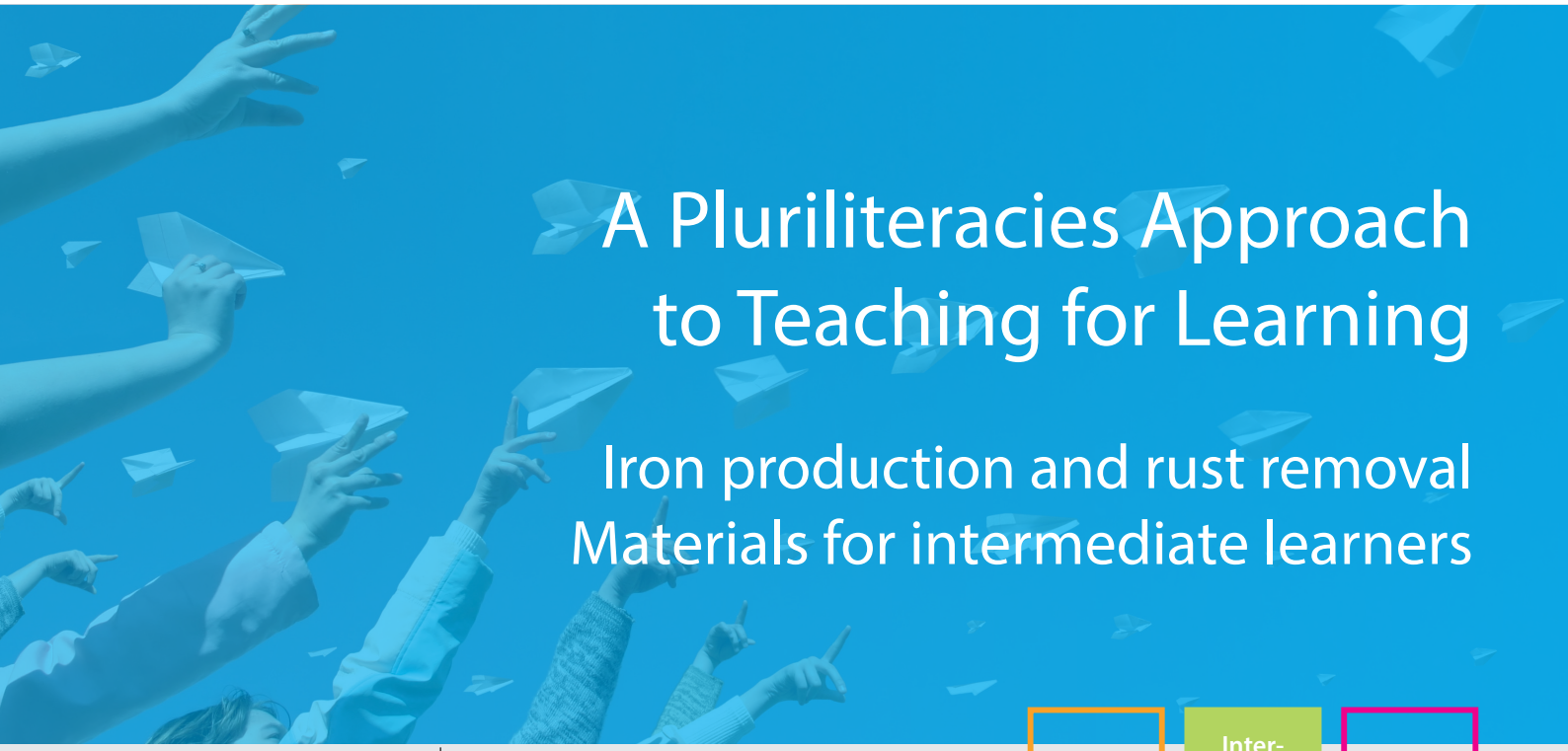
Pluriliteracies making meaning happen



A Pluriliteracies Approach to Teaching for Learning

Iron production and rust removal
Materials for intermediate learners

Inter-mediate learners

Teresa Kaub

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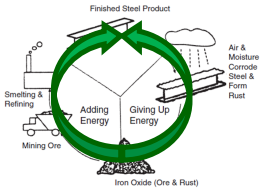


Create your own rust remover!

In groups of four, carry out the experiment described below. You have 20 minutes for the practical work and 30 minutes for the analysis (wait at least one day).

Make sure to assign the following tasks within your group (presenter, writer/recorder, time watcher, emissary, language guard)

material 6 test tubes, test tube rack, funnel, spatula, Bunsen burner, lighter, test tube clamp

chemicals 6 rusty iron nails, tab water, Coca Cola, Sinalco, Sprite, soda water, citric acid solution (20%),

procedure Place the six rusty nails in one test tube each. Dissolve the citric acid crystals in distilled water to produce a 20% solution. Fill the tubes with one of the possible "rust-removers" each so that two thirds of the nail is covered with liquid.

hypothesis What do you expect to happen and why?

If . . . then . . . because . . .

_____

_____

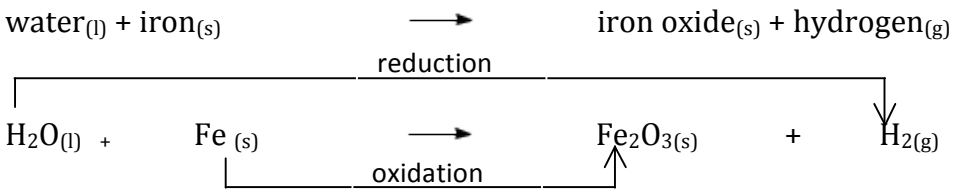
Observation

1. Write down your observations in the chart below.
   Have a close look at colour, aggregate states, consistency, precipitate, weight and any possible noises.

	before the reaction		**after the reaction**	
	liquid	nail	liquid	nail
tab water				
Coca Cola				
Sinalco				
Sprite				
citric acid solution				
soda water				

Explanation

2. Form all chemical equations similar to the example below. *Help cards provided.*



Tab water + iron oxide → _____ + _____

_____ ( ) + _____ ( ) → _____ ( ) + _____ ( )

Coca Cola + iron oxide → _____ + _____

_____ ( ) + _____ ( ) → _____ ( ) + _____ ( )

Sinalco + iron oxide → _____ + _____

_____ ( ) + _____ ( ) → _____ ( ) + _____ ( )

Sprite + iron oxide → _____ + _____

_____ ( ) + _____ ( ) → _____ ( ) + _____ ( )

citric acid solution (20%)+ iron oxide → _____ + _____

_____ ( ) + _____ ( ) → _____ ( ) + _____ ( )

soda water + iron oxide → _____ + _____

_____ ( ) + _____ ( ) → _____ ( ) + _____ ( )

Discussion

3. Restate the purpose, problem and hypothesis of your experiment in a coherent paragraph. *Use the word bank below.*

T h e	main chief primary principal	aim objective purpose	o f t h e	study investigation experiment	w a s t o	determine examine	t h e	value, mass, amount, effect, change, difference, increase, structure, reaction, mechanism, behavior structure, presence, existence,	of …

It was	our aim our intention	to (re-)examine, find (out about), obtain, elucidate	X
It was	the purpose of this	study, investigation, experiment	to
w e	aimed to identify, sought to justify have concentrated on, carried out a study of, decided to (re-)examine X		

_____

_____

_____

_____

_____

_____

4. Sum up your findings.

Start each sentence at the beginning of a new line and use every third line only.

It was	found shown	that . . .	X	increased decreased	Y
The	experiment investigation study	showed revealed	that . . .		

Example: *It was found that the dry nail was still coloured red after the experiment.*

_____

_____

The experiment showed_____

_____

_____

It was found that _____

_____

_____

_____

_____

_____

5. Now explain your findings in academic language! Therefore restate the above listed observations with nominalizations and give reasons for your observations. What a nominalization is and how it is formed can be found in the grammar box below.

Example:

observation: *The dry nail was still coloured red after the experiment.*

nominalisation: The red **colour** of the dry nail remained unchanged . . .

reason: . . . because/since/as it did not get in contact with any rust remover enabling the **dissolution/reduction** of red iron oxide.

NOMINALIZATIONS are used to make a text sound more academic. They are created by turning verbs and adjectives into nouns, which then function as subject or object of the sentence.
This can be achieved by adding suffixes to a verb as in

–tion: *to suggest → the suggestion*
–ing: *to play → the playing*
–ment: *to achieve → achievement*

or to an adjective as in

–ness: *lonely → loneliness*
–ance: *relevant → relevance*

6. Define the process of rust removal.
   Include cause and effect constructions (if… then… because…), compare examples of good and inefficient chemicals, name the classes these substances belong to, describe which characteristics a rust remover must have.

_____

_____

_____

_____

Write a coherent conclusion. *Remember the following aspects:*

- connection between your results and existing theories/ previous findings
- practical and theoretical implications of your obtained findings
- generalizations and future research questions

From the results	it is concluded that X is due to Y a conclusion is made as to		
The results	suggest imply	that the hypothesis should be	revised abandoned restricted to the cases of X extended to the cases of Y
The results	(do not) seem to confirm the explanation		
Our data	seem to support the hypothesis/ data as proposed in XYZ (…). contradict the hypothesis developed by XYZ (…).		
Thus, Hence, Therefore,	X provides a	reasonable satisfactory convincing	explanation for Y.
The findings make it possible to		conclude explain suggest	that… a new treatment a new model
Thus,	X is clearly not Y X shows that Y is (not) Z.		

These	assumptions conclusions	are also	confirmed supported	by the data reported in/ by …

_____

_____

_____

_____

_____

Homework

Can vinegar be used as rust remover? *Compare it to any of the substance classes/ chemicals used during the experiment? Which features does a rust remover need to have?*

_____

_____

front:

help card 1

back:

relevant ingredients:

tab water	Coca Cola	Sinalco	Sprite	citric acid	soda water
H_2O	H_3PO_4	$CitH_3$	$CitH_3$	$CitH_3$ (a lot)	H_2CO_3

front:

help card 2

back:

What does rust consist of? How is it formed?

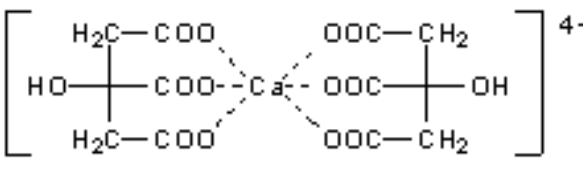
The chemical reaction of rust removal must include the opposite processes!

front:

help card 3

back:

Even though citric acid is a weak acid and not fully dissociated, it quite often builds complexes with base metals.



Materials developed by **Teresa Kaub** (2015) as part of her master thesis. For educational purposes (teacher training) only.

front:

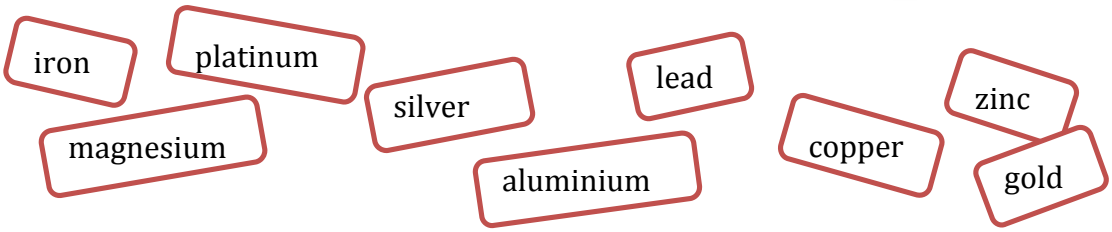
help card 4

back:

These are some of the resulting products:

$Fe(OH)_{3(s)}$ (also rust) $2\ FePO_{4}$**(solid)** $CO_{2(g)}$

Who is the strongest?



To find out who the strongest reducing agent is, you will have to test the elements against each other. Work in groups of four to six students using the jigsaw method. Decide in class which combinations of chemicals you want to try out and divide the experiments evenly. Follow the procedure below and fill out the lab report sheet provided. You have 15 minutes time to complete your experiments and 30 minutes to analyse your findings.

material Bunsen burner, spade, test tubes, test tube rack, utility clamp, ring stand

chemicals red iron oxide, black copper oxide, zinc oxide, magnesium oxide, iron powder, copper powder, zinc powder, magnesium powder

procedure
- fill one spade point tip of metal oxide in a test tube and add one spade point tip of metal to it
- shake the test tube to mix up the chemicals
- attach the test tube to the ring stand with a utility clamp
- heat up the mixture with a Bunsen burner

Homework

Look up the term *thermit* and *blast furnace technology*. Explain the chemical reaction behind the process and decide whether the reaction is faster/more aggressive with iron or with copper. *Enjoy watching the videos afterwards :)*

Thermit reaction with iron: https://www.youtube.com/watch?v=P1Is0jc5j2A

Thermit reaction with copper: https://www.youtube.com/watch?v=Z9R-gcKv7dI

Write a 500 word article for the science fair introducing the technology, chemical reaction and relevance for the industry and public.

Title

1. Assign a suitable title to your experiment.

The reaction of . . . and . . .
The effect of . . . on . . .

_____

Introduction

2. Formulate a coherent introduction including: aim, theoretical background, and a connection to previous research

The aim of the experiment was to test
According to XYZ (2014), . . .
It is know from the lecture that . . .
Further research on . . . is still needed

_____

_____

_____

_____

_____

Problem

3. Write down the problem of your experiment.

What happens if ... and ... react together?

_____

Hypothesis

4. Develop a hypothesis including the independent and dependent variables.

If . . . then . . . because . . .

_____

_____

Material

5. List all tools and chemicals used in your experiment.

Chemicals: _____ Tools: _____

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

6. Draw your experimental set up.

Procedure

7. Write down the procedure. *Keep the rules in mind!*

order steps chronologically
omit standard procedures
use 3rd person singular
write concisely
use the passive voice
omit any observations

_____

_____

_____

_____

_____

Results

8. Write down your observations using the word box below.

Describe your substances before, during and after the reaction including (color, aggregate state, smell, texture, weight, noises, . . .).

It was	found shown	that …	X	increased decreased	Y
The	experiment investigation study	showed revealed	that…		

_____

_____

_____

_____

_____

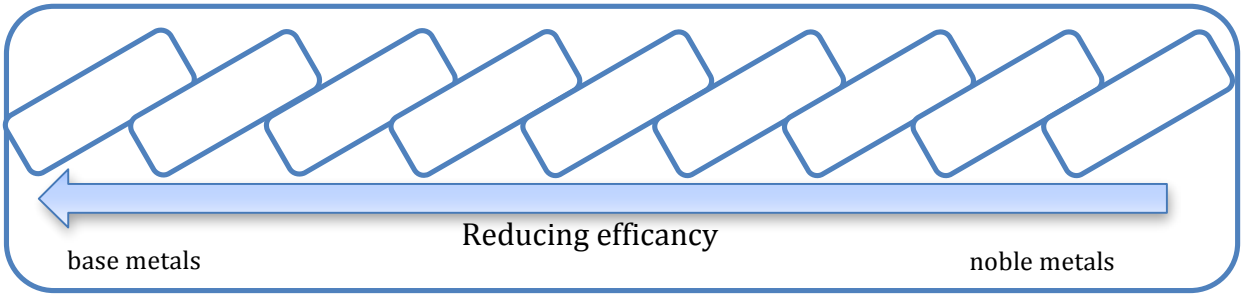
_____

9. Go back into your original group and complete the table with the findings of the other group members.

metal / oxide	iron	magnesium	zinc	copper	aluminium
iron oxide					
magnesium oxide					
zinc oxide					
copper oxide					
aluminium oxide					

Discussion

10. Order the metals on page 23 according to their ability as reduction agent.



11. Name two more noble and base metals. *Make use of the PSE!*

_____

12. Explain the results and say whether or not they were expected.

_____

_____

_____

13. Write down the equations for either one metal with all oxides or one oxide with all metals.

_____ ( ) + _____ ( ) → _____ ( ) + _____ ( )

_____ ( ) + _____ ( ) → _____ ( ) + _____ ( )

_____ ( ) + _____ ( ) → _____ ( ) + _____ ( )

_____ ( ) + _____ ( ) → _____ ( ) + _____ ( )

_____ ( ) + _____ ( ) → _____ ( ) + _____ ( )

_____ ( ) + _____ ( ) → _____ ( ) + _____ ( )

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14. Re-define the terms oxidation, reduction, redox-reaction, reducing agent, oxidizing agent. *Use the given formulations and chemical termini.*

A . . .	is a . . .	that who which	is made up of . . . has the following characteristics . . . is used for . . . is opposed to . . . can be used for . . .
The term . . . comes from two terms, namely . . . which means . . . and . . .which means . . .			

You might have to add words if necessary.

oxide - bound reaction – oxygen - chemical reaction - is itself oxidized – oxidation - donates oxygen - gain of oxygen - loss of oxygen - - is itself reduced – oxidizing agent – metallic ore – accepts electrons – metal - donates electrons – oxidative - reductive

oxidation: _____

_____

reduction: _____

_____

redox-reaction: _____

_____

reducing agent: _____

_____

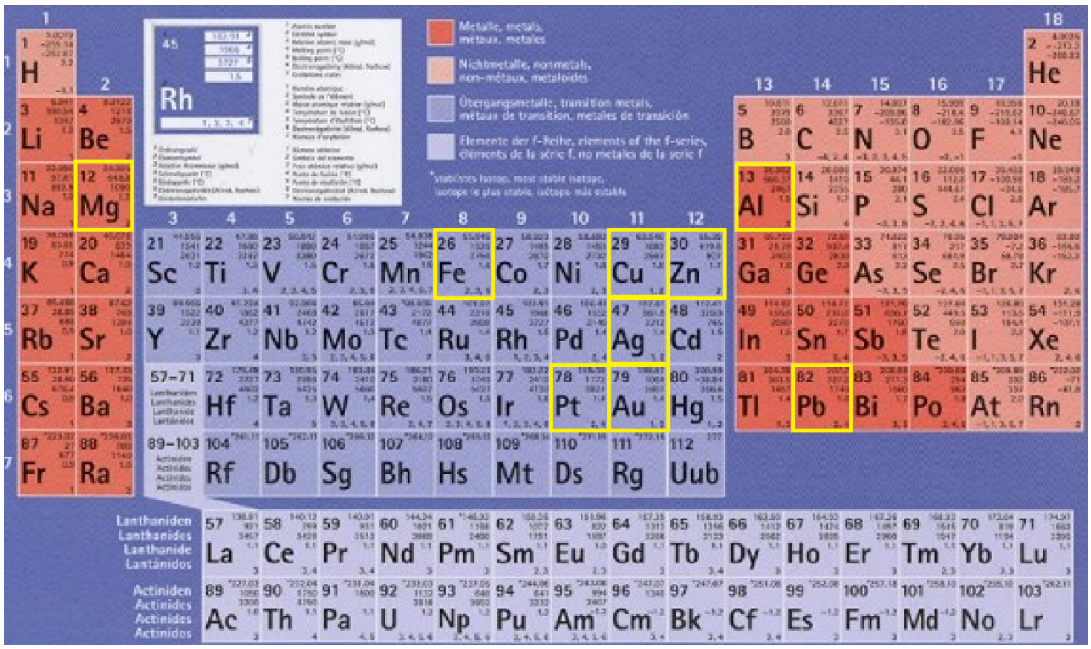
oxidizing agent: _____

_____

front:

help card 1

back:



order the elements in the yellow squares according to their ability as reducing agent

front:

help card 2

back:

Standard electrode potential:

Au^{+}/Au +1,69V Mg^{2+}/Mg -2,362V Pb^{2+}/Pb -0,13V Ag^{+}/Ag +0,80V Cu^{2+}/Cu +0,35V

Pt^{2+}/Pt +1,20V Fe^{2+}/Fe -0,41V Al^{3+}/Al -1,66V Zn^{2+}/Zn -0,76V

front:

help card 3

back:

The standard reduction potential describes the likelihood for a chemical substance to be reduced. The more positive the potential is, the more likely it will be reduced. KEEP IN MIND: ability to get reduced is contrary to the strength as reducing agent!

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