Maroochydore State High School

Chemistry

IA2

Student name	
Student number	
Teacher	
Issued	18/03/2024
Due date	10/05/2024

Marking summary

Criterion	Marks allocated	Provisional marks
Research and planning	6	
Analysis of evidence	6	
Interpretation and evaluation	6	
Communication	2	
Overall	**20**	

Conditions

Technique	Student experiment
Unit	Unit 3: Equilibrium, acids and redox reactions
Topic/s	Topic 1: Chemical equilibrium systems Topic 2: Oxidation and reduction
Duration	10 hours class time
Mode / length	Written (e.g. scientific report): 1500–2000 words
Individual / group	Individual response: students may collaborate to develop the methodology and perform the experiment
Resources	School science laboratory and library (online: internet and school intranet, databases, journals)

Context

You have completed the following practicals in class:

- Investigate the electrical conductivity of strong and weak acids and bases (suggested practical).
- Acid-base titration to calculate the concentration of a solution with reference to a standard solution (mandatory practical).
- Perform single displacement reactions in aqueous solutions (mandatory practical).
- Construct a galvanic cell using two metal/metal-ion half cells (mandatory practical).
- Use an electrolytic cell to carry out metal plating (suggested practical).
- Carry out electrolysis of water or copper sulfate (suggested practical).

Task

Modify (i.e. refine, extend or redirect) an experiment in order to address your own related hypothesis or question.

You may use a practical performed in class, a related simulation or another practical related to Unit 3 (as negotiated with your teacher) as the basis for your methodology and research question.

To complete this task, you must:

- Identify an experiment to modify*
- Develop a research question to be investigated*
- Research relevant background scientific information to inform the modification of the research question and methodology
- Conduct a risk assessment and account for risks in the methodology*
- Conduct the experiment*
- Collect sufficient and relevant qualitative and/or quantitative data to address the research question*
- Process and present the data appropriately
- Analyse the evidence to identify trends, patterns or relationships
- Analyse the evidence to identify uncertainty and limitations
- Interpret the evidence to draw conclusion/s to the research question
- Evaluate the reliability and validity of the experimental process
- Suggest possible improvements and extensions to the experiment
- Communicate findings in an appropriate scientific genre, i.e. scientific report.

* The steps indicated with an asterisk above will be completed in groups. All other elements must be completed individually.

Checkpoints

- ☐ Term 1 Before Week 10: Select experiment and identify proposed modifications. Prepare Risk Assess. (Allow at least two working days for preparation of equipment/chemicals to occur).
- ☐ Term 1 Week 10: Perform experiment and process data.
- ☐ Term 2 Week 1: Analyse and evaluate evidence.
- ☐ Term 2 Week 1: Submit draft.
- ☐ Term 2 Week 4: Submit final response.

Authentication strategies

- Your teacher will collect and annotate a draft.
- You must acknowledge all sources.
- Your teacher will observe you completing work in class.
- You will be provided class time for task completion.
- Your teacher will ensure class cross-marking occurs.
- Your teacher will compare the responses of students who have worked together in groups.
- You will use Turn It In to submit your response.
- You must submit a declaration of authenticity.

Acknowledgement of assessment responsibility I understand the consequences of plagiarism/cheating and confirm this is my own work. **Student Signature:**	**Date:**

Scaffolding

The response must be presented using an appropriate scientific genre (i.e. scientific report) and contain:

- a research question
- a rationale for the experiment
- reference to the initial experiment and identification and justification of modifications to the methodology
- raw and processed qualitative and/or quantitative data
- analysis of the evidence
- conclusion/s based on the interpretation of the evidence
- an evaluation of the methodology and suggestions of improvements and extensions to the experiment
- a reference list.

An example of how one of the practicals could be modified to develop a research question

Practical that will be modified: Investigate the effect of temperature on solubility.

Research question: What effect does pH have on the solubility (and mass of precipitate formed) of calcium carbonate in aqueous solutions?

Developing the research question:

Description	Example
Identify the independent variable to be investigated	pH of calcium carbonate solution
Identify the dependent variable	mass of precipitate formed
Identify the methodology to be used	precipitation reactions to form insoluble salt at pH 7
Draft research questions	What effect does pH have on solubility?

Refine and focus the research question	• What substances are being investigated for their solubility? (Salts which are sparingly soluble or insoluble in water at pH 7) • How will solubility be measured? (Mass of precipitate formed)
Present research question to teacher for approval	What effect does pH have on the solubility (and mass of precipitate formed) of calcium carbonate in aqueous solutions?

Note: You cannot use this sample research question for your experiment.

Instrument-specific marking guide (IA2): Student experiment (20%)

Criterion: Research and planning

Assessment objectives

2. apply understanding of chemical equilibrium systems or oxidation and reduction to modify experimental methodologies and process primary data

5. investigate phenomena associated with chemical equilibrium systems or oxidation and reduction through an experiment

The student work has the following characteristics:	Marks
• informed application of understanding of chemical equilibrium systems or oxidation and reduction to modify experimental methodologies demonstrated by – a considered rationale for the experiment – justified modifications to the methodology • effective and efficient investigation of phenomena associated with chemical equilibrium systems or oxidation and reduction demonstrated by – a specific and relevant research question – a methodology that enables the collection of sufficient, relevant data – considered management of risks and ethical or environmental issues.	5–6
• adequate application of understanding of chemical equilibrium systems or oxidation and reduction to modify experimental methodologies demonstrated by – a reasonable rationale for the experiment – feasible modifications to the methodology • effective investigation of phenomena associated with chemical equilibrium systems or oxidation and reduction demonstrated by – a relevant research question – a methodology that enables the collection of relevant data – management of risks and ethical or environmental issues.	3–4
• rudimentary application of understanding of chemical equilibrium systems or oxidation and reduction demonstrated by – a vague or irrelevant rationale for the experiment – inappropriate modifications to the methodology • ineffective investigation of phenomena associated with chemical equilibrium systems or oxidation and reduction demonstrated by – an inappropriate research question – a methodology that causes the collection of insufficient and irrelevant data – inadequate management of risks and ethical or environmental issues.	1–2
• does not satisfy any of the descriptors above.	0

Criterion: Analysis of evidence

Assessment objectives

2. apply understanding of chemical equilibrium systems or oxidation and reduction to modify experimental methodologies and process primary data

3. analyse experimental evidence about chemical equilibrium systems or oxidation and reduction

5. investigate phenomena associated with chemical equilibrium systems or oxidation and reduction through an experiment

The student work has the following characteristics:	Marks
• appropriate application of algorithms, visual and graphical representations of data about chemical equilibrium systems or oxidation and reduction demonstrated by correct and relevant processing of data • systematic and effective analysis of experimental evidence about chemical equilibrium systems or oxidation and reduction demonstrated by – thorough identification of relevant trends, patterns or relationships – thorough and appropriate identification of the uncertainty and limitations of evidence • effective and efficient investigation of phenomena associated with chemical equilibrium systems or oxidation and reduction demonstrated by the collection of sufficient and relevant raw data.	5–6
• adequate application of algorithms, visual and graphical representations of data about chemical equilibrium systems or oxidation and reduction demonstrated by basic processing of data • effective analysis of experimental evidence about chemical equilibrium systems or oxidation and reduction demonstrated by – identification of obvious trends, patterns or relationships – basic identification of uncertainty and limitations of evidence • effective investigation of phenomena associated with chemical equilibrium systems or oxidation and reduction demonstrated by the collection of relevant raw data.	3–4
• rudimentary application of algorithms, visual and graphical representations of data about chemical equilibrium systems or oxidation and reduction demonstrated by incorrect or irrelevant processing of data • ineffective analysis of experimental evidence about chemical equilibrium systems or oxidation and reduction demonstrated by – identification of incorrect or irrelevant trends, patterns or relationships – incorrect or insufficient identification of uncertainty and limitations of evidence • ineffective investigation of phenomena associated with chemical equilibrium systems or oxidation and reduction demonstrated by the collection of insufficient and irrelevant raw data.	1–2
• does not satisfy any of the descriptors above.	0

Criterion: Interpretation and evaluation

Assessment objectives

4. interpret experimental evidence about chemical equilibrium systems or oxidation and reduction

6. evaluate experimental processes and conclusions about chemical equilibrium systems or oxidation and reduction

The student work has the following characteristics:	Marks
• insightful interpretation of experimental evidence about chemical equilibrium systems or oxidation and reduction demonstrated by justified conclusion /s linked to the research question • critical evaluation of experimental processes about chemical equilibrium systems or oxidation and reduction demonstrated by – justified discussion of the reliability and validity of the experimental process – suggested improvements and extensions to the experiment that are logically derived from the analysis of evidence .	5–6
• adequate interpretation of experimental evidence about chemical equilibrium systems or oxidation and reduction demonstrated by reasonable conclusion /s relevant to the research question • basic evaluation of experimental processes about chemical equilibrium systems or oxidation and reduction demonstrated by – reasonable description of the reliability and validity of the experimental process – suggested improvements and extensions to the experiment that are related to the analysis of evidence.	3–4
• invalid interpretation of experimental evidence about chemical equilibrium systems or oxidation and reduction demonstrated by inappropriate or irrelevant conclusion /s • superficial evaluation of experimental processes about chemical equilibrium systems or oxidation and reduction demonstrated by – cursory or simplistic statements about the reliability and validity of the experimental process – ineffective or irrelevant suggestions.	1–2
• does not satisfy any of the descriptors above.	0

Criterion: Communication

Assessment objectives

7. communicate understandings and experimental findings , arguments and conclusions about chemical equilibrium systems or oxidation and reduction.

The student work has the following characteristics:	Marks
• effective communication of understandings and experimental findings , arguments and conclusions about chemical equilibrium systems or oxidation and reduction demonstrated by – fluent and concise use of scientific language and representations – appropriate use of genre conventions – acknowledgment of sources of information through appropriate use of referencing conventions .	2
• adequate communication of understandings and experimental findings , arguments and conclusions about chemical equilibrium systems or oxidation and reduction demonstrated by – competent use of scientific language and representations – use of basic genre conventions – use of basic referencing conventions .	1
• does not satisfy any of the descriptors above.	0