RISK ASSESSMENT **Blackwood High School**

14.1 Reactions of Acids

Written by: Lyron Winderbaum **Commenced on:** 31 Aug 2018 **Expires:** 30 Nov 2019

Classes for which experiment is required

Teacher: Lyron Winderbaum (training code 1) **Year Group:** 11 Chemistry

Room	Period	Date
CheL	1-2	Tue 4/9/18

Items to be prepared by laboratory technician (training code 1)

Use medium sized test tubes for gas generation (produces a louder sound).

Use 2M HCl solution

For 4.1c (reaction of carbonates):

- Use freshly prepared limewater:
1) Add 2.0 g of Calcium hydroxide to 1 L water.
2) Shake then leave to stand overnight.
3) decant into a container and close (reacts with CO2 over time).

- Bubble the CO2 through a test tube of limewater (as shown in ScienceWorld 8, pg 44, part A.

Procedure or reference, including variations

Chemical Connections 1 page 444.

I wasn't going to do the whole experiment from the textbook, one metal, one carbonate, and one metal oxide would be enough. Copper, Copper oxide, and Hydrogen Carbonate for example. Or if you think different metal/ oxide/ carbonates might work better. Along with the corresponding testing equipment (so stoppered test tubes and matches to test for Hydrogen gas, lime solution and maybe some stoppered test tubes with a pipe attachment to transfer the gas to test for carbon dioxide --- nothing needed for the metal oxide as the color change should be visible.

Equipment to be used

box of matches

Potential hazards
Box burns violently if ignited.

Standard handling procedures
Keep dry. Used matches should never be returned to the box. Count boxes out and in.

bunsen burner

Potential hazards
Roaring flame is very hot and can cause severe burns. Rapid passage of hand through fully luminous flame usually does not result in a burn. Roaring bunsen burner may "burn back" at low gas flow, with flame emerging from air holes in base; this makes the base of the burner hot to touch and liable to cause burns. Gas from gas tap or from end of rubber tube burns with large luminous flame, likely to cause burns. Rubber hose is easily melted by flame from burner, e.g. if burner knocked over, resulting in fire from burn hole in tube. Ensure hair is tied back, so does not catch alight.

Standard handling procedures
Inspect and clean the jet and base of bunsen burners regularly. Inspect and replace tube whenever any sign of wear or damage is noticed. Use only hoses of the correct size to ensure a comfortable fit on both bunsen burner and gas tap.

insulating mat

Potential hazards
Mat can be thrown, ninja-style; possibility of eye injury.

Standard handling procedures
Store only after cooling.

rubber stopper

Potential hazards
ALLERGY ALERT. Take care fitting stoppers to glass containers since the container may break if the stopper is too large or too much force is applied. Take extreme care inserting glass tubing into holes in rubber stoppers; ensure hole is correct size for tube and tube is lubricated with glycerine or oil. May cause allergic reaction due to

the presence of latex.

test tube stand

Potential hazards
Wooden test tube rack is flammable and may catch fire if too near bunsen flame. Wooden test tube rack may contain splinters.

test tube, medium (~150 x 15 mm), borosilicate ("pyrex")

Potential hazards
Breakage of test tubes. Cuts from chipped test-tube rims. Small test tubes more likely to eject material during exothermic reactions.

Standard handling procedures
Inspect and discard any damaged test tubes. Sweep up broken glass with brush and dustpan; do not use fingers.

test tube, small (~75 x 8 mm), soda glass

Potential hazards
Breakage of test tubes. Cuts from chipped test-tube rims. Melts at red heat in roaring bunsen flame (sodium fusion test) and shatters when dropped into water; use gauze to protect against flying glass fragments.

Standard handling procedures
Inspect and discard any damaged test tubes. Sweep up broken glass with brush and dustpan; do not use fingers.

wooden splint

Potential hazards
When lit, it acts as an ignition source; may cause burns. Possibility of splinters, especially if damaged.

Standard handling procedures
Extinguish all tapers with water before disposal.

Chemicals to be used

acetic acid, vinegar (~0.7-1.3 M; ~4-8% wt/wt) (ethanoic acid) $CH_3COOH_{(aq)}$
CAS: 64-19-7

Class: nc PG: none Users: K-12* Training: 1-6*

GHS data: Not classified as a hazardous chemical.

Potential hazards
Irritant vapour.

bromothymol blue, solution $CH[C_6HBrCH_3(CH(CH_3)_2)OH]_2[C_6H_4SO_3]_{(aq)}$
CAS: 76-59-5

Class: nc PG: none Users: 7-12 Training: 1-5

GHS data: Not classified as a hazardous chemical.

Potential hazards
Low toxicity.

Standard handling procedures
GHS data are the same for solutions in <24% wt/wt ethanol, <24% wt/wt methylated spirits and <1% methanol.

calcium carbonate (calcite, chalk (rock), lime (limestone), limestone, marble chips) $CaCO_3$
CAS: 471-34-1

Class: nc PG: none Users: K-12* Training: 1-6

GHS data: Not classified as a hazardous chemical.

Potential hazards
Not toxic.

Standard handling procedures
Solubility ~0.6 mg/L at 20°C.

calcium hydroxide, solution (limewater) $Ca(OH)_{2(aq)}$
CAS: 1305-62-0

Class: nc PG: none Users: K-12 Training: 1-6

GHS data: Not classified as a hazardous chemical.

Potential hazards
Low toxicity.

Standard handling procedures
Solubility ~1.7 g/L at 20°C.

copper, powder Cu
CAS: 7440-50-8

Class: nc PG: none Users: 7-12 Training: 1-5

GHS data: Not classified as a hazardous chemical.

Potential hazards
Not toxic. Avoid fine particles in the eyes.

copper(II) oxide **CuO**

Class: 9 PG: III Users: 7-12* Training: 1-5 UN: 3077 CAS: 1317-38-0

GHS data:

WARNING

Very toxic to aquatic life
Harmful to aquatic life with long lasting effects

Potential hazards
Low toxicity.

Standard handling procedures
Do not attempt reduction to copper metal in the "thermite" reaction with aluminium metal, since the process is extremely violent. Great care must be taken if reducing copper oxide with magnesium or hydrogen. Can be safely reduced with carbon or zinc.

hydrochloric acid <3 M (<10% wt/wt) **$HCl_{(aq)}$**

Class: nc PG: none Users: 7-12* Training: 1-5 CAS: 7647-01-0

GHS data: Not classified as a hazardous chemical.

Potential hazards
Higher concentrations irritate eyes, lungs and skin.

Standard handling procedures
Avoid inhalation of vapour.

iron, pieces **Fe**

Class: nc PG: none Users: K-12* Training: 1-6 CAS: 7439-89-6

GHS data: Not classified as a hazardous chemical.

Potential hazards
Not toxic. Usually mild steel. Sharp edges and points may cause injury.

Standard handling procedures
Store in a dry location to prevent rusting of iron surfaces. May be heavy.

magnesium, ribbon **Mg**

Class: 4.1 PG: III Users: 7-12* Training: 1-5 UN: 1869 CAS: 7439-95-4

GHS data:

DANGER

In contact with water releases flammable gases which may ignite spontaneously

Potential hazards
Burns with white-hot flame; UV radiation emitted from flame may cause eye damage; do not allow students to view flame from close distance. Reaction with ethanol may be violent after a long induction period. Reactions of magnesium with dichromate salts, nitrate salts, sulfur, phosphorus or halogenated solvents can be dangerously violent. Reaction of magnesium with silica (sand) to form silicon may be dangerously exothermic if the silica is not completely dry. Do not use magnesium as an alternative to aluminium in the thermite reaction; the reaction is dangerously explosive. Magnesium ribbon can, however, be used as a fuse for the thermite reaction.

Standard handling procedures
Keep containers tightly sealed to prevent corrosion.

magnesium oxide **MgO**

Class: nc PG: none Users: K-12 Training: 1-6 CAS: 1309-48-4

GHS data: Not classified as a hazardous chemical.

Potential hazards
Low toxicity. Fine particles may irritate lungs.

sodium carbonate, anhydrous (soda ash) **Na_2CO_3**

CAS: 497-19-8

Class: nc PG: none Users: 7-12 Training: 1-6

GHS data:

WARNING Causes serious eye irritation

Potential hazards
Eye and skin irritant, since alkaline. Low toxicity.

sodium hydroxide 0.12-0.51 M (0.5-2% wt/wt) **$NaOH_{(aq)}$**

CAS: 1310-73-2

Class: nc PG: none Users: 7-12 Training: 1-6

GHS data:

WARNING Causes skin irritation
Causes serious eye irritation

Potential hazards
Strongly irritates eyes and skin.

sulfuric acid <0.53 M (<5% wt/wt) **$H_2SO_{4(aq)}$**

CAS: 7664-93-9

Class: nc PG: none Users: 7-12* Training: 1-6

GHS data: Not classified as a hazardous chemical.

Potential hazards
Eye irritant.

zinc, granules **Zn**

CAS: 7440-66-6

Class: nc PG: none Users: K-12* Training: 1-6*

GHS data:

WARNING Very toxic to aquatic life with long lasting effects

Potential hazards
Granular zinc contains sharp pieces which may cause cuts. Not toxic.

Chemicals to be produced

calcium chloride <0.54 M (<6% wt/wt) **$CaCl_{2(aq)}$**

CAS: 10043-52-4

Class: nc PG: none Users: K-12 Training: 1-6

GHS data: Not classified as a hazardous chemical.

Potential hazards
Low toxicity.

carbon dioxide, gas generated during experiment **CO_2**

CAS: 124-38-9

Class: 2.2 PG: none Users: K-12 Training: 1-6

GHS data: Not classified as a hazardous chemical.

Potential hazards
Harmless, in quantities generated during experiments. Toxic at high concentrations in air due to absorption through lungs into blood, lowering the pH.

Standard handling procedures
DO NOT GENERATE CARBON DIOXIDE IN A CLOSED CONTAINER SINCE THE CONTAINER MAY EXPLODE. Magnesium burns in carbon dioxide to form magnesium oxide and carbon.

copper(II) chloride <0.07 M (<1% wt/wt) $CuCl_{2(aq)}$

Class: nc PG: none Users: 7-12 Training: 1-5 UN: 2802 CAS: 10125-13-0

GHS data: Not classified as a hazardous chemical.

Potential hazards
Low toxicity.

hydrogen, gas generated during experiment H_2

Class: 2.1 PG: none Users: 7-12* Training: 1,2,5* CAS: 1333-74-0

GHS data:

DANGER

Extremely flammable gas

Potential hazards
EXTREMELY FLAMMABLE GAS. Forms dangerously explosive mixtures with air. Not toxic, but can act as asphyxiant; hydrogen/air mixture in lungs can explode if ignited. Detonation ("popping") of small volume of hydrogen/air mixture in sturdy test tube by ignition with match or wooden taper is generally safe; breakage of test tube is possible.

Standard handling procedures
DO NOT GENERATE HYDROGEN IN A CLOSED CONTAINER SINCE THE CONTAINER MAY EXPLODE. Generate hydrogen only in small volumes (<1 mL). Detonate hydrogen/air mixtures only in small undamaged test tubes (<8 cm; <5 mL). Use borosilicate ("pyrex") test tubes; do not use thin-walled soda glass test tubes. Protect against flying broken glass from breakage of test tubes.

iron(II) chloride, tetrahydrate (ferrous chloride) $FeCl_2.4H_2O$

Class: 8 PG: III Users: 11-12 Training: 1,2,5 UN: 3260 CAS: 13478-10-9

GHS data:

DANGER

Harmful if swallowed
Causes severe skin burns and eye damage

Potential hazards
CORROSIVE TO SKIN AND EYES. Strongly acidic.

Standard handling procedures
Do not inhale vapours or fine particles. Keep tightly sealed to prevent absorption of moisture and to prevent oxidation to iron(III) chloride.

magnesium chloride, solution $MgCl_{2(aq)}$

Class: nc PG: none Users: 7-12 Training: 1-5 CAS: 7786-30-3

GHS data: Not classified as a hazardous chemical.

Potential hazards
Low toxicity.

sodium chloride, solution (salt) $NaCl_{(aq)}$

Class: nc PG: none Users: K-12 Training: 1-6 CAS: 7647-14-5

GHS data: Not classified as a hazardous chemical.

Potential hazards
Low toxicity.

water <43.5°C (cold-warm) H_2O

Class: nc PG: none Users: K-12 Training: 1-6 CAS: 7732-18-5

GHS data: Not classified as a hazardous chemical.

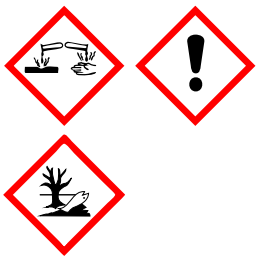
Potential hazards
Cold water causes numbness and hypothermia if exposure is prolonged. Water below 43.5°C is generally considered safe for adults and children.

Standard handling procedures
Water in a laboratory should not be drunk, due to the possibility of chemical contamination. Water spilled on the floor may be a slip hazard.

zinc chloride, anhydrous $ZnCl_2$

Class: 8 PG: III Users: 7-12* Training: 1,2,5 UN: 2331 CAS: 7646-85-7

GHS data:



DANGER

Harmful if swallowed
Causes severe skin burns and eye damage
Very toxic to aquatic life with long lasting effects

Potential hazards
CORROSIVE TO EYES AND SKIN. Toxic.

Knowledge

I have read and understood the potential hazards and standard handling procedures of all the equipment, chemicals and biological items, including living organisms.
I have read and understood the Safety Data Sheets for all hazardous chemicals used in the experiment.
I have copies of the Safety Data Sheets of all the hazardous chemicals available in or near the laboratory.

Risk assessment

I have considered the risks of:

fire or explosion	breakage of equipment	exposure to pathogens	waste disposal
chemicals in eyes	injuries from equipment	injuries from animals	improper labelling/storage
inhalation of gas/dust	rotating equipment	intense light/lasers	inappropriate behaviour
chemicals on skin	electrical shock	UV, IR, nuclear radiation	communication issues
ingestion of chemicals	vibration or noise	pressure inside equipment	allergies
runaway reaction	sharp objects	heavy lifting	special needs
heat or cold	falling or flying objects	slipping, tripping, falling	other risks

Certification by Teacher

I have assessed the risks associated with performing this experiment in the classroom on the basis of likelihood and consequences using the School's risk matrix, according to International Organization for Standardization Standard ISO 31000:2009.

I consider the inherent level of risk (risk level without control measures) to be:

Low risk **Medium risk** High risk Extreme risk

Control measures:

Additional measures: safety glasses, gloves, apron

With the specified control measures in place, I have found that all the risks are "low risk". Risks will therefore be managed by routine procedures in the classroom, in combination with the specified control measures.

Electronic Signature: Dr. Lyron Juan Winderbaum **Date:** 31 Aug 2018

You have provided an electronic signature which is the equivalent of signing your name with a pen and as such will constitute a legally binding agreement between the relevant parties. We can give no warranty in respect to fraud or security breach resulting from the use of an electronic signature.

Certification by Laboratory Technician

I have assessed the risks associated with preparing the equipment, chemicals and and biological items, including living organisms, for this experiment and subsequently cleaning up after the experiment and disposing of wastes, on the basis of likelihood and consequences using the School's risk matrix, according to International Organization for Standardization Standard ISO 31000:2009.

I consider the inherent level of risk (risk level without control measures) to be:

Low risk **Medium risk** High risk Extreme risk

Control measures:

Additional measures: safety glasses, apron

With the specified control measures in place, I have found that all the risks are "low risk". Risks will therefore be managed by routine procedures in the laboratory, in combination with the specified control measures.

Name: ..... **Signature:** ..... **Date:** .....

Monitoring and review

This risk assessment will be monitored using comments below and will be reviewed within 15 months from the date of certification.

Attach further pages as required