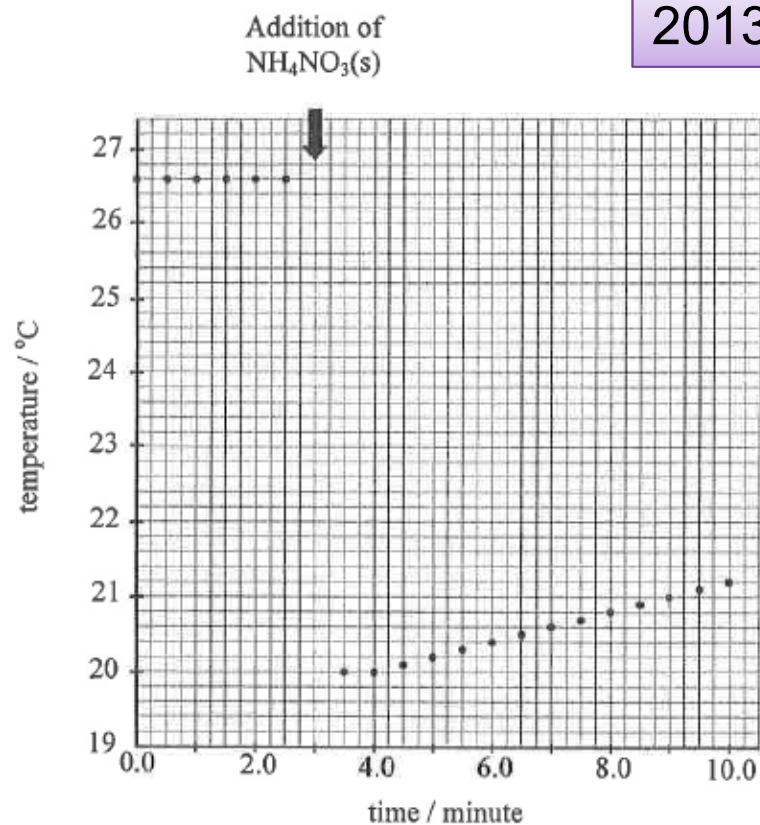
<http://www.youtube.com/watch?v=5ofNp-dFkdo>

5. The following experiment was carried out to determine the enthalpy change of solution of ammonium nitrate:



A certain volume of water was placed in an expanded polystyrene cup. The temperature of the water in the cup was measured with a thermometer at half-minute intervals. Right at the third minute, 2.0 g of $\text{NH}_4\text{NO}_3(\text{s})$ was added to the cup. The solution in the cup was then stirred thoroughly and its temperature was measured for an additional 7 minutes.

The recordings of temperature are shown in the graph below:



- (a) (i) From the graph, estimate the greatest temperature drop of the solution in the cup.

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

2013 Chemistry DSE Paper 1B

Question Types in Exam

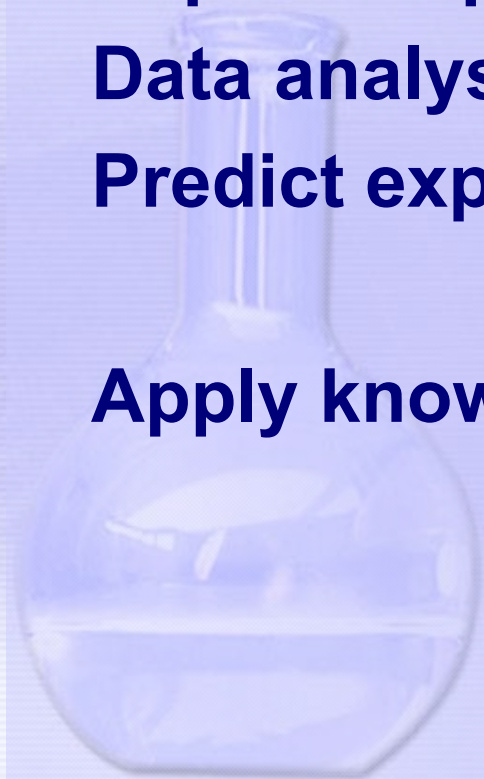
Basic principles / concepts

Explain experimental phenomenon

Data analysis / calculations involved in expts

Predict experimental results

Apply knowledge to daily life situations



Memorize Hard Facts vs. Recall Hands-on Experience

Describe the experimental steps:

- *6. 概述由固體硝酸鉛(II) 製備固體硫酸鉛(II) 的各步驟。你要寫出所需的各額外化學試劑，但毋須說明所涉及的儀器。

(4 分)

首先，把固體硝酸鉛(II) 放入燒杯，加入蒸餾水，用玻璃棒攪拌，硝酸鉛(II) 溶解後，之後加入^{過量}硫酸鈉，硫酸鈉和全部硝酸鉛反應，生成固體硫酸鉛沉澱和硝酸鈉溶液。

然後，將溶液過濾，過濾的沉澱便是硫酸鉛(II)，用少量蒸餾水沖洗二至三次，除去固體表面雜質。

之後，用兩片濾紙輕壓，吸乾水分。

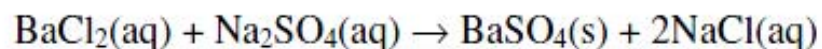
製出固體硫酸鉛(II)。

Student Handout

Preparation of an insoluble salt – barium sulphate

For preparing an insoluble salt, one method is to mix two soluble reagents each containing the respective cation and anion. When the ions of the insoluble salt combine, the precipitate of the salt forms. Such a reaction is called precipitation.

In preparing barium sulphate, barium chloride solution can be mixed with sodium sulphate solution.



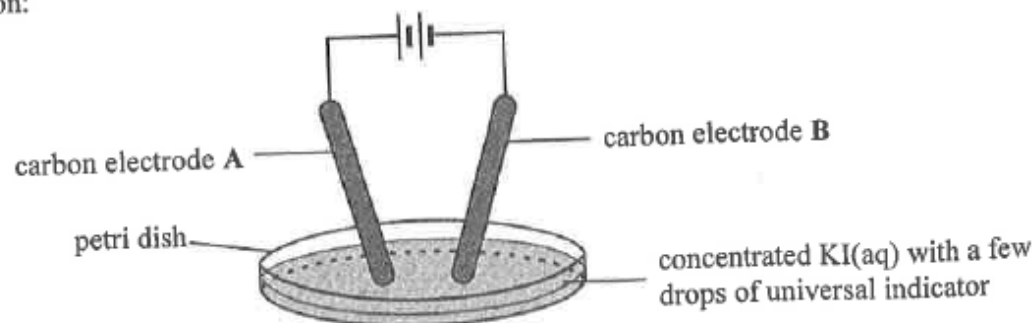
The precipitate formed is then filtered and washed with deionized water. Finally, the precipitate can be dried in an oven or in a desiccator.

Level of Learning (Bloom's Taxonomy)

1. At Knowledge Level of Learning a student can define terms
2. At Comprehension Level of Learning a student can work assigned problems and can recall examples of what they did
3. At Application Level of Learning a student recognizes what methods to use and then use the methods to solve problems
4. At Analysis Level of Learning a student can explain why the solution process works
5. At Synthesis Level of Learning a student can combine the parts of a process in new and useful ways
6. At Evaluation Level of Learning a student can create a variety of ways to solve the problem and then, based on established criteria, select the solution method best suited for the problem.

High Level of Learning (Exploration and Interpretation)

9. The diagram below shows the set-up used in an investigation on the electrolysis of concentrated potassium iodide solution:



- (ii) Would there be any change in observation if carbon electrode **B** is replaced by a copper electrode in the investigation? Explain.

- Allow students to explore the chemistry by trying different combinations of electrodes and see what happen.
- Make interpretations and discuss.

Objectives of Teaching Chemistry in Secondary Schools

Scientific Knowledge?

Scientific Literacy?



Enriching the Assessment Methods for Chemistry SBA

	Practical Related Tasks		
	BCA		EXPT
	Basic Chemical Analysis		Experiment
Task content (student's work)	- Volumetric Analysis - Worksheet	- Detection of cations or anions or both - Worksheet	- Perform experiments suggested in the Curriculum and Assessment Guide (other than Volumetric Analysis & Detection of ions) - Worksheet / simple report / detailed report on experiments performed; AND/OR Quiz on the experiment involved.
Group/Individual	- Individual BCA - Individual worksheet		- Group EXPT - Individual worksheet/report/quiz
In-class time	80 mins	20 mins	80 mins
Out-of-school time	0 mins	0 mins	0 – 60 mins
Means of assessment (teacher's work)	Mark worksheet	Mark worksheet	Mark worksheet / simple report / detailed report / quiz
Authentication	Hand in worksheets in class time		Hand in the following in class time: - worksheet / simple report / raw data sheet (if detailed report to be finished at home) - AND/OR - quiz

Assessments Methods of TAS vs SBA

HKALE (TAS)

- Area A (Performance)
- Area B (Reports)
- Area C (Attitude)

HKDSE (SBA)

- Worksheets / Reports / Quiz
- Do not assess students' performance?



Some Observations from SBA Implementation

Some teachers concerns about:

- The marks do(can) not reflect students' ability in carrying out experiments.
- For VA (volumetric analysis) experiment, students may get very high marks for correct calculations, even though the their experimental skills are far from satisfactory.
- For QA (qualitative analysis) experiment, students can complete the worksheets and get high marks from standard answers from books / web sources.
- (?) SBA is not assessing students' ability in performing experiments, it just assesses whether students can produce good quality written work / perform well in written tasks.

Assessment Criteria

(from Chemistry SBA Handbook)

Criteria for assessment of volumetric analysis

Teachers are required to mark the worksheets submitted by their students. Teachers may also assess student performance during practical lessons if circumstances allow. The criteria involved are as follows:

- (a) The number of accurate titration readings is adequate and there is an inclusion of the trial run.
- (b) There is an accurate detection / recording of colour change.
- (c) Calculations are shown clearly and concisely.

- Marking criteria for results accuracy.
- Provide unknown samples of different concentrations to different groups students.
- (Possible?) Ask students to take a snapshot of the end-point and attach it to the report.

Assessment Criteria

(For VA Accuracy)

Titration Result (as a suggested example):

Marks allocated to result accuracy = 3

- Results **within 1%** error: full mark **(3 marks)**
- Results with **1% – 2%** error: **2 marks**
- Results with **2% - 4%** error: **1 mark**
- Results **larger than 4%** error: **0 mark**



Assessment Criteria

(from Chemistry SBA Handbook)

Criteria for assessment of qualitative analysis

Teachers are required to mark the worksheets submitted by their students. Teachers may also assess student performance during practical lessons if circumstances allow. The criteria involved are as follows:

- (a) Results are recorded and described accurately.
 - (b) Unknowns are deduced in a systematic and logical way.
 - (c) Due consideration has been given to laboratory safety.
- (Possible?) Ask students to take a snapshot of the chemical test result and attach it to the report.

Enriching the Assessment Methods

For Other Experiments:

Preparative experiments: product yield, accuracy of physical data obtained, quality/appearance of the product obtained.

Kinetic / heat of reaction experiments: consistency / accuracy of the data obtained.



Some Clarifications about SBA

- Students' performance can be included in the SBA marks. Teachers may design a practical and fair plan to assess students' lab performance
(Advice: Explicitly put down the weighting of lab performance and the marks given on the work sheets)
- Marking SBA's written work $\neq$ Area B mark in TAS(HKALE).
- Marking written works is only the minimum requirement for SBA. Marking students' performance is not mandatory due to some practical concerns.
- **Assess students' ability only. SBA does not assess students' attitude.**

Resources to Support T&L of Practical Work

Chemistry Experimental Techniques (化學實驗技巧)

Chemistry Experimental Techniques (化學實驗技巧) HKedCity > Chemistry E

Introduction

Chemistry is a practical oriented discipline of science. In the NSS Chemistry and Combined Science (Chemistry Part) curricula, students are expected to develop understanding of various experimental techniques and chemical analyses through different learning and teaching activities. Other than real-time demonstration and hands-on experience in practical lessons, instruction in mode of multimedia can also serve as a useful tool to familiarise students with the experimental techniques and methods.

The videos included here have demonstrated the procedures of the selected experimental methods supplementing with the simple theoretical description. They can be used by students for familiarizing themselves with the corresponding experimental techniques and methods before conducting experiments, practical tests of School-based Assessment and the investigative study, as well as used by teachers for teaching and pre-experiment instruction.

This site is best viewed at 1024x768 screen resolution with the latest version of Chrome and Firefox or Internet Explorer 9.

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(English) <http://minisite.proj.hkedcity.net/chemtech/eng/index.html>

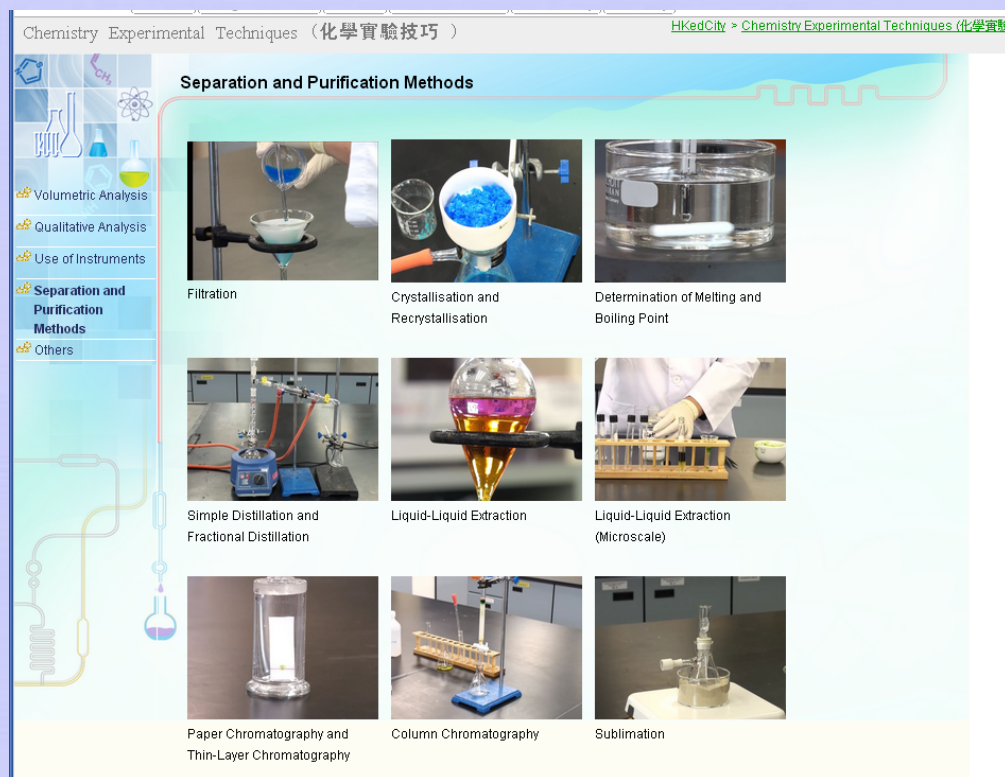
(Chinese) <http://minisite.proj.hkedcity.net/chemtech/cht/index.html>

- Volumetric Analysis
- Qualitative Analysis
- Use of Instruments
- Separation and Purification Methods
- Others

22 Videos – 170 mins

Bilingual versions

- English voice-over with English subtitles
- Cantonese voice-over with Chinese subtitles



Volumetric Analysis:

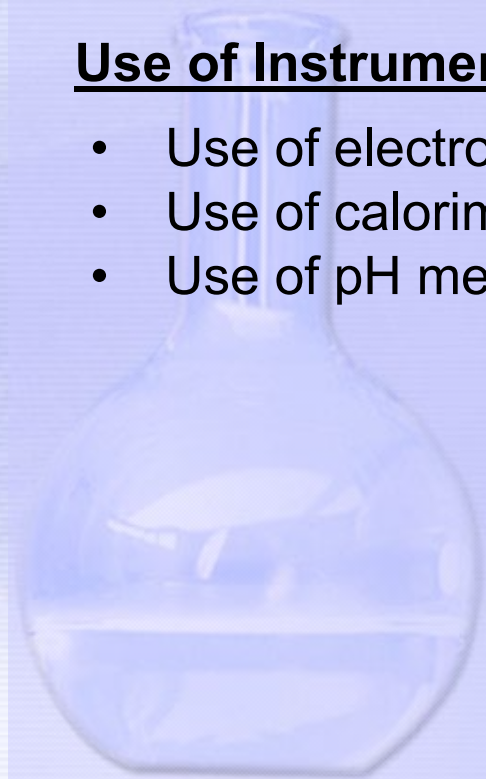
- Preparation of a standard solution (2 parts)
- Titration (3 parts)

Qualitative Analysis:

- Flame test
- Qualitative analysis of cations
- Qualitative analysis of anions
- Test for carbonyl compounds using Tollens' reagent

Use of Instruments:

- Use of electronic balance and weighing substances
- Use of calorimeter
- Use of pH meter

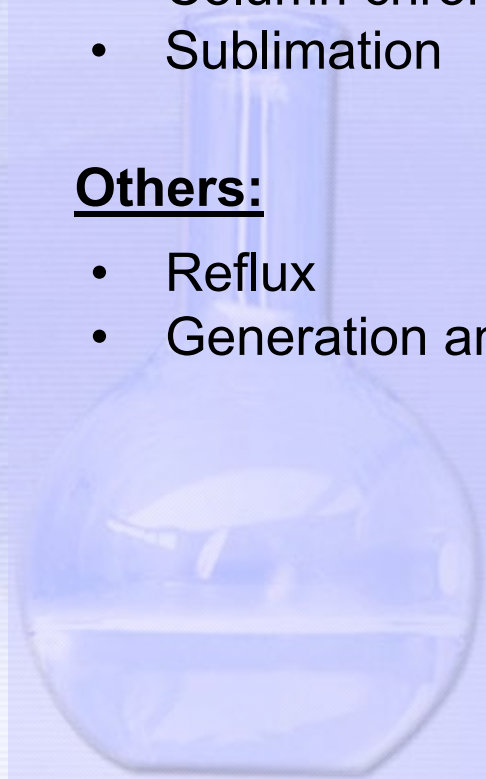


Separation and Purification Methods:

- Filtration
- Crystallisation and recrystallisation
- Determination of melting and boiling point
- Simple distillation and fractional distillation
- Liquid-liquid extraction (miniscale)
- Liquid-liquid extraction (microscale)
- Paper chromatography and thin-layer chromatography
- Column chromatography
- Sublimation

Others:

- Reflux
- Generation and collection of gases



- Facilitate students to make preparations before coming to lab and performing experiments.
- Facilitate teachers to conduct pre-lab briefings.
- Allow students to review the techniques after finished the lab sessions.
- **Not intended to substitute hands-on experience.**



Teaching Resources for Nanomaterials



The banner features a central photograph of students in a laboratory setting, surrounded by a navigation menu and various logos. The navigation menu includes links to Overview, News, Activities, Application, Contact Us, Useful Links, and Sitemap. The banner also includes a title for a workshop on innovative practices for science and nanotechnology education, and a footer with copyright information and browser compatibility instructions.

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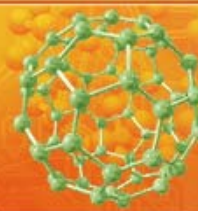
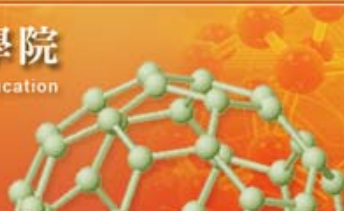
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| ■ [敬邀參加]奈米標章產業商機說明暨技術交流會，2013-4-30星期二下午1點30分至5點00分 NEW | 人培計畫(公告) | 2013/04/19 |
| ■ 聞「氣」色變的高敏奈米流體 NEW | 研發新知 | 2013/04/19 |
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類型	學科領域	教學層級	教材名稱	作者
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	基礎概要	國小	B2-5蓮環炮	奈米教學團隊
	基礎概要	國中	B3-5奈米之旅	楊子昆
	基礎概要	國中	圖解奈米新科技與光觸媒的應用	台北市, 民族國中
	基礎概要	國中	奈米世界概論(奈米nm)	吳家增
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