Topic: Chemical Reactions

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Issues tackled:

1. **Key ideas, use of language and terminology – Balancing equations.**
2. **Models and analogies – Electrolysis.**
3. **Practical work (including health and safety) – An experiment to find the formula of magnesium oxide.**
4. **Investigative skills – An investigation into the purification of copper by electrolysis.**

Issue 1: Key ideas, use of language and terminology – Balancing equations.

Prior knowledge and experience:

Possible tasks:

Preparation for tutorial:

1. Learn how to balance equations (if necessary).
2. Research ways of teaching how to balance equations.
3. Plan a part of a lesson on balancing equations to be delivered at the tutorial. Start with $H_2O_2 \rightarrow H_2O + O_2$ and similar equations.

Possible activities during tutorial:

1. and 2. Plan a lesson on balancing equations.
3. Deliver the lesson section as planned and discuss the strengths and areas to develop.

AST Input:

- Discuss various models which help with balancing equations.
- Discuss how misconceptions can be dealt with and also how to differentiate.

Reading:

Subject knowledge and understanding

Milner, B., (2001), **Science Foundations: Physics**, Cambridge University Press, Cambridge. Pages 136-7.

Ryan, L. (2002), **Chemistry for You**, Nelson Thornes, Cheltenham. Pages 24-5.

Subject pedagogy

Ryan, L., (2002), **Chemistry for You: Support pack for teachers**, Nelson Thornes, Cheltenham. Page 88.

Useful websites and applications

Multimedia Science School: **Equation Balancer**, New Media (2002). Find information form their website at www.new-media.co.uk

There are some useful questions, quizzes and notes to be found at www.wpbschoolhouse.btinternet.co.uk follow links to **KS4, elements** and **balancing equations**.

The following site has an excellent game which lets you balance equations in an interactive on-line quiz:
http://www.dun.org/sulan/chembalancer - try equation balancer.

Resources:

Issue 2: Models and analogies – Electrolysis

Prior knowledge and experience:

Possible tasks:

Preparation for tutorial:

1. Do some background reading on electrolysis and ion formation, make a list of any areas which need clarification.
2. Find out about the processes of aluminium extraction and the purification of copper by electrolysis.

Possible activities during tutorial:

1. Discuss the "current model of electrolysis" and ask questions as appropriate.
2. Present some information about aluminium extraction and copper purification.

AST Input:

- Discuss problems with the recommended models of electrolysis – include equations and modelling ions in solution.
- Start work on a model of electrolysis based on the extraction of aluminium from its oxide by electrolysis. Use Chemistry for You support pack page 107 (see Resources) as a start.
- Work through a model of electrolysis based upon the purification of copper.

Reading:

Subject knowledge and understanding

Milner, B., (2001), **Science Foundations: Physics**, Cambridge University Press, Cambridge. Pages 36-39 & 48-51.

Subject pedagogy

Ryan.L., (2002), **Chemistry for You – Support pack for teachers**, Nelson Thornes, Cheltenham. Page 107 and 139-140.

Useful websites and applications

Multimedia Science School: Electrochemistry, New Media (2002), for information see www.new-media.co.uk,

Information on the extraction of aluminium *via* electrolysis can be found at http://cwx.prenhall.com/bookbind/pubbooks/blb/chapter23/medialib/blb2304.html

Resources:

Tutorial

Ryan.L., (2002), **Chemistry for You – Support pack for teachers**, Nelson Thornes, Cheltenham. Page 107.

Issue 3: Practical work (including health and safety) – An experiment to find the formula of magnesium oxide.

Prior knowledge and experience:

Possible tasks:

Preparation for tutorial:

1. Perform a magnesium + oxygen → magnesium oxide experiment in a crucible. Record data in readiness to calculate the formula of magnesium oxide within the tutorial.
2. Attempt some relative atomic mass and mole calculations to build confidence and identify any difficulties.

Possible activities during tutorial:

1. Produce a risk assessment within the tutorial for the experiment done by the trainee as both a class practical and a demo. Show (using the data obtained in the preparation practical) how the calculation would be delivered to a class of high-ability pupils.
2. Demonstrate a magnesium + oxygen experiment and use the data collected to work out the formula of magnesium oxide. Discuss any difficulties with the calculations.

AST Input:

- Discuss the experiment done e.g. safety, what could go wrong?
- Discuss suitable equipment for the experiment – how essential is it to use a balance that reports results to 2 (or more) decimal places? How much magnesium should be used?
- Check the calculations performed by the trainee.
- Consider how this kind of chemical process could be delivered to a class of lower ability pupils? What kind of background knowledge is needed to perform the calculation and how could this be dealt with?

Reading:

Subject knowledge and understanding

GCSE or A-Level Textbook. For example;
Ryan, L., (2002), **Chemistry for You**, Nelson Thornes, Cheltenham, pages 358-359.

Burton, G., Holman, J., Pilling, G., and Waddington, D., (1994), **Salters Advanced Chemistry Chemical Ideas**, Heinemann, Oxford, Section 1.1.

Subject pedagogy

Ryan, L., (2002), **Chemistry for You – Support pack for teachers,** , Nelson Thornes, Cheltenham. Page 359 – Experiment 28.1 is the magnesium + oxygen experiment suggested as task 1.

Useful websites and applications

Resources:

Task 1 or **tutorial** if task 2 has been done as preparation.
Equipment for a magnesium + oxygen experiment;
Mg ribbon, accurate balance, crucible with lid, tongs.

Task 2
Practise calculations about moles and RAM.

Issue 4: Investigative skills – An investigation into the purification of copper by electrolysis.

Prior knowledge and experience:

Possible tasks:

Preparation for tutorial:

1. Trial an experiment to purify copper by electrolysis. Do a brief assessment as to how the voltage will affect the rate of copper deposition. N.B. Discuss the risk analysis with a technician or mentor before starting the experiment.
2. Plan an introduction to an investigation into the optimum conditions to purify copper by electrolysis. Consider how to grab the pupils' attention and what variables you want them to consider.

Possible activities during tutorial:

1. Discuss problems with the trial of the experiment. Plan an investigation based on the practical trialled.
2. Deliver the introduction. Carry out the experiment and do a risk assessment. Discuss the effectiveness of the introduction.

AST Input:

- Guide the trainee through the assessment criteria for a piece of science coursework, paying particular attention here to the planning stage.
- Discuss the hazards and the risk assessment associated with doing this practical.

Reading:

Subject knowledge and understanding

Martin, J and Milner, B., (2001), **Science Foundations – Chemistry**, Cambridge University Press, Cambridge, pages 36-39 & 48-51.

Ryan, L., (2002) **Chemistry for You**, Nelson Thornes, Cheltenham.

Subject pedagogy

Ryan, L., (2002), **Chemistry for You – Support pack for teachers**, Nelson Thornes, Cheltenham, page 112.

DfES Key Stage 3 Strategy: http://www.standards.dfes.gov.uk/keystage3/
Click on 'resources and publications', scroll down to 'Science', click on 'scientific enquiry', open 'posters (A3) pdf.

Useful websites and applications

Information on the industrial purification of copper can be found at
http://cwx.prenhall.com/bookbind/pubbooks/blb/chapter23/medialib/blb2304.html

Resources:

Task 1 and **tutorial**

Hazcards for copper sulphate and propanone (if used to rinse the copper electrodes).
Practical equipment for an experiment to purify copper by electrolysis.

Tutorial

Appropriate exam board specification for coursework assessment.
Example of appropriate coursework if available, (any coursework would be useful).