CHEMISTRY (CHM415115)

External Assessment Specifications inform the development of external assessments. The primary audience for this document is the course Setting Examiner and Exam Critics. It may also be of use to teachers and students.

These specifications must be read in conjunction with the current Course Document on the TASC website.

The external assessment for this course consists of a written exam.

WRITTEN EXAM STRUCTURE

The written exam is THREE hours.

Students will have an additional 15-minute preparation time during which students can take notes on the note paper provided and highlight any key words in the exam booklet during the allocated time. Students will not be permitted to start their exam until advised by the Exam Supervisor.

The written exam includes FOUR sections. A set of spare diagrams used in each section is provided in the back of the relevant exam booklet.

The criteria to be externally assessed are:

Criterion 5: identify and apply fundamental principles and theories of electrochemistry

Criterion 6: identify and apply principles and theories of thermochemistry, kinetics and equilibrium

Criterion 7: demonstrate knowledge and understanding of properties and reactions of organic and inorganic matter

Criterion 8: apply logical processes to solve quantitative chemical problems

SPECIFIC MATERIALS AND EQUIPMENT APPROVED FOR USE BY STUDENTS

- A calculator as approved by TASC
- The current year's External Exam Information Sheet *Chemistry*.

OFFICE OF TASMANIAN ASSESSMENT, STANDARDS & CERTIFICATION

ASSESSMENT

All criteria are assessed numerically with marks out of 45.

A set of solutions or a marking tool will be developed by the Setting Examiner, provided to markers at the marking meeting that follows the external written exam; and will be available from TASC in the following year.

The external assessment must include questions that, separately or together, give opportunities to demonstrate the standards from rating C to rating A.

Final results will be awarded as a rating of A, B, C, t or z in the above criteria. These ratings are used in determining the final award according to the algorithm in the course document.

Numerical Mark Allocation

Exam papers are designed so that the number of marks allocated to a section, part or question corresponds to the recommended time allocation for it. This is so that a student knows when answering a 10 mark question that the question has been designed for students to spend approximately 10 minutes reading, thinking and then answering the question. Students may find that they spend less or more time on certain questions throughout the exam.

SECTION A

Structure

- This section will take approximately 45 minutes and be allocated 45 marks.
- This section will include between FIVE and SEVEN questions. All questions are compulsory.
- Some questions will be broken into items.

This section addresses the following course content:

- Fundamental principles and theories of electrochemistry

Assessed Criteria

- Criterion 5 identify and apply fundamental principles and theories of electrochemistry (all Elements).

Nature of Questions

See Appendix A

Nature of Responses

- Responses will be assessed numerically.

SECTION B

Structure

- This section will take approximately 45 minutes and be allocated 45 marks.
- This section will include between FIVE and SEVEN questions. All questions are compulsory.

- Some questions will be broken into items.

This section addresses the following course content:

- Principles of thermochemistry, kinetics and equilibrium

Assessed Criteria

- Criterion 6 identify and apply principles and theories of thermochemistry, kinetics and equilibrium (all Elements).

Nature of Questions

See Appendix A

Nature of Responses

- Responses will be assessed numerically.

SECTION C

Structure

- This section will take approximately 45 minutes and be allocated 45 marks.
- This section will include between FIVE and SEVEN questions. All questions are compulsory.
- Some questions will be broken into items.

This section addresses the following course content:

- Properties and reactions of organic and inorganic matter

Assessed Criteria

- Criterion 7 demonstrate knowledge and understanding of properties and reactions of organic and inorganic matter (all Elements).

Nature of Questions

See Appendix A

Nature of Responses

- Responses will be assessed numerically.

SECTION D

Structure

- This section will take approximately 45 minutes and be allocated 45 marks.
- This section will include between FIVE and SEVEN questions. All questions are compulsory.

- Some questions will be broken into items.

This section addresses the following course content:

- Application of logical processes to solve quantitative chemical problems

Assessed Criteria

- Criterion 8 apply logical processes to solve quantitative chemical problems (all Elements).

Nature of Questions

See Appendix A

Nature of Responses

- Responses will be assessed numerically.

Appendix A

Types of Questions (All SECTIONS)

- Some extended questions should be in non-routine contexts
- Some scenarios of questions are real-world scenarios
- A balance of questions ranging from short to extended response formats
- Responses range from closed to open-ended

Routine context: These questions require rehearsed skills in Chemistry, and in familiar contexts.

TCE Chemistry Exam 2012 – Q23 Combined Gas Equation calculation

Air that has a volume of 500 mL, a pressure of 99.4 kPa and a temperature of 32°C is cooled to –15°C. Calculate the volume of air at this temperature if the pressure is increased to 205.9 kPa. (3 marks)

Non-routine context: These questions require procedures not previously encountered in expected prior learning activities. These require the combination, and sometimes the selection, of a set of skills in unfamiliar contexts.

TCE Chemistry Exam 2011 – Q27 Non-standard (difficult) empirical formula calculation

12.66 g of pure $Pb_3O_{4(s)}$ was heated. 240 mL of oxygen at 27.0°C and 96.0 kPa was produced and another oxide of lead.

(a) Calculate the mass of oxygen gas produced. (2 marks)

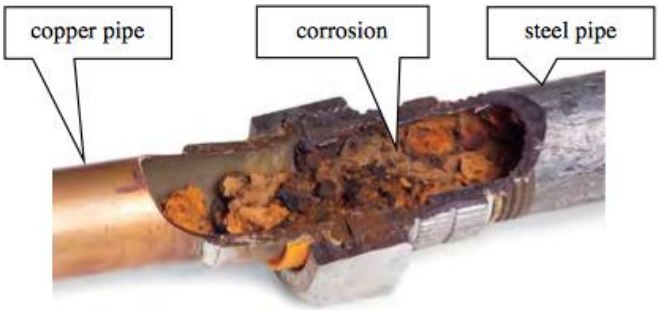
(b) Hence calculate the empirical formula of the lead oxide produced. (4 marks)

Real-world scenarios:

TCE Chemistry Exam 2014 – Q4 Corrosion of water pipes

A hot water system was repaired by connecting a steel pipe to a copper pipe.

After a short time the steel pipe became very corroded where the two pipes connected.



(a) Explain, including half equations, why the steel pipe corroded so quickly where the two pipes connected. (4 marks)

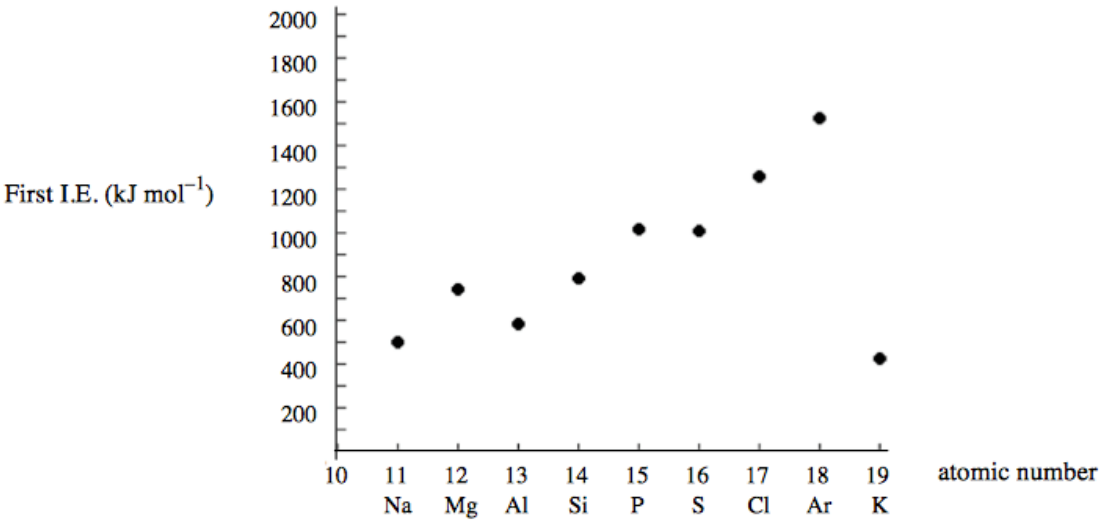
(b) Describe two different ways in which the corrosion of the steel pipe could have been slowed down. There is no need to give any equations. (2 marks)

Short response format: These questions are composed of a brief prompt that demands a response to some stimulus material that varies from a single response to a few written points. This sort of question is suited to assessing the student's ability to:

- recall specific information and methods related to key content
- apply rehearsed methods to familiar situations
- demonstrate understanding of key concepts in previously unseen stimulus material

TCE Chemistry Exam 2013 – Q17 Ionization energy

The graph below shows the first ionisation energy (first I.E.) for elements 11 to 19 of the periodic table.



(a) Account for the general **increasing trend** in first ionisation energies for sodium to argon. (2 marks)

(b) Account for the fact that the first ionisation energy of aluminium is less than that of magnesium. (2 marks)

Extended response format: These questions involve lengthy and/or multi stage responses [of increasing complexity]. Greater complexity may be due to one or more of, but not limited to, the following:

- a greater cognitive demand of Chemistry concepts
- the necessity to select appropriate information
- justification of a response via a logical line of reasoning.

TCE Chemistry Exam 2011

Q4 Electrochemical Cells EMF values

Some electrochemical cells were constructed based on the metals labelled A, B, C, D and E and their corresponding ions. The equations for the overall cell reactions and their measured voltages are given below. (Assume that the ions undergo only the reactions shown.)

Overall cell reaction	Voltage (V)
$A_{(aq)} + B^{2+}_{(aq)} \rightarrow A^{2+}_{(aq)} + B_{(s)}$	0.98
$B_{(s)} + D^{2+}_{(aq)} \rightarrow B^{2+}_{(aq)} + D_{(s)}$	1.05
$2C_{(s)} + B^{2+}_{(aq)} \rightarrow 2C^{+}_{(aq)} + B_{(s)}$	1.68
$B_{(s)} + B^{2+}_{(aq)} \rightarrow B^{2+}_{(aq)} + B_{(s)}$	0.00
$B_{(s)} + E^{2+}_{(aq)} \rightarrow B^{2+}_{(aq)} + E_{(s)}$	0.66

(a) **Arrange the half cell equations in decreasing order of reduction potentials. State the voltage relative to the reference cell used in this experiment. List the metal and the metal ions in solution using the letters A, B, C, D or E.** **(5 marks)**

(b) **Explain why a solution of $D^{2+}_{(aq)}$ ions will not react with a solution of $A^{2+}_{(aq)}$ ions.** **(1 mark)**

Closed-ended response: These are questions for which there is a single 'correct' or 'best' response.

TCE Chemistry Exam 2013 – Q11 Hess' Law

Consider the following thermochemical reactions.

$$Cu_{(s)} + \tfrac{1}{2}O_{2(g)} \longrightarrow CuO_{(s)} \qquad \Delta H = -155 \text{ kJ}$$

$$Cu_{(s)} + S_{(s)} \longrightarrow CuS_{(s)} \qquad \Delta H = -53.1 \text{ kJ}$$

$$S_{(s)} + O_{2(g)} \longrightarrow SO_{2(s)} \qquad \Delta H = -297 \text{ kJ}$$

$$4CuS_{(s)} + 2CuO_{(s)} \longrightarrow 3Cu_2S_{(s)} + SO_{2(g)} \qquad \Delta H = -13.1 \text{ kJ}$$

Use the above data to predict the heat released or absorbed (in kJ) for the reaction below for the production of copper(I) sulfide:

$$CuS_{(s)} + Cu_{(s)} \longrightarrow Cu_2S_{(s)}$$ **(4 marks)**

Open-ended response: These are questions for which there may be multiple correct responses OR in which the quality of the argument and/or the expression is being assessed.

TCE Chemistry Exam 2013 – Q14 Equilibrium – Ammonia synthesis conditions

Nitrogen monoxide is produced industrially when ammonia gas reacts with oxygen gas.

$$4NH_{3(g)} + 5O_{2(g)} \rightleftharpoons 4NO_{(g)} + 6H_2O_{(g)} \qquad \Delta H = -910 \text{ kJ}$$

In order to maximise yields of nitrogen monoxide, the reaction conditions involve:

- relatively low pressure (100 kPa)
- temperatures of approximately 900 °C
- the use of a catalyst

Using your understanding of reaction kinetics and equilibrium chemistry, explain why these conditions are used. (6 marks)