

Enhancing Learning with Practical Tasks 2014

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**Science (Chemistry)
without practical work
is like swimming
without water.**

Aims and Purposes:

1. To introduce some suitable practical tasks for the learning and teaching of SS Chemistry and Combined Science (Chemistry)
2. To facilitate teachers to apply different pedagogical approaches in chemistry practical tasks for effective learning

Speakers today

- Ms Anita LEUNG, Ho Fung College
(Sponsored by Sik Sik Yuen)
- Dr Kenneth HUI, Sing Yin Secondary School
- Ms Sophia CHENG, Education Bureau
- Mr Tim TSE, Education Bureau

Teachers' views of practical tasks

- Fostering students' interest in chemistry (Learning and Teaching)
- Creating excitement with hands-on experiments for students (Learning)
- Helping students to acquire process skills / planning skills / problem solving skills / ... (Learning)
- Helping students to acquire an understanding of hazard, risk and safe working (Learning)
- Helping students to reinforce concepts and understanding in chemistry (Learning and Teaching)
- Gathering information about students' attainment in chemistry (Assessment)
- ...

Students' views of practical tasks ?

Hands-on = Minds-on ?
動手 = 動腦 ?



SCORE (Science Community Representing Education) (2009)

Practical work in science is
“a hands-on learning
experience which prompts
thinking about the world in
which we live”.

Quality practical tasks will be

- integrated
- well-planned
- adaptable
- time-efficient

http://www.score-education.org/downloads/practical_work/framework.pdf

Two types of practical tasks:

1. Chemistry techniques and procedures
2. Chemistry enquiries and investigative study

A. TLC of Chlorophyll / Painkillers

Skills in apparatus use and standard procedures

<http://edblog.hkedcity.net/nsschem/>
Search chlorophyll



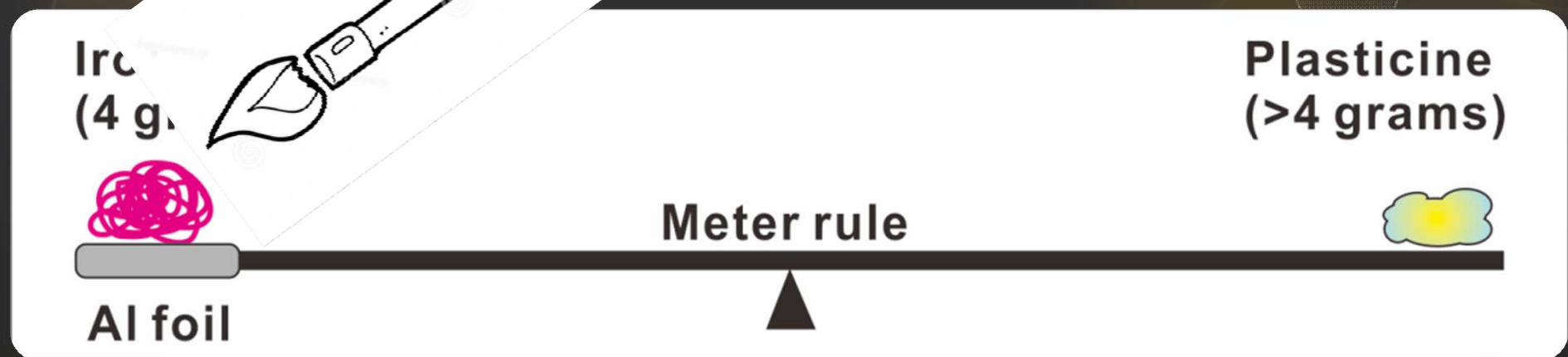
B. Synthesis of Benzoic Acid



**Skills in apparatus use and
standard procedures**

<http://edblog.hkedcity.net/nsschem/>
Search benzoic acid

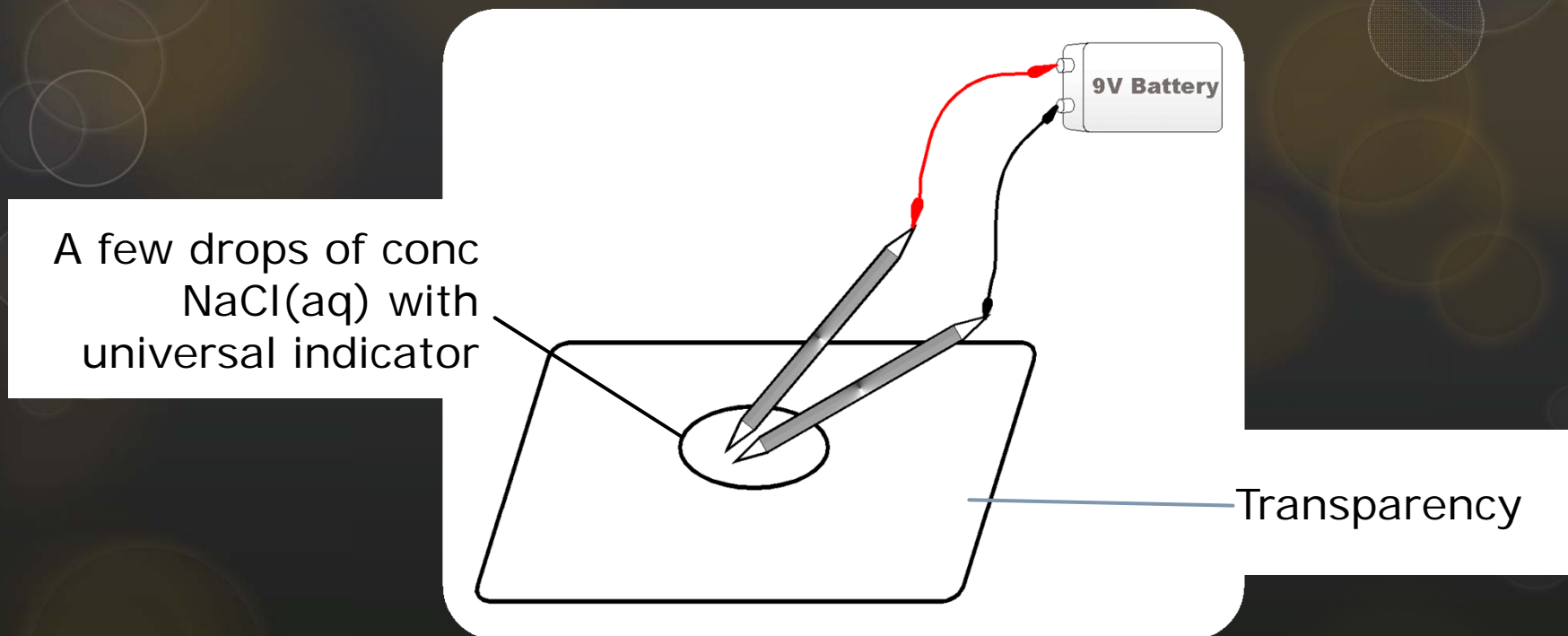
C. A Matter of Balance: The Corrosion of Iron Wool



Knowledge and understanding
Understanding scientific investigation

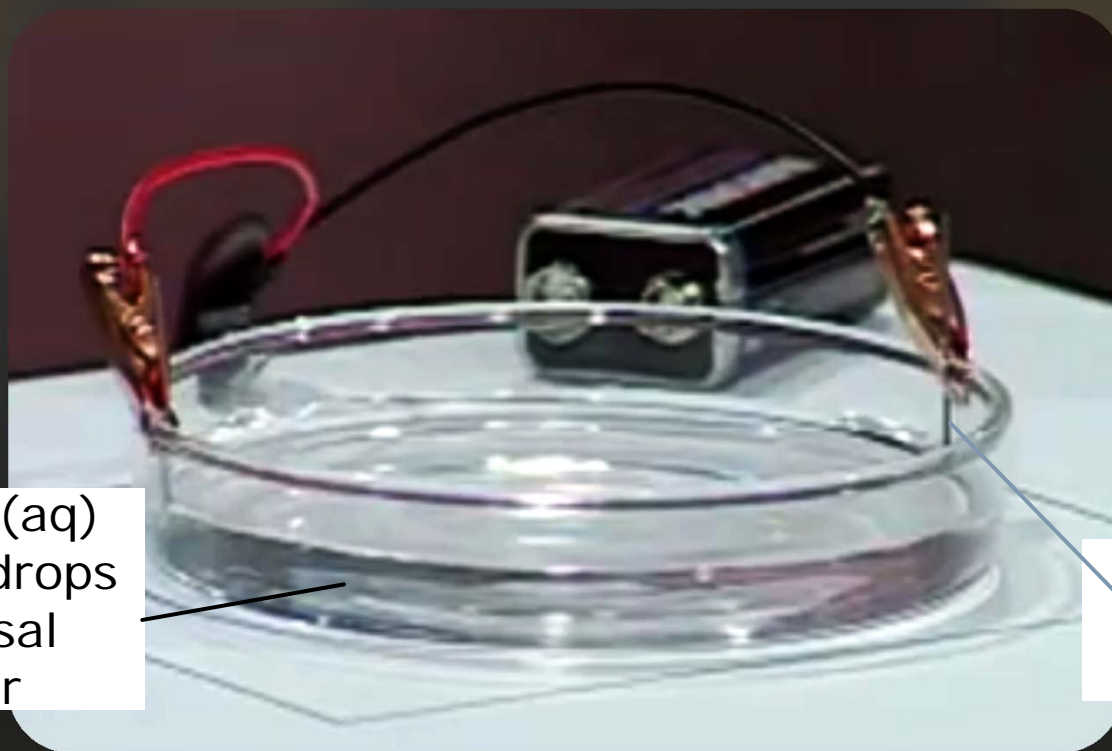
www.score-education.org/downloads/practical_work/report.pdf

D1. Microscale Electrolysis of Brine (with universal indicator)



Knowledge and understanding

D2. Petri Dish Electrolysis (with universal indicator)



1M $\text{Na}_2\text{SO}_4(\text{aq})$
with a few drops
of universal
indicator

Pencil Lead

Knowledge and understanding



Organisation of a quality practical task

1. Pre: _____
2. During (in class): _____
3. Right before the end (in class):

4. After: _____



Learning Outcomes

- What do I expect my students to learn by completing a practical task? (Millar, 2002)
- Nuffield Foundation Practical Work for Learning
(Youtube Video)



Providing students with practical learning tasks in their 3-year courses

Brainson and hands-on

Enquiry-based

Self-directed

Timely

Purposeful

Relevant to student ...

Addaptable to suit ...

Connected to the world ...

Technically authentic and contemporary ...

IT for data collection ...

Coherently planned and managed ...

Engaging all students in the 'messiness' of real-world data ...

Reference #1

- Chemistry Experimental Techniques Video Clips (EDB, CUHK):

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

<http://minisite.proj.hkedcity.net/chemtech/cht/index.html> 中文版

- Edblog for NSS Chemistry

<http://edblog.hkedcity.net/nsschem>

Reference #2

- SCORE:

- www.score-education.org/downloads/practical_work/report.pdf

- www.scoreeducation.org/downloads/practical_work/framework.pdf

- Practical Chemistry: www.practicalchemistry.org

- Nuffield Re:Act: www.chemistry-react.org

- RSC Classic Chemistry Demonstrations:
www.rsc.org/education/teachers/learnnet/classic.htm

- RSC Classic Chemistry Experiments:
www.rsc.org/education/teachers/learnnet/classic_exp.htm

- RSC Microscale Chemistry:
www.rsc.org/education/teachers/learnnet/microscale.htm

- RSC Video material for teachers of chemistry:
www.rsc.org/education/teachers/learnnet/videoclips.htm

Assessment #1

- (c) An aqueous solution only contains HCl(aq) and HI(aq) . Based on the fact that AgCl(s) , but not AgI(s) , can dissolve in excess $\text{NH}_3\text{(aq)}$, you are required to plan a gravimetric analysis to determine the mole ratio of $\text{Cl}^-\text{(aq)}$ to $\text{I}^-\text{(aq)}$ in the solution.
- (i) Suggest TWO reagents, other than deionised water, that should be used in the analysis. (2 marks)
- (ii) Outline the experimental steps involved in the analysis. (4 marks)
- (iii) Outline the steps in the calculation of the mole ratio of $\text{Cl}^-\text{(aq)}$ to $\text{I}^-\text{(aq)}$ in the solution using the data obtained from (ii) above. (2 marks)

Assessment #2

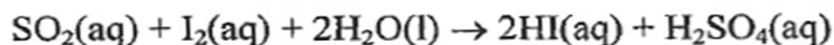
- (b) Both white wine and red wine contain SO_2 preservative which is fixed in different forms. A volumetric analysis experiment was performed to determine the total concentration of SO_2 in a sample of white wine. In the experiment, 25.00 cm^3 of the wine sample was transferred to a conical flask. Following certain stipulated procedures, NaOH(aq) and $\text{H}_2\text{SO}_4\text{(aq)}$ were successively added to the flask to liberate all SO_2 from the wine. The resultant solution was immediately titrated with $0.00412 \text{ mol dm}^{-3} \text{ I}_2\text{(aq)}$ using freshly prepared starch solution as indicator. The experiment was repeated several times, and the mean volume of $\text{I}_2\text{(aq)}$ required to reach the end point was 10.50 cm^3 .

(i) A reaction must fulfill certain conditions in order that it can be used in volumetric analysis. State ONE such condition. (1 mark)

(ii) Explain why the resultant solution needed to be titrated immediately. (1 mark)

(iii) State the expected colour change at the end point of the titration. (1 mark)

(iv) The chemical equation for the reaction involved in the titration is as follows:



Calculate the total concentration of SO_2 , in mg dm^{-3} , in the white wine sample. (4 marks)

(v) Explain whether the total concentration of SO_2 in a sample of red wine can be determined in such an experiment. (1 mark)