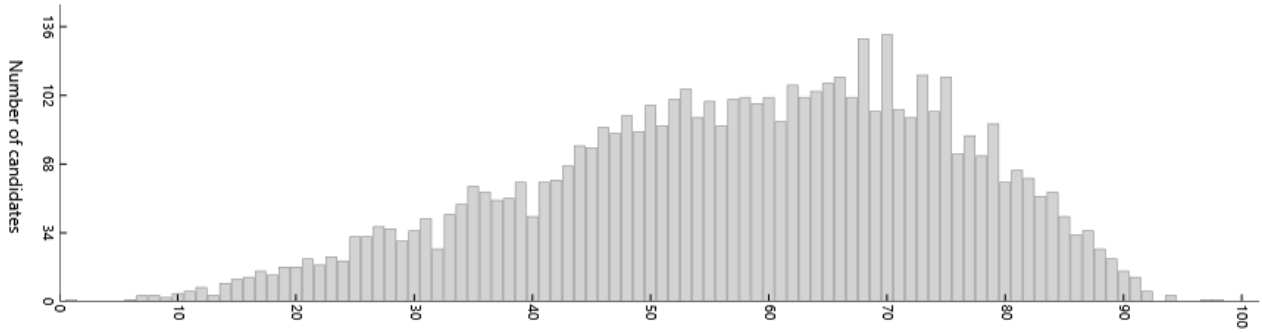
Government of **Western Australia**
School Curriculum and Standards Authority

Summary report of the 2017 ATAR course examination: Chemistry

Year	Number who sat	Number of absentees
2017	5007	54
2016	4997	57

Examination score distribution



Summary

Attempted by 5007 candidates Mean 57.65% Max 97.98% Min 1.00%

Overall, the paper was well received by candidates, teachers and markers with most candidates attempting the majority of questions. It was considered a good paper in length, difficulty, discrimination and accessibility. The paper was well-balanced and reflected a wide range and good spread of the syllabus. The calculations were considered to be straight forward.

The paper included several application questions which were challenging and required higher order thinking or the drawing on linked concepts and principles from different areas of the syllabus to answer. Affirming feedback received, included comments that the paper made the candidates think and apply their knowledge of chemistry rather than regurgitate what was learned resulting in discriminating between the better candidates. The conscious effort made to include more questions assessing 'Science Inquiry Skills' in the paper was applauded. It was a fair paper that produced the desired distribution of scores from an ATAR examination.

The examination mean was 57.65% (slightly lower that 58.73% in 2016) and the standard deviation was 19.22% (compared with 18.47% in 2016). The paper functioned well to discriminate between the ability of candidates as the score distribution given above indicates; scores ranged from 1.00% to 97.98%.

Section means were:

Section One: Multiple-choice	Mean 68.59%		
Attempted by 5007 candidates	Mean 17.15(/25)	Max 25.00	Min 1.00
Section Two: Short answer	Mean 50.32%		
Attempted by 5003 candidates	Mean 17.61(/35)	Max 34.38	Min 0.00
Section Three: Extended answer	Mean 57.34%		
Attempted by 4999 candidates	Mean 22.94(/40)	Max 39.60	Min 0.00

General comments

Most candidates demonstrated familiarity with most of the concepts and principles of the course but were unable to provide comprehensive explanations or to the appropriate specificity; many had difficulty drawing on and linking fundamental chemical principles. Marks are not awarded for re-stating information provided in the questions nor for vague references and full marks are not awarded when failing to demonstrate how an answer was obtained. It was evident within the examination that candidates could often do the calculations well but many did not express themselves clearly and concisely using the appropriate scientific terminology when providing justifications or explaining concepts, or clearly provide a logical progression or strategy to obtaining the answer.

Since the introduction of the new syllabus, there has been a conscious effort to provide a greater opportunity in the examination to discriminate between the performances of candidates by increasing the mark allocation to some questions. While the length of the paper remains the same, the total of raw marks has increased.

Many candidates gave similar incorrect responses to the questions on solubility and in describing the origin of intermolecular forces. Candidates seemed to not understand what was being asked or were not familiar with the language used in the question. It is important that the candidate reads all information in the question carefully. Some questions require answers to be specific, others refer to generalisations and some questions require answers to be more detailed than others.

In this examination a relatively large number of marks were allocated to intermolecular forces and bonding. Candidates did not answer questions on intermolecular forces well. This has historically been an area of weakness and remains so. Candidates often fail to recognise that molecules might exhibit more than one type of intermolecular force and with few exceptions, the cumulative dispersions forces are greater than any other force present.

The syllabus refers to the relationship between structure, properties and chemical reactions. The understanding of these relationships requires an understanding of the intermolecular forces present rather than the rote learning of a list of functional groups and their effect.

Advice for candidates

- The examination questions are based on the syllabus; not from a text book.
- Do not expect the examination to contain similar or standard questions from year to year. While assessing the same syllabus, expect a range of different types of questions, often reflecting authentic chemistry contexts.
- Not every aspect of the syllabus can be assessed within one examination.
- An examination is not the place for using abbreviations or acronyms.
- You should know commonly used reactions – acid/base indicators and colour changes.
- Answer using the terms requested in the question e.g. if asked for a name, give the name, if asked for a symbol/formula, give the symbol/formula.
- The examinable content of the syllabus includes: Science Inquiry Skills, Science as a Human Endeavour and Science Understanding. These must be read within the context of the Aims, General Capabilities, Cross-Curriculum Priorities and the Learning Outcomes.
- Be conversant with the terms used in the syllabus, e.g. chemical test, data, evidence, genre, hydrolysis, hypothesis, ionisation energy, law, measurement error, origin of intermolecular interactions, partial pressures, polarities, polymerisation, pyramidal, risk assessments, research ethics, significant figures, systematic error, theory, trend, uncertainty etc.
- Understand the differences between similar terms: e.g.
    - intermolecular force and intramolecular force
    - equivalence point and end point.

- Practise writing clear, concise and coherent explanations and justifications; incorporating illustrative, labelled diagrams that are clear and relevant. You have limited space and time in which to answer.
- Make it a habit to use the appropriate units and express numerical answers to the appropriate significant figures.
- Be familiar with the content of, and how to use, the Chemistry Data Booklet; knowing where to find the information it contains quickly.
- Know how to generate, read and apply data from graphs and tables.
- Use the given formula to determine the nature and bonding of a substance and all its intermolecular forces.
- Be familiar with, and how to clearly express, the expected observations and inferences that can be made for the reactions indicated in the syllabus. For example: all solutions are clear; some are colourless and some exhibit a colour. Referring to clear solution is redundant and is not the same as referring to a colourless solution. Copper sulfate solution is blue, while sodium sulfate solution is colourless; both are clear because they are solutions.
- Practise writing equations providing the appropriate formula and state symbols for only those species that are taking part in the reaction unless otherwise directed.
- Answer questions with specific reference to what the question demands rather than in general terms or by implication. You are not necessarily awarded any marks for correct chemistry unless it pertains specifically to the question asked.
- Read and select the relevant information provided carefully in order to answer the specific question asked.
- Be prepared for the examination with all the authorised writing materials you might need, choosing (coloured) pens and pencils which are easy to use and to read; have spares.

Advice for teachers

- Ensure coverage of all syllabus dot points as set out in the syllabus document. The entire syllabus is not necessarily examined in any one examination but could be expected to be assessed in its entirety over the course of a few years. Some syllabus points are examined regularly as they are essential for the understanding and communication of chemical concepts and processes.
- The examinable content of the syllabus include the knowledge, understandings and skills found in the Unit Content. This includes:
    - Science Inquiry Skills
    - Science as a Human Endeavour
    - Science Understanding.

  These must be read within the context of the Aims, General Capabilities, Cross-Curriculum Priorities and the Learning Outcomes.
- An understanding of the Year 11 content is assumed knowledge for students in Year 12. It is recommended that students studying Unit 3 and Unit 4 have completed Unit 1 and Unit 2. Likewise Unit 4 builds on the content covered in Unit 3.
- Prepare candidates to expect the examination to contain a range of different types of questions often reflecting authentic chemistry contexts.
- Teach efficient and critical reading of information to extract and understand the relevant information.
- Note that Le Châtelier's Principle is a predicting tool not an explanation. Distinguish between the use of:
    - collision theory to explain the changes in rates of reaction
    - the change in rates of the forward and reverse reactions to determine and explain the effect on equilibrium position
    - Le Châtelier's Principle to predict the impact of changing conditions to a system on its chemical equilibrium.

- Engage students in conducting relevant experiments and problem solving. Candidates often struggle to apply knowledge of common laboratory procedures.
- Insist that students use the appropriate units and express numerical answers to the appropriate significant figures unless otherwise directed.
- Provide students with practise in writing extended answers, justifications and explanations; incorporating illustrative diagrams that are clear, labelled and relevant.
- Encourage students to set out their working and reasoning clearly; full marks are not awarded unless it is clear how the answer was obtained and the relevant chemical ideas (such as relevant mole ratios) are shown.
- Teach students to think critically and apply their knowledge of chemistry rather than just rote learning.
- Teach students to recognise that molecules might exhibit more than one type of intermolecular force and the attraction between molecules is the result of the cumulative effect of all intermolecular forces. While between an atom pair, a hydrogen bond is stronger than a dipole-dipole bond which is stronger than a dispersion force, with few exceptions, the cumulative dispersion forces is usually the predominant intermolecular force present.

Comments on specific sections and questions

Section One: Multiple-choice (25 Marks)

Attempted by 5007 candidates Mean 17.15(/25) Max 25.00 Min 1.00

The easiest questions, with means of 0.88 or above were questions 1, 2 14 and 17. Another seven questions had means between 0.78 and 0.84; these included questions 4, 5, 6, 11 and 16. Most of the more capable candidates did well with these questions. The most challenging questions, with means less than 0.50, were questions 3, 7, 8, 9, 13 and 18.

Section Two: Short answer (85 Marks)

Attempted by 5003 candidates Mean 17.61(/35) Max 34.38 Min 0.00

The mean for Section Two (50.32%) was significantly lower than Section Three (57.34%) and that of 2016 (56.46%). Traditionally, it has been Section Three which provided the greater challenge and discrimination between candidates because the questions in this section are context-based, more complex and demanding in what candidates are required to do. There were a few questions in Section Two in which many more candidates than expected performed poorly.

Section Three: Extended answer (100 Marks)

Attempted by 4999 candidates Mean 22.94(/40) Max 39.60 Min 0.00

Candidates performed better in Section Three this year (57.34%) than those in 2016 (55.98%). Although most candidates did complete the paper, there was a higher proportion of candidates who appeared to run out of time compared to previous years; there were a significant number of questions in Section Three that were incomplete.