2002 HSC Notes from the Marking Centre Chemistry

Published by Board of Studies NSW
GPO Box 5300
Sydney 2002
Australia

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Internet: http://www.boardofstudies.nsw.edu.au

ISBN 174099 724 7

2003223

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2002 HSC NOTES FROM THE MARKING CENTRE CHEMISTRY

Introduction

This document has been produced for the teachers and candidates of the Stage 6 course in Chemistry. It provides comments with regard to responses to the 2002 Higher School Certificate Examination, indicating the quality of candidate responses and highlighting the relative strengths and weaknesses of the candidature in each section and each question.

It is essential for this document to be read in conjunction with the relevant syllabus, the 2002 Higher School Certificate Examination, the Marking Guidelines and other support documents which have been developed by the Board of Studies to assist in the teaching and learning of Chemistry.

General Comments

In 2002, 8867 candidates attempted the chemistry examination.

This year candidates seemed to have a greater awareness of the importance of the key verbs in the examination. There was a slight improvement in the ability of candidates to successfully respond to the higher level verbs in extended response questions.

There was a significant improvement in the setting out of calculations so that responses could be more easily understood.

Candidates need to be more aware of the full requirements of questions.

The variation in the quality of responses seems to suggest that candidates who have actively planned and performed a first-hand investigation are more likely to have retained knowledge and understanding of the experience than those who have rote learnt an expected answer.

Teachers and candidates should be aware that examiners may write questions that address the syllabus outcomes in a manner that requires candidates to respond by integrating their knowledge, understanding and skills developed through studying the course. This reflects the fact that the knowledge, understanding and skills developed through the study of discrete sections should accumulate to a more comprehensive understanding than may be described in each section separately.

Section I – Core

Part A – Multiple choice

Question	Correct Response
1	A
2	B
3	C
4	A
5	D
6	C
7	B
8	A

Question	Correct Response
9	D
10	D
11	B
12	D
13	C
14	C
15	A

Part B

General Comments

Overall, the candidates' responses indicated that the majority had a grasp of chemical concepts, appropriate for HSC candidates. Candidates need to be aware that the answer space allocated is a guide to the length of the required response. A succinct answer, within the allocated number of lines, is all that is needed to gain full marks for a question.

Specific Comments

Question 16

Most candidates' answers indicated that they had carried out a first-hand investigation.

However, a significant number of candidates responded with reagents such as ethene, ethane and chlorine which indicated that the candidate had not carried out a first-hand investigation. The omission of equipment used or amounts of chemicals used also indicated lack of first-hand experience. The procedure was not done well by candidates who only had knowledge of the expected results.

Question 17

Explanations of the similar physical properties of alkanes and corresponding alkenes were poorly answered while the difference in chemical properties was mostly answered correctly.

Question 18

(a) More than 90% of candidates correctly named the type of polymerisation.

(b) Many candidates appear to have memorised an answer about biopolymers without necessarily understanding the chemistry involved. Where a question asks for plural responses, as indicated by developments and biopolymers, candidates must supply more than one example in their answer. A question asking about current developments calls for a response describing recent developments.

Question 19

Most candidates indicated a reasonable understanding of nuclear chemistry. A significant number of candidates wrote excessively long answers. Such long answers are likely to have missed the point of the question or provide responses that contain contradictions.

(a) In this part most candidates wrote too much, going well beyond the allocated space. Many candidates erroneously included electrons in their answer to a question on nuclear stability.

(b) The majority of candidates interpreted the graph well.

Question 20

(a) Candidates who responded by naming a chemical that was a base usually obtained a mark. Naming a commercial product mixture was not a satisfactory response.

(b) The assessment of the validity of a conclusion was not well done. Some candidates confused reliability and validity. Others discussed the validity of the experimental design rather than validity of the conclusion. The eight lines of space provided were adequate to achieve full marks.

Some candidates did not appreciate the concept of pH range, wanting to average the range figures.

Question 21

It was encouraging to see underlining of key words and other evidence of planning by candidates before responding to this question. Most candidates demonstrated knowledge of the impacts of industrial sources and of sulphur dioxide and nitrogen oxides on the environment. Equations given were generally appropriate and accurate. Few candidates demonstrated in their answer the ability to make a value judgement as is required when asked to ‘evaluate’.

Question 22

(a) Most candidates correctly calculated the pH of the hydrochloric solution.

(b) Many candidates used general terms like more or less acidic in their answer rather than comparing the pH values.

(c) Generally well answered but some candidates confused higher pH with higher hydrogen ion concentration.

Question 23

(a) The majority of candidates answered this question correctly.

(b) The calculation was generally well done, many candidates achieving full marks.

Question 24

Candidates generally had difficulty interpreting this question. It was encouraging to see the key words underlined as part of the candidate's preparation for response. However, many responses did not show evidence of specific knowledge of trace elements and their effects. A good understanding of AAS was demonstrated, but many failed to assess its impact in terms of improvement over other techniques.

Question 25

(a) Many candidates had difficulty naming the compounds.

(b) Few candidates could correctly draw the required diagram and identify the two types of bonding present.

(c) Candidates who wrote about chlorine ions, chloride ions or chlorine molecules could not achieve the three marks. It is the chlorine atom or chlorine free radical released by ultraviolet radiation from a CFC molecule that reacts with ozone.

Question 26

(a) This was poorly answered in terms of the skills associated with outcomes H13 and H14, describing tests and detailing anticipated results. Many candidates named a test instead of describing it.

(b) The calculation was quite well done.

Question 27

Candidates responded well to this question with hardly any non-attempts and with most candidates able to describe physical and chemical processes.

Section II – Options

Specific Comments

Question 28 – Industrial Chemistry

(a) (i) Very few candidates provided the required detail, most simply writing 'soap making' – insufficient to gain a mark in an option where they had studied the process in detail.

(ii) This question required the candidates to describe the process using details of the structure of soap particles and the attraction of different parts of that structure for polar water and non-polar substances.

(b) Many candidates did not realise that they had to process the information provided to determine the concentrations at equilibrium.

(c) (i) A significant number of candidates were unable to write a balanced equation.

(ii) Candidates made better use of equations in this part but many descriptions included incorrect or contradictory statements.

(d) (i) A surprising number of candidates claimed to have carried out the Haber process as a first-hand investigation, evidence of a rote learned procedure, rather than having carried out a first-hand investigation.

(ii) In this part candidates were expected to be able to apply core conceptual understanding of Le Chatelier's principle to analyse an equilibrium that had been performed as a first-hand investigation in the option. Responses were spread fairly uniformly over the full range of available marks.

(e) This question illustrates the point made in the last paragraph in the General Comments on page 5. The syllabus requires candidates to analyse the technical and environmental difficulties associated with the three main processes used to extract sodium hydroxide. The candidates needed to make a value judgement to answer this question completely.

Question 29 – Shipwrecks and Salvage

(a) (i) A sizeable minority of candidates gave an example of an electrochemical cell rather than naming the type as required.

(ii) Most candidates identified the appropriate half-equations and performed the correct calculation without recognising that a slightly higher voltage than that calculated was needed.

(b) Some candidates responded with the historical context of proton-transfer reactions which is not part of this option. Most correctly responded with descriptions related to electron transfer reactions, but there was a lack of understanding of the work of Galvani and Volta.

(c) (i) Most candidates could name a suitable chemical or physical method.

(ii) Candidates often showed confusion between the methods required for cleaning, stabilising and preserving. Chemical procedures were also often confused with physical/mechanical cleaning of artefacts. Candidates should recognise the need to provide a response that shows a causal link to address the 'how and/or why' nature of an 'explain' question.

(d) (i) Generally well done but most candidates did not suggest a method to measure the amount of corrosion. Some candidates thought that salt water was acidic.

(ii) Candidates were required to describe the results of their first-hand investigation and relate how these supported or did not support the hypothesis. Most candidates did not distinguish between the observed results and the conclusion for their practical work. There were indications that some candidates had not actually done the required practical work.

(e) Generally well done, however, some responses did not show the links between facts as is required to meet the demands of a question asking candidates to 'analyse'.

Question 30 – Biochemistry of Movement

(a) (i) Most candidates answered the question correctly.

(ii) Answered well.

(b) Many candidates were aware that TAGs provide more energy per gram than carbohydrates but few explained that TAGs could be converted to carbohydrates and vice versa.

(c) (i) Most candidates answered this correctly.

(ii) The responses indicated a high level of understanding.

(d) (i) The responses indicated that most candidates had performed a first-hand investigation. Some, however, confused the enzyme renin with the product junket. Few candidates correctly used a control or described a method of collecting reliable results.

(ii) Many candidates did not give the results of their practical procedure. Those that did, often had difficulty linking their practical observations with changes in the structure of the enzyme. Most candidates demonstrated some knowledge of secondary and tertiary structure and were able to discuss denaturation as a change in structure/shape that could destroy enzyme activity.

(e) Many candidates stated that fatty acid oxidation produces acetyl CoA but no candidate made the connection with the dietary needs of sprinters.

Question 31 – Chemistry of Art

(a) (i) Generally well answered.

(ii) Generally well answered.

(b) Candidates scored well by focusing on the nature of the bonding rather than just the example to be used in describing the bonding.

(c) (i) Many candidates repeated the question with a slight embellishment such as 'when light is reflected a reflectance spectrum is produced'. This was insufficient to gain any mark.

(ii) Most candidates did not know how infrared and ultraviolet light are used, frequently mentioning visible light or explaining reflectance spectra again. The idea of relating the data obtained to standards was understood by only a small number of candidates.

(d) (i) The responses indicated a high level of understanding of this content.

(ii) It was obvious to the markers that many candidates had not performed the practical work. Frequently candidates would choose combinations of reagents that would not react yet claimed that they did. The idea of 'oxidising strength' was frequently confused with 'concentration' of potassium permanganate.

(iii) Very few candidates identified any results, instead common errors included justifying a conclusion and then exploring the use of half equations, half equations involving hydrogen ions used where there had been no mention of acid conditions in part (ii), reversible arrows being left in half equations, and transcription errors.

(e) Most candidates gained some marks. Candidates showed some lack of understanding of how the physical properties identified related to the electron arrangement in the 3d subshell. Atomic radius and melting point trends were handled best while density and magnetism trends were less well understood.

Question 32 – Forensic Chemistry

(a) (i) The majority of candidates answered this correctly. Common errors were hydroxide ion, hydroxide or alcohol.

(ii) Many candidates answered this part correctly.

(b) Many responses were vague and could have been about any scientific instrument. Few candidates gave applications or examples of the use of the techniques.

(c) (i) Few candidates answered this correctly. Many capable candidates lost the mark by being too specific and negating the enzyme part of their response by specifying restriction enzymes.

(ii) A large number of candidates showed a particularly good understanding of electrophoresis. Responses on chromatography were not as detailed or accurate.

(d) (i) Many candidates did not respond with 'spectroscope' even though they described its use correctly in (d)(ii).

(ii) Generally well done – candidates had obviously attempted this practical work. A significant number of candidates, however, described a flame test or failed to accurately describe what they were looking for in a spectrum.

(iii) Answered well by the majority of candidates.

(e) Candidates should be advised to plan their responses before writing their final answer. Many responses were disjointed or repetitive lists of examples. Selected examples were often dealt with superficially and failed to show an understanding of either the chemistry of DNA or the processes involved in its use in forensic chemistry.

Chemistry

2002 HSC Examination Mapping Grid

Question	Marks	Content	Syllabus outcomes
Section I Part A			
1	1	9.2.3	H4, H8
2	1	9.2.3	H8
3	1	9.2.4	H1, H3
4	1	9.2.4	H7, H13
5	1	9.2.4	H8, H14
6	1	9.3.4	H10
7	1	9.3.4	H1, H2
8	1	9.3.4	H11, H12
9	1	9.3.5	H8, H10, H11, H12
10	1	9.3.5	H9, H10
11	1	9.4.1	H6, H8, H9, H10
12	1	9.4.1	H13, H14
13	1	9.4.2	H1, H4
14	1	9.4.2	H2, H7, H8,H14
15	1	9.4.3	H2, H3, H8, H10, H14
16 (a)	1	9.2.1	H9
16 (b)	2	9.2.1	H9, H11, H13
16 (c)	3	9.2.1	H9, H11, H13, H14
17	3	9.2.1	H1, H3, H9, H13
18 (a)	1	9.2.2	H9
18 (b)	5	9.2.2	H3, H4, H9
19 (a)	2	9.2.5	H1, H2, H6
19 (b)	3	9.2.5	H1, H2, H6
20 (a)	1	9.3.1	H6, H8
20 (b)	3	9.3.1	H1, H2, H3, H10, H11, H12, H13, H14
21	7	9.3.2	H1, H3, H4, H5, H6, H7, H8, H10, H13
22 (a)	1	9.3.3	H10, H13
22 (b)	2	9.3.3	H2, H6, H10, H13
22 (c)	2	9.3.3	H2, H6, H10, H13, H14
23 (a)	1	9.3.2	H6, H8, H10
23 (b)	3	9.3.2	H6, H7, H10, H13, H14

Question	Marks	Content	Syllabus outcomes
24	4	9.4.3	H1, H3, H7
25 (a)	1	9.4.4	H9, H13
25 (b)	2	9.4.4	H2, H6, H13
25 (c)	3	9.4.4	H2, H4, H6, H7, H8, H9, H10, H13
26 (a)	2	9.4.5	H3, H4, H8, H11, H13
26 (b)	3	9.4.5	H10, H13
27	5	9.4.5	H3, H4, H5, H8, H13
Section II — Industrial Chemistry			
28 (a) (i)	1	9.5.5	H2, H3, H4, H9, H10
28 (a) (ii)	3	9.5.5	H2, H3, H4, H9, H10
28 (b)	4	9.5.2	H2, H3, H10, H12, H13
28 (c) (i)	2	9.5.3	H6, H7, H8, H10, H13
28 (c) (ii)	3	9.5.3	H1, H2, H3, H8, H9, H10, H13
28 (d) (i)	2	9.5.2	H2, H3, H10, H13
28 (d) (ii)	4	9.5.2	H2, H3, H10, H13
28 (e)	6	9.5.4	H1, H2, H3, H4, H7, H8
Section II — Shipwrecks and Salvage			
29 (a) (i)	1	9.6.3	H2, H3, H7, H8
29 (a) (ii)	3	9.6.3	H2, H3, H7, H8, H10, H13
29 (b)	4	9.6.1	H1, H2, H3, H4, H7
29 (c) (i)	1	9.6.7	H1, H3, H4, H5, H6, H8
29 (c) (ii)	4	9.6.7	H1, H3, H4, H5, H6, H8, H11, H13
29 (d) (i)	2	9.6.6	H3, H6, H8, H10, H11, H13, H14
29 (d) (ii)	4	9.6.6	H3, H6, H8, H10, H11, H13, H14
29 (e)	6	9.6.5, 9.6.6	H2, H3, H4, H5, H6, H7, H8, H10, H13
Section II — The Biochemistry of Movement			
30 (a) (i)	1	9.7.4	H9, H13
30 (a) (ii)	3	9.7.4	H6, H9, H10, H13
30 (b)	4	9.7.3	H2, H3, H4, H7, H13
30 (c) (i)	1	9.7.11	H7, H9, H10, H13
30 (c) (ii)	4	9.7.6	H2, H4, H8, H13
30 (d) (i)	2	9.7.4	H2, H3, H8, H9, H11, H13

Question	Marks	Content	Syllabus outcomes
30 (d) (ii)	4	9.7.4	H2, H3, H7, H8, H9, H11, H13, H14
30 (e)	6	9.7.7, 9.7.8, 9.7.11	H2, H3, H4, H8, H9, H13
Section II — The Chemistry of Art			
31 (a) (i)	1	9.8.3	H2, H3, H4, H7, H11, H13
31 (a) (ii)	3	9.8.3, 9.8.4	H2, H3, H4, H7, H11, H13
31 (b)	4	9.8.7	H2, H3, H4, H6, H10, H13
31 (c) (i)	2	9.8.3	H2, H3, H7, H13
31 (c) (ii)	3	9.8.3	H2, H3, H4, H7, H13
31 (d) (i)	1	9.8.4, 9.8.5	H2, H3, H6, H7, H13
31 (d) (ii)	2	9.8.5	H2, H6, H11
31 (d) (iii)	3	9.8.5	H2, H6, H7, H8, H9, H10, H13, H14
31 (e)	6	9.8.5, 9.8.6	H2, H6, H13, H14
Section II — Forensic Chemistry			
32 (a) (i)	1	9.9.3	H2, H9
32 (a) (ii)	3	9.9.3	H8, H9, H13
32 (b)	4	9.9.6	H1, H3, H4, H12, H13
32 (c) (i)	1	9.9.4	H3, H4, H8, H9, H13
32 (c) (ii)	4	9.9.4	H1, H3, H4, H13
32 (d) (i)	1	9.9.7	H1, H2, H3, H7
32 (d) (ii)	2	9.9.7	H1, H2, H3, H7, H11, H13
32 (d) (iii)	3	9.9.7	H1, H2, H3, H4, H7, H11, H13
32 (e)	6	9.9.5	H1, H3, H4, H5, H13

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NEW SOUTH WALES

2002 HSC Chemistry
Marking Guidelines

Section I
Part B

Question 16 (a)

Outcomes assessed: H9

MARKING GUIDELINES

Criteria	Marks
• States the name of a plausible alkene	1

Question 16 (b)

Outcomes assessed: H9, H11, H13

MARKING GUIDELINES

Criteria	Marks
• Gives a correct procedure that could be used to compare the reactivity of the chosen alkene with its corresponding alkane, including the reagent	2
• Gives a partially correct procedure that could be used to compare the reactivity of the chosen alkene with its corresponding alkane OR • Correctly names the reagent for the procedure	1

Question 16 (c)

Outcomes assessed: H9, H11, H13, H14

MARKING GUIDELINES

Criteria	Marks
• Results described correctly, with correct equation	3
• Results described correctly for one reaction, with equation OR • Results described correctly	2
• Results described correctly for one reaction OR • Correct equation	1

Question 17

Outcomes assessed: H1, H3, H9, H13

MARKING GUIDELINES

Criteria	Marks
• Explains the similarities of physical properties and the difference in chemical properties of alkanes and alkenes	3
• Explains a physical property of alkanes and alkenes OR • Explains a chemical property of alkanes and alkenes OR • Describes both a physical and a chemical property of alkanes and alkenes	2
• Identifies the polarity of the molecules OR • Identifies the single bonds in alkanes and double bonds in alkenes OR • Identifies a similar physical property of alkanes and alkenes OR • Identifies a difference in chemical reactivity between alkanes and alkenes	1

Question 18 (a)

Outcomes assessed: H9

MARKING GUIDELINES

Criteria	Marks
• Correct answer given	1

Question 18 (b)

Outcomes assessed: H3, H4, H9

MARKING GUIDELINES

Criteria	Marks
• Describes accurately current developments in the use of biopolymers AND • Makes a valid judgement of the value of those developments	4–5
• Describes accurately current developments in the use of biopolymers OR • Accounts for the current developments in the use of biopolymers OR • Describes accurately ONE current development in the use of biopolymers and accounts for a benefit/limitation in the use of biopolymers	2–3
• Names a biopolymer OR • Gives a use for a biopolymer OR • Identifies a benefit/limitation for biopolymers	1

Question 19 (a)

Outcomes assessed: H1, H2, H6

MARKING GUIDELINES

Criteria	Marks
• Correctly identifies the features that make a nucleus unstable	2
• Identifies that 'protons' and 'neutrons' are found in nucleus OR • Correctly describes one condition under which a nucleus is unstable	1

Question 19 (b)

Outcomes assessed: H1, H2, H6

MARKING GUIDELINES

Criteria	Marks
• Describes alpha and beta decay using examples from the flow diagram	3
• Describes alpha decay using an example from the flow diagram OR • Describes beta decay using an example from the flow diagram OR • Describes alpha and beta decay	2
• Describes either alpha or beta decay	1

Question 20 (a)

Outcomes assessed: H6, H8

MARKING GUIDELINES

Criteria	Marks
• Any correct household base	1

Question 20 (b)

Outcomes assessed: H1, H2, H3, H10, H11, H12, H13, H14

MARKING GUIDELINES

Criteria	Marks
• Correctly concludes solutions *A* and *B* must be basic, and concludes, based on correct reasoning, that solution *C* may be in the range basic to acidic and assesses that the conclusion may be or may not be correct	3
• Correctly concludes solution *A* and *B* must be basic and concludes, based on correct reasoning, that solution *C* may be in the range basic to acidic	2
• Correctly concludes solutions *A* or *B* must be basic OR • Makes a correct assessment without any explanation	1

Question 21

Outcomes assessed: H1, H3, H4, H5, H6, H7, H8, H10, H13

MARKING GUIDELINES

Criteria	Marks
• Demonstrates an extensive knowledge of the industrial production of nitrogen oxides and sulfur dioxide • Demonstrates an extensive knowledge of impacts on the environment • Includes examples and chemical equations • Provides an evaluation of these impacts	7
• Demonstrates an extensive knowledge of the industrial production of nitrogen oxides and sulfur dioxide • Demonstrates an extensive knowledge of impacts on the environment • Includes chemical equation(s) OR • Demonstrates a sound knowledge of impacts • Uses chemical equations and gives a limited evaluation • Demonstrates a sound knowledge of the industrial production of nitrogen oxides and sulfur dioxide	5–6
• Demonstrates a sound knowledge of industrial production of sulfur dioxide and nitrogen oxides • Demonstrates limited knowledge of environmental impacts OR • Demonstrates a sound knowledge of environmental impacts • Demonstrates limited knowledge of industrial production of sulfur dioxide and nitrogen oxides	3–4
• Names oxides of nitrogen or sulfur dioxide or gives formulas AND/OR • Names industrial sources of a nitrogen oxide or sulfur dioxide AND/OR • States environmental effects of an oxide of nitrogen or of sulfur dioxide	1–2

Question 22 (a)

Outcomes assessed: H10, H13

MARKING GUIDELINES

Criteria	Marks
• Correctly calculates pH	1

Question 22 (b)

Outcomes assessed: H2, H6, H10, H13

MARKING GUIDELINES

Criteria	Marks
• Identifies that sulfuric acid has a lower pH than hydrochloric acid • Justifies answer in terms of the diprotic nature of sulfuric acid	2
• Identifies that sulfuric acid has a lower pH than hydrochloric acid OR • States that sulfuric acid is diprotic whereas hydrochloric acid is monoprotic	1

Question 22 (c)

Outcomes assessed: H2, H6, H10, H13, H14

MARKING GUIDELINES

Criteria	Marks
• Distinguishes the acids in terms of their 'strength' and hence their $[H^+]$ • Correctly relates pH with $[H^+]$	2
• Distinguishes the acids in terms of their 'strength' and hence their $[H^+]$ OR • Correctly relates pH with $[H^+]$	1

Question 23 (a)

Outcomes assessed: H6, H8, H10

MARKING GUIDELINES

Criteria	Marks
• Names the gas correctly	1

Question 23 (b)

Outcomes assessed: H6, H7, H10, H13, H14

MARKING GUIDELINES

Criteria	Marks
• Correctly calculates the volume of gas, including units and showing relevant working	3
• Correct method used, but has a mistake*	2
• Correct number of moles of gas calculated	1

*Mistakes could include: transcription errors, using wrong formula mass, using 22.4L, missing units.

Question 24

Outcomes assessed: H1, H3, H7

MARKING GUIDELINES

Criteria	Marks
• Describes how the use of AAS has changed analytical procedures and assesses the impact of AAS on scientific understanding of the effects of trace elements	4
• Describes how the use of AAS has changed analytical procedures AND/OR • Describes how the use of AAS has enhanced scientific understanding of trace elements AND/OR • A good explanation of how AAS works AND/OR • Describes the effects of trace elements	2–3
• Identifies some trace elements measured using AAS OR • Describes AAS OR • Indicates an advantage of AAS	1

Question 25 (a)

Outcomes assessed: H9, H13

MARKING GUIDELINES

Criteria	Marks
• Correct answer given	1

Question 25 (b)

Outcomes assessed: H2, H6, H13

MARKING GUIDELINES

Criteria	Marks
• Identifies the bonding using a Lewis electron-dot diagram	2
• Draws Lewis electron-dot diagram OR • Identifies the position of the coordinate covalent bond OR • Identifies the position of the double covalent bond	1

Question 25 (c)

Outcomes assessed: H2, H4, H6, H7, H8, H9, H10, H13

MARKING GUIDELINES

Criteria	Marks
• Demonstrates extensive knowledge of the reactions of CFCs with ozone. Must use relevant equations	3
• Demonstrates extensive knowledge of the reactions without equations OR • Demonstrates a limited knowledge of reactions with equations	2
• Demonstrates a limited knowledge of reactions or species present	1

Question 26 (a)

Outcomes assessed: H3, H4, H8, H11, H13

MARKING GUIDELINES

Criteria	Marks
• Describes test with expected distinguishing results	2
• Describes test OR • Gives results without test	1

Question 26 (b)

Outcomes assessed: H10, H13

MARKING GUIDELINES

Criteria	Marks
• Gives correct answer and working	3
• Incorrect answer with some correct working	2
• Correct molar mass for $MgCO_3$ OR • Correct formula for conversion of moles/L to moles OR • Correct answer without working	1

Question 27

Outcomes assessed: H3, H4, H5, H8, H13

MARKING GUIDELINES

Criteria	Marks
• Demonstrates an extensive knowledge of both chemical and physical processes used to purify and sanitise a town water supply	5
• Demonstrates a thorough knowledge of both chemical and physical processes used to purify and sanitise a town water supply OR • Demonstrates an extensive knowledge of either chemical or physical processes used to purify and sanitise a town water supply	3–4
• Demonstrates a basic knowledge of both chemical and physical processes used to purify and sanitise a town water supply OR • Demonstrates a sound knowledge of either chemical or physical processes used to purify and sanitise a town water supply	1–2

Section II

Industrial Chemistry

Question 28 (a) (i)

Outcomes assessed: H2, H3, H4, H9, H10

MARKING GUIDELINES

Criteria	Marks
• Correctly defines the process	1

Question 28 (a) (ii)

Outcomes assessed: H2, H3, H4, H9, H10

MARKING GUIDELINES

Criteria	Marks
• States reasons for the cleaning action of soap	3
• Identifies water solubility of soaps AND • Identifies polar and non-polar ends of soaps	2
• Identifies water solubility of soaps OR • Identifies polar and non-polar ends of soaps	1

Question 28 (b)

Outcomes assessed: H2, H3, H10,H12, H13

MARKING GUIDELINES

Criteria	Marks
• Gives correct answer with working and equations	4
• Gives correct equilibrium values for gases AND • Gives correct equilibrium expression AND • Gives correct chemical equation	3
• Gives correct equilibrium expression AND • Gives correct chemical equation	2
• Gives correct equilibrium expression OR • Gives correct chemical equation	1

Question 28 (c) (i)

Outcomes assessed: H6, H7, H8, H10, H13

MARKING GUIDELINES

Criteria	Marks
• Gives correct equation and states that ionisation is exothermic	2
• States that the reaction is exothermic OR • Gives correct equation	1

Question 28 (c) (ii)

Outcomes assessed: H1, H2, H3, H8,H9, H10, H13

MARKING GUIDELINES

Criteria	Marks
• States three correct reactions and gives at least two correct equations OR • Gives three correct equations	3
• States three correct reactions OR • States two correct reactions and gives one correct equation OR • Gives two correct equations	2
• States one correct reaction OR • Gives one correct equation	1

Question 28 (d) (i)

Outcomes assessed: H2, H3, H10, H13

MARKING GUIDELINES

Criteria	Marks
• Demonstrates a detailed knowledge of the use of appropriate experimental procedures in an equilibrium reaction	1–2

Question 28 (d) (ii)

Outcomes assessed: H2, H3, H10, H13

MARKING GUIDELINES

Criteria	Marks
• Demonstrates an extensive knowledge of equilibria by analysis of the effects of at least two factors	4
• Demonstrates a thorough knowledge of equilibria by analysis of the effects of at least two factors OR • Demonstrates an extensive knowledge by analysis of the effects of one factor	3
• Describes the effect of two factors on the equilibrium OR • Describes the effect of one factor on the equilibrium and mentions Le Chatelier's principle	2
• Describes the effect of one factor on the equilibrium OR • Mentions Le Chatelier's principle	1

Question 28 (e)

Outcomes assessed: H1, H2, H3, H4, H7, H8

MARKING GUIDELINES

Criteria	Marks
• Demonstrates an extensive knowledge of the changes in the industrial production methods for NaOH and evaluates the changes	5–6
• Demonstrates a thorough knowledge of the changes in the industrial production methods for NaOH	3–4
• Demonstrates a limited knowledge of changes in the industrial production methods for NaOH	1–2

Section II

Shipwrecks and salvage

Question 29 (a) (i)

Outcomes assessed: H2, H3, H7, H8

MARKING GUIDELINES

Criteria	Marks
• Correctly identifies the name of the electrochemical cell	1

Question 29 (a) (ii)

Outcomes assessed: H2, H3, H7, H8, H10, H13

MARKING GUIDELINES

Criteria	Marks
• Indicates that the correct voltage for the electrolytic cell is greater than the galvanic cell, and calculates this voltage, and includes correct relevant equations	3
• Calculates the potential of the galvanic cell illustrated and writes correct equations	2
• Writes one correct equation OR • Calculates the potential of the galvanic cell	1

Question 29 (b)

Outcomes assessed: H1, H2, H3, H4, H7

MARKING GUIDELINES

Criteria	Marks
• Demonstrates a thorough knowledge of the work of early scientists which led to an understanding of electron transfer reactions	3–4
• Demonstrates a sound knowledge of the work of early scientists which led to an understanding of electron transfer reactions	2
• Demonstrates a basic knowledge of the work of early scientists which led to an understanding of electron transfer reactions	1

Question 29 (c) (i)

Outcomes assessed: H1, H3, H4, H5, H6, H8

MARKING GUIDELINES

Criteria	Marks
• Correctly names a method for removing salt from an artefact	1

Question 29 (c) (ii)

Outcomes assessed: H1, H3, H4, H5, H6, H8, H11, H13

MARKING GUIDELINES

Criteria	Marks
• Provides a thorough explanation, using an example, of chemical procedures to clean and preserve artefacts from wrecks	3–4
• Provides a thorough explanation of chemical procedures used to either clean or preserve an artefact from wrecks • Provides a sound knowledge of chemical procedures to clean and preserve an artefact from wrecks	2
• Identifies ONE chemical procedure that is used to either clean or preserve an artefact from a wreck • Correctly identifies an example of an artefact from a wreck	1

Question 29 (d) (i)

Outcomes assessed: H3, H6, H8, H10, H11, H13, H14

MARKING GUIDELINES

Criteria	Marks
• Demonstrates a thorough knowledge of the use of appropriate experimental procedures for comparing and describing the rate of corrosion of materials in different acidic and neutral solutions	1–2

Question 29 (d) (ii)

Outcomes assessed: H3, H6, H8, H10, H11, H13, H14

MARKING GUIDELINES

Criteria	Marks
• Provides a thorough description of the results • Provides a thorough explanation of how the results do or do not support the hypothesis	3–4
• Provides a basic explanation of how the results do or do not support the hypothesis OR • Describes the results	1–2

Question 29 (e)

Outcomes assessed: H2, H3, H4, H5, H6, H7, H8, H10, H13

MARKING GUIDELINES

Criteria	Marks
• Demonstrates an extensive knowledge of the factors that affect corrosion of metallic objects and how these factors are affected by ocean depth	5–6
• Demonstrates a sound knowledge of factors that affect corrosion of metallic objects and how these factors are affected by ocean depth	3–4
• Identifies how one factor, that can affect corrosion of a metallic object, varies with depth	2
• Identifies one factor that will affect the corrosion of metallic objects and that changes with depth	1

Section II

The Biochemistry of Movement

Question 30 (a) (i)

Outcomes assessed: H9, H13

MARKING GUIDELINES

Criteria	Marks
• Correctly identifies class of compound	1

Question 30 (a) (ii)

Outcomes assessed: H6, H9, H10, H13

MARKING GUIDELINES

Criteria	Marks
• Demonstrates a thorough knowledge of peptide bond formation, using the correct equation • Describes elimination of water from carboxyl and amino groups and identifies the peptide band	3
• Demonstrates a sound knowledge of peptide bond formation describing the elimination of water from carboxyl and amino groups OR • Gives an equation for the peptide bond formation with an error not including the peptide bond	2
• Demonstrates a basic knowledge of peptide bond formation by identifying the peptide bond OR • Describing the role of amino acids in the formation of the bond OR • Providing a simple description of the peptide bond formation	1

Question 30 (b)

Outcomes assessed: H2, H3, H4, H7, H13

MARKING GUIDELINES

Criteria	Marks
• Demonstrates an extensive knowledge of TAG features and the reasons why these features make TAGs important energy store AND • Demonstrates that TAGs can be converted to and from other energy sources as needed	4
• A sound knowledge of TAGs as an energy store with some reasons given. Some knowledge of energy comparisons with other energy sources	2–3
• Basic knowledge of TAGs as an energy store OR • One reason for TAGs being used as an energy store	1

Question 30 (c) (i)

Outcomes assessed: H7, H9, H10, H13

MARKING GUIDELINES

Criteria	Marks
• Names correct acid	1

Question 30 (c) (ii)

Outcomes assessed: H2, H4, H8, H13

MARKING GUIDELINES

Criteria	Marks
• Demonstrates a thorough knowledge of the characteristics and functions of Type 1 and Type 2 muscles	3–4
• Demonstrates a sound knowledge of the characteristics and functions of Type 1 and Type 2 muscles	2
• Demonstrates a basic knowledge of the characteristics or functions of Type 1 and Type 2 muscles	1

Question 30 (d) (i)

Outcomes assessed: H2, H3, H8, H9, H11, H13

MARKING GUIDELINES

Criteria	Marks
• Demonstrates a thorough knowledge of the use of appropriate experimental procedures to test the influence of one factor on the reaction of a named enzyme	2
• Demonstrates limited knowledge of the use of appropriate experimental procedures to test the influence of one factor on the reaction of a named enzyme	1

Question 30 (d) (ii)

Outcomes assessed: H2, H3, H7, H8, H9, H11, H13, H14

MARKING GUIDELINES

Criteria	Marks
• Uses correct results to reach a correct conclusion based on an extensive knowledge of enzyme structure	4
• Uses correct results to reach a correct conclusion based on a sound knowledge of enzyme structure OR • Uses correct results to reach a conclusion based on a thorough knowledge of enzyme structure	2–3
• Gives correct results of experiment OR • States a correct conclusion OR • Shows a limited knowledge of enzyme structure	1

Question 30 (e)

Outcomes assessed: H2, H3, H4, H8, H9, H13

MARKING GUIDELINES

Criteria	Marks
• Shows an extensive knowledge of the oxidation of fatty acids as an inhibitor of the conversion of pyruvate to acetyl Co A and links this to the dietary needs of sprinting athletes	5–6
• Shows a sound knowledge of the oxidation of fatty acids as an inhibitor of the conversion of pyruvate to acetyl Co A	3–4
• Shows a limited knowledge of the oxidation of fatty acids as an inhibitor of the conversion of pyruvate to acetyl Co A	1–2

Section II

The Chemistry of Art

Question 31 (a) (i)

Outcomes assessed: H2, H3, H4, H7, H11, H13

MARKING GUIDELINES

Criteria	Marks
• Correctly identifies metal ion	1

Question 31 (a) (ii)

Outcomes assessed: H2, H3, H4, H7, H11, H13

MARKING GUIDELINES

Criteria	Marks
• Provides a thorough explanation of how a flame colour is produced	2–3
• Correctly identifies ONE aspect associated with production of a flame colour	1

Question 31 (b)

Outcomes assessed: H2, H3, H4, H6, H10, H13

MARKING GUIDELINES

Criteria	Marks
• Provides features of bonding in a coordination complex using an example from medicine or biological research	3–4
• Identifies a correct aspect of bonding and identifies a coordination complex OR • Sound description of bonding	2
• Identifies a coordination complex OR • Identifies one correct aspect of bonding	1

Question 31 (c) (i)

Outcomes assessed: H2, H3, H7, H13

MARKING GUIDELINES

Criteria	Marks
• Provides a sound explanation of the nature of a reflectance spectrum	1–2

Question 31 (c) (ii)

Outcomes assessed: H2, H3, H4, H7, H13

MARKING GUIDELINES

Criteria	Marks
• As for below and must mention that to identify composition of a pigment a comparison with a known standard is needed	3
• Describes the use of infrared/ultraviolet reflectance/absorption spectra	1–2

Question 31 (d) (i)

Outcomes assessed: H2, H3, H6, H7, H13

MARKING GUIDELINES

Criteria	Marks
• Correctly states the electronic configuration	1

Question 31 (d) (ii)

Outcomes assessed: H2, H6, H11

MARKING GUIDELINES

Criteria	Marks
• Demonstrates a thorough knowledge of the use of appropriate experimental procedures in determining the oxidising strength of potassium permanganate	1–2

Question 31 (d) (iii)

Outcomes assessed: H2, H6, H7, H8, H9, H10, H13, H14

MARKING GUIDELINES

Criteria	Marks
• Uses correct results to justify conclusion and includes correct half equations	3
• Justifies a conclusion based on results OR • States correct results and includes correct half equations	2
• States correct results OR • Writes a correct half equation OR • Justifies conclusion without reference to the results	1

Question 31 (e)

Outcomes assessed: H2, H6, H13, H14

MARKING GUIDELINES

Criteria	Marks
• Demonstrates an extensive knowledge of the physical properties of the elements in the first transition series and draws relationships between these properties	5–6
• Provides an analysis of the trend in one physical property of the elements in the first transition series and refers to other properties	3–4
• Identifies correctly one trend in one physical property of the elements in the first transition series	2
• Identifies one physical property of the elements in the first transition series OR • Identifies the first transition series	1

Section II

Forensic Chemistry

Question 32 (a) (i)

Outcomes assessed: H2, H9

MARKING GUIDELINES

Criteria	Marks
• Correctly identifies the functional group	1

Question 32 (a) (ii)

Outcomes assessed: H8, H9, H13

MARKING GUIDELINES

Criteria	Marks
• Correctly compares several aspects of the chemical reactions	3
• Compares one or two aspects of the reactions correctly OR • Gives correct details of several aspects of one of the reactions of one compound	2
• Shows a basic knowledge of reactions of the compounds with $KMnO_4$	1

Question 32 (b)

Outcomes assessed: H1, H3, H4, H12, H13

MARKING GUIDELINES

Criteria	Marks
• Demonstrates a thorough knowledge of the uses of each technique in forensic chemistry (with an example) and discusses the value of each technique	3–4
• Demonstrates a sound knowledge of the processes of each technique OR • Makes a statement of the value of each technique	1–2

Question 32 (c) (i)

Outcomes assessed: H3, H4, H8, H9, H13

MARKING GUIDELINES

Criteria	Marks
• Correctly identifies the class of compound	1

Question 32 (c) (ii)

Outcomes assessed: H1, H3, H4, H13

MARKING GUIDELINES

Criteria	Marks
• Demonstrates an extensive knowledge of how both processes separate organic compounds	4
• Demonstrates a thorough knowledge of how both processes separate organic compounds	3
• Sound knowledge of how both processes separate organic compounds	2
• Basic knowledge of how both processes separate organic compounds OR • Sound knowledge of ONE process	1

Question 32 (d) (i)

Outcomes assessed: H1, H2, H3, H7

MARKING GUIDELINES

Criteria	Marks
• Correctly identifies the piece of equipment	1

Question 32 (d) (ii)

Outcomes assessed: H1, H2, H3, H7, H11, H13

MARKING GUIDELINES

Criteria	Marks
• Demonstrates a thorough knowledge of the procedure used to determine the emission spectrum of sodium	1–2

Question 32 (d) (iii)

Outcomes assessed: H1,H2, H3, H4, H7, H11, H13

MARKING GUIDELINES

Criteria	Marks
• Demonstrates an extensive knowledge of the transition of electrons between different energy levels and applies this to the method used to generate a sodium spectrum in the lab	3
• Demonstrates a sound knowledge of the way emission spectra are formed. Gives only general information	2
• Demonstrates a basic knowledge of emission spectra	1

Question 32 (e)

Outcomes assessed: H1, H3, H4, H5, H13

MARKING GUIDELINES

Criteria	Marks
• Demonstrates an extensive knowledge of the uses of DNA analysis in forensic chemistry	5–6
• Demonstrates a sound knowledge of the uses of DNA analysis in forensic chemistry	3–4
• Demonstrates a basic knowledge of the uses of DNA analysis in forensic chemistry OR • Gives examples of uses of DNA analysis	1–2