2004 HSC Notes from the Marking Centre Chemistry

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2004 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 2004 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 2004 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 2004, 10 124 candidates attempted the chemistry examination.

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. This aspect needs to be more fully appreciated by all systems and candidates.

Overall, the candidates' responses were appropriate and indicated a level of understanding of Chemistry concepts that was appropriate for HSC candidates. Candidates need to be reminded that the answer space allocated is a guide to the maximum length of response required. Similarly, the key word used in the question gives an indication of the depth of the required response. The option question is divided into a number of parts: candidates should clearly label each part of the question when writing in their answer booklets.

Spelling, grammar and scientific expression were very poor from some candidates, with handwriting being more illegible than in the past. There was significant evidence that many candidates had a very poor knowledge of basic definitions specific to terminology associated with chemistry.

Candidates should check a variety of sources for reliability and accuracy of content, rather than rely heavily on one source. There was evidence of rote-learnt answers based on a text book. These did not address the syllabus content and/or outcomes being assessed and hence did not score full marks.

It is imperative that candidates recognise that content from the Preliminary Course (knowledge, understanding and skills) is assumed knowledge in the HSC course. This includes the mole concept and any calculations/interpretations associated with it.

Candidates need to set out their work clearly in calculation questions, showing all steps in their working, and expressing their answers with the correct number of significant figures (see Module 9.1–H11.1(c)).

Where appropriate, it is advisable to write balanced chemical equations, including the correct states of matter, to support an answer.

Markers report a wide variety in the quality of responses to questions relating to first-hand investigations. Some of these responses show evidence of rote-learning an anticipated answer. Candidates who have actively planned and performed practical activities clearly demonstrate a deeper knowledge and understanding of the content described in Module 9.1.
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Section I – Core

Part A – Multiple choice

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

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

Part B

Specific Comments

Question 16

(a) Although most candidates identified that the solid needed to be weighed, few completely outlined that it was transferred and dissolved in a volumetric flask and then filled it up to the calibration line. Candidates need to sequence their steps more appropriately. The terminology associated with equipment must be known.

(b) Most candidates correctly calculated the number of moles of solid, but fewer candidates were able to calculate the mass and express it to two significant figures. Appropriate setting out of working is crucial. Rounding-off needs to be done at the end of the calculation.

Question 17

(a) The monomer identification was mostly well done, although some candidates seemed unsure as to which is the common and which is systematic name.

(b) The better responses were able to correctly and clearly link at least two different uses with two different properties for the named isomer.

(c) Well answered by most. The better responses showed two or more monomer units joined together rather than the simple abbreviated structure and the bonds at each end of the chain open without the use of 'n' molecules.

Question 18

Most candidates wrote lengthy responses to this question.

The better responses discussed two trends in the behaviour of the acid/base oxides of elements, related these to their positions on the Periodic Table, and correctly identified amphoteric oxides by name or properties. Very few candidates provided accurate, up-to-date chemistry as in the oxides of some of the noble gases.

Many responses did not demonstrate a sound knowledge of specific acid/base properties of oxides. There was significant confusion between the terms amphoteric (by name or implication) and amphiprotic.

Question 19

(a) Better responses scored well in this question linking the observations to the chemistry involved and giving an accurate overall equation with correct states identified. Many responses that demonstrated a sound knowledge of metal displacement reactions did not link the observations to the chemistry involved. Responses often gave only correct half-equations and a significant number of responses indicated that there was more difficulty in linking the change in the colour of the solution than linking the red-brown deposit. There was evidence that some candidates did not know how to interpret the equations from the Data Sheet with respect to the appropriate use of arrows.

(b) Better responses correctly calculated the concentration (molarity) to the correct number of significant figures, showing working, using either the mole concept or the Law of Conservation of Mass. These candidates often used a scaffold to process the calculations. Many responses indicated confusion between decimal places and significant figures, and many calculated the moles/concentration (molarity) for zinc.

Question 20

(a) Most responses were able to identify the end result of AAS and how it could be used but were unable to distinguish the purpose of the individual components. Better responses were able to identify the function of the light source and that the light provided the energy to excite the electrons to shift orbitals. Poorer responses relating to the purpose of the flame used words like 'adds heat', 'burns' or 'ionises'. Some candidates gave more general answers about the overall purpose of the machine or the detector.

(b) The better candidates were able to clearly state the relevant points to support their judgement about both validity and reliability. There were a large number of responses that linked both terms together and showed no clear understanding of the difference between them. Most responses identified the outlier but stated incorrectly that including it in the average made the result more valid or more reliable or more accurate.

Question 21

(a) Most candidates were able to describe some qualititative and quantitative tests but were unable to state the difference between qualititative analysis and quantitative analysis.

(b) Most candidates successfully identified two factors with only the better responses stating the features of each factor that affect the concentration of ions in natural bodies of water. Candidates needed to apply relevant knowledge from the various parts of the syllabus to answer this question effectively.

(c) The best responses included the correct name or formula for the reagent needed to test for the specific anion and a correct statement of the observations. Most candidates knew the reagent to test for the sulfate ion. It was evident that some candidates did not recall results from their first-hand investigations. Some candidates did not understand the term 'reagent'.

Question 22

(a) This part of the question was generally poorly answered. The response required a definition of amphiprotic. The better responses stated that amphiprotic substances were able to act as both proton donors and proton acceptors.

(b) This part of the question was generally poorly answered. Better responses demonstrated the understanding of proton transfer as well as the ability to balance the charge for each equation. There was confusion between the hydrogen ion and the hydronium ion in this context.

Question 23

The better responses processed the information provided in the table and used it as evidence for the judgement that was made. It was encouraging to see some indication of planned responses, such as the use of headings, eg 'advantages', 'disadvantages', 'assessment'.

Weaker responses indicated that candidates were not aware that ammonia is a weak base and a few even referred to pure water as being basic.

Question 24

(a) Better responses set out the calculation for both dilution and pH very clearly. Most candidates knew the equation for calculating pH. A significant proportion of responses did not arrive at the correct dilution. Several candidates correctly calculated dilution, but did not subsequently calculate pH.

(b) This question addressed several dot points of the syllabus. Better responses provided good scientific explanations that related the given use of the acid/acids to a chemical property that causes it, such as low pH or presence of H^+. Most referred to the effect of the acids on the flavour or taste of food, or for preservation purposes. Most candidates identified a use for the acids as food additives. A concern in this question was the number of responses that stated that acids were 'bitter'. There was evidence that candidates brought generalised information with them from other courses.

(c) Better responses related the pH of the given acids to hydrogen ion concentration and were able to explain the difference due to the different degree of ionisation in each acid. A significant proportion of weaker responses referred to differences in acid strength without relating it to ionisation or did not explain why there was a difference between the two weak acids. Candidates are reminded that the lower pH of citric acid compared to an equal concentration of acetic acid is due mainly to its higher degree of ionisation rather than to its being triprotic. Responses indicated that candidates' understanding of the terms 'ionisation' and 'dissociation' in relation to acids varied considerably.

Question 25

The greater majority of candidates were very familiar with the actual content required in the question. Many candidates directed their responses towards listing the benefits and problems associated with the use of ethanol, but did not make any judgement as to the potential use of the chemical as a fuel.

There was considerable confusion over the use of the data and the units in the table.

Many candidates assumed that ethanol was a renewable fuel, even when formed from a chemical derived from fossil fuels.

The wording of the question required candidates to use the table. Many responses revealed rote learning of prepared answers, and some candidates presented very long and detailed responses, containing little information relevant to the question.

Question 26

Candidates are reminded that they should be able to distinguish between industrial and medical uses of radioisotopes. Better responses clearly identified a radioisotope used in industry, including the correct mass number, and a well-structured answer that included multiple points for and against an identified use of a radioisotope. Few responses showed a clear link between the properties of the radioisotope and the benefits or problems associated with these properties. It was evident that many candidates had little understanding of industrial radioisotopes.

Question 27

Candidates responded well to this question, with few non-attempts and with most able to use data from the table. Better responses clearly discussed the use of CFCs, indicating points for and/or against. Most candidates provided a description of the mechanism of ozone depletion, including the use of equations. The better candidates explained why other chemicals are used as replacements for CFCs, using data from the table. They needed to include a specific judgement relating to the replacements. There was evidence of rote-learned responses that did not fully answer the question. Candidates are reminded that it is essential to provide a well-balanced answer working from the simpler concepts to the more complex chemistry.

Section II – Options

Specific Comments

Question 28 – Industrial Chemistry

(a) (i) Most candidates correctly identified a safety precaution appropriate to the investigation.

(ii) Most candidates identified a reversible step, and provided a balanced equation for the step including states and equilibrium arrows. Better responses included how the identified step maximised the yield. Some responses made incorrect or ambiguous statements about the effect of catalysts on the yield.

(b) (i) Most candidates explained the polar/hydrophilic and non-polar/hydrophobic nature of anionic detergents quite well. Higher-level responses usually incorporated a labelled diagram showing how an emulsion formed.

(ii) Better responses considered the impacts of the different classes of detergents separately, and either gave an ongoing support for their judgement or concluded their response with an overall assessment. Such judgements considered both the 'positives' and 'negatives' of the different classes of detergents. Eutrophication was often incorrectly linked to supposed breakdown products from anionic and cationic detergents, rather than to the presence of phosphorus in 'builders' in detergent mixtures. Poorer responses gave general information on detergents and their impact on the environment, with little or no attempt to assess their environmental impact.

(c) Better responses included a thorough description of the chemistry of the two processes, including products and pollutants, followed by a judgement based on available resources needed for each process. These better responses often included positive and negative aspects for each site. Many candidates produced very general answers about environmental, social and economic factors relating to the three sites on the given map. In doing so the responses either did not give enough chemistry associated with the two processes concerned or did not discuss all three sites for each process.

(d) (i) Most candidates were able to define an emulsion. Better responses used appropriate chemical language and kept to the more general definition that could be applied to all emulsions.

(ii) Better responses indicated the main features of a procedure performed on a named emulsion, for testing two or more of its properties. Candidates are reminded of the difference between experimental results and a conclusion.

(iii) Candidates who responded well to this question clearly outlined the steps in both the laboratory and industrial preparation of soap. The chemical names and/or formulae of all the reagents and products and the reaction conditions, eg temperature, how mixing was achieved and the types of oils and fats used, were included. Better responses made an attempt to highlight and explain the differences between school laboratory and industrial processes. In many instances there was no evidence of an understanding of the industrial process for soap production.

Question 29 – Shipwrecks, Corrosion and Conservation

(a) (i) Most candidates answered this question well and were able to state the origin of minerals in the ocean as either hydrothermal vents or leaching of minerals from the soil.

(ii) Most candidates described the damage resulting from drying as cracking and distortion of the artefact. Better responses indicated that this damage resulted from the growth of salt crystals within the wood as the water evaporated. Poor responses discussed bacterial damage and did not relate the damage to drying of the artefact.

(b) (i) Few responses demonstrated a good understanding of the electrolysis of aqueous solutions. Better responses showed water being reduced at the cathode and bromide ions being oxidised at the anode to produce aqueous bromine. Many responses indicated that potassium metal would be produced or that platinum electrodes took part in the reaction.

(ii) The better responses outlined Faraday's work on Laws of Electrolysis, his invention of the coulometer and his development of the terms used today to describe electrolysis. They then went on to relate his work to everyday applications of this process in industry and Chemistry.

(c) Better responses introduced a range of metals and alloys that were appropriate to ships and compared the ideas for and against the use of these materials. Other good responses approached the question by discussing ways of protecting metals from corrosion by using protective coatings, sacrificial anodes and impressed current.

(d) (i) The better answers related corrosion to the oxidation of metals in the presence of oxygen and water.

(ii) The better responses outlined a valid investigation and the appropriate result that they observed, eg red-brown colour change, mass difference. They clearly explained the purpose of a particular investigation and the relevant controlled variables. Candidates are reminded of the difference between experimental results and a conclusion. Candidates unfortunately did not use chemical equations to support their answers.

(iii) Candidates needed to explain the differences in oxygen levels and temperature at the two wrecks and to describe the ship on the shore as being the most corroded. Better responses then went on to explain why changes in these two factors affected the rate at which the chemical reaction was occurring.

Question 30 – Biochemistry of Movement

(a) (i) Most candidates recognised the structure of the compound lactic acid (or 2-hydroxypropanoic acid) from their study of anaerobic respiration.

(ii) Better responses provided points of similarity or difference between the processes of anaerobic respiration and fermentation and showed development of understanding beyond the study of the Core modules, specifically in tracing the different biochemical pathways through pyruvic acid.

(b) (i) Most candidates used the stimulus material well and identified the muscle protein fibres actin and myosin and the metal ion calcium. Candidates should clearly match their response with the labels used in the question.

(ii) Most candidates stated that the different processes of respiration (aerobic and anaerobic) occurred during gentle exercise and in a heavy exercise such as sprinting and related the process to oxygen supply. Better responses explained the relationship between rates of ATP demand and ATP production through aerobic and anaerobic pathways. Few candidates developed their response to identify a number of alternate non-oxygen/non-mitochondrial- based ATP production processes.

(c) Most candidates described the importance of oxidative phosphorylation in increasing the level of ATP available to the cell and identified the mitochondria as the location where this chain of enzyme-controlled reactions occurs. Better responses outlined the entry of the compounds NADH and $FADH_2$ into the cytochrome reactions from the TCA cycle and related the release of energy from these molecules to ATP production. These also included judgements about the importance of oxidative phosphorylation as an energy source. Relatively few responses were developed to correctly outline the relationship between the TCA products, cytochrome enzymes, electron transfer and oxygen. Some candidates provided a biochemical flowchart as their attempt to this question.

(d) (i) Generally candidates only defined an enzyme at its operational level while better responses indicated that enzymes are a class of proteins with a substrate-specific site that catalysed biochemical processes.

(ii) This question assessed the skill of planning and performing an investigation. Better responses outlined a relevant investigation that showed control of variables that may have affected the result of the pH change on the activity of a named enzyme. A clear and accurate description of the result was given in the best responses. Candidates are reminded of the difference between an experimental result and a conclusion.

(iii) Better responses outlined the bonding in all three structures referred to in the question and detailed the effect of pH change on each structure.

Question 31 – Chemistry of Art

(a) (i) Better responses indicated a clear understanding of the arrangement of electrons in the 4s and 3d orbitals.

(ii) Better responses had a clearly labelled Lewis diagram of the complex and displayed an understanding of the bonding (particularly coordinate covalent) within the complex.

(b) (i) Few candidates related the energy level diagram to transition from the 3p to the 3s for both spectral lines.

(ii) Most candidates showed a sound understanding of the Bohr model of the atom and were able to state at least one limitation. Better responses were able to describe clearly the relationship between the Bohr model and the line pattern of the hydrogen spectrum.

(c) Candidates generally had a sound understanding of chemicals used in ancient culture, including their mineral name and chemical formula. Better responses were able to relate the metal in the compound to specific health risks, clearly outlining symptoms produced through prolonged exposure. Also judgements relating to potential health risks were generally thoughtful and relevant.

(d) (i) Better responses indicated a clear relationship between the definition of a transition metal and the partially filled d subshell.

(ii) Responses indicated that a variety of different first-hand investigations were used to address this part of the syllabus. Better responses included all reagents, and related results to the investigation outlined. Candidates are reminded of the difference between experimental results and a conclusion.

(iii) Most candidates were able to relate oxidation state to the similarity in energy of the 4s and 3d subshells. Clarity in explaining the relationship between these subshells, successive electron loss and oxidation state, was only achieved by better candidates.

Question 32 – Forensic Chemistry

(a) (i) Most candidates could identify the technique.

(ii) Most candidates displayed some knowledge of the 'general idea' of how a mass spectrometer operates but did not provide enough detail of the features of its operation. Better responses included a clearly labelled diagram of a mass spectrometer.

(b) (i) Few responses showed the difference in the amino acid composition. Better responses clearly identified the differences with distinct comparisons using link words like 'whereas'. A large number of candidates just listed all the information provided including similarities.

(ii) Better responses provided information about the composition and structure of proteins as well as a function for the different types of protein. Mid-range responses provided information about either composition or structure. The lower-range responses identified only basic detail of either structure or composition or function.

(c) Most candidates did not provide distinguishing tests for both carbohydrates and metal ions. The better responses clearly outlined carbohydrate and metal ion tests both in the school and in the forensic laboratory, including specific examples. Their answers were structured and organised with clear headings to address each part of the question. Average responses outlined the school tests well but did not include a full outline of the forensic laboratory tests.

(d) (i) The better responses provided a clear general definition of chromatography. Most candidates answered in terms of a specific type of chromatography, eg gas–liquid chromatography.

(ii) Better responses clearly outlined the procedure used in school including specific equipment and results using a number of solvents and used clearly labelled diagrams to clarify the set-up. Candidates are reminded of the difference between experimental results and a conclusion.

(iii) Better responses clearly linked a reason for each precaution and gave a general explanation as to why they are all needed. A significant number of candidates confused contamination with preservation.

Chemistry

2004 HSC Examination Mapping Grid

Question	Marks	Content	Syllabus outcomes
Section I Part A			
1	1	9.3.5 column 2, dp 4	H9
2	1	9.3.4 column 2 dp 1	H2, H9
3	1	9.4.3 column 3 dp 1	H6, H8, H12
4	1	9.4.4 column 3 dp 2, 9.4.4 column 2 dp 9	H2, H9
5	1	9.3.4 column 2 dp 1	H1, H8
6	1	9.4.4 column 2 dp 1	H2, H6, H13
7	1	9.3.3 column 2 dp 5	H12, H14
8	1	9.4.4 column 2 dp 1	H2, H12
9	1	9.3.2 column 2 dp 6, 9.4.4 column 2 dp 6	H8, H12
10	1	9.3.2 column 2 dp 4	H8, H9
11	1	9.1 H12.3 (c), 9.2.3 column 2 dp 9	H3, H9, H12
12	1	9.4.4 column 2 dp 5	H8, H9
13	1	9.2.3 column 2 dp 9, 9.2.3 column 3 dp 6	H7, H8, H9, H12
14	1	9.2.4 column 2 dp 2, 9.2.4 column 3 dp 2	H6, H7, H8, H12
15	1	9.2.4 column 3 dp 3	H5, H7, H8, H12
Section I Part B			
16 (a)	3	9.3.4 column 3 dp3	H11, H13
16 (b)	2	9.3.4 column 2 dp 8 and 3 dp3	H10, H13
17 (a)	1	9.2.1 column 2 dp 7	H9, H13
17 (b)	3	9.2.1 column 2 dp 8	H3, H4, H9
17 (c)	1	9.2.1 column 2 dp 7	H9, H13
18	4	9.3.2 column 2 dp 1, dp 2	H2, H6, H8
19 (a)	3	9.2.4 column 2 dp1	H6, H10, H13
19 (b)	3	9.2.4 column 2 dp 1, H13.1 (d)	H10, H13

Question	Marks	Content	Syllabus outcomes
20 (a)	2	9.4.3 column 2 dp 2, 9.4.3 column 3 dp 5	H3, H7
20 (b)	4	9.1 H11.2 (c), 9.1 H12.4 (e)	H4, H11, H12, H14
21 (a)	2	9.4.5 column 3 dp 1	H11, H13
21 (b)	3	9.4.5 column 3 dp 2	H8, H12
21 (c)	2	9.4.5 column 2 dp 6	H4, H8, H13
22 (a)	1	9.3.4 column 2 dp 6	H8, H13
22 (b)	2	9.3.4 column 2 dp 6	H8, H13
23	3	9.3.1 column2 dp 2, 9.3.1 column 3 dp 1	H5, H11, H12, H14
24 (a)	1	9.3.3 column 2 dp 5	H10, H13
24 (b)	2	9.3.3 column 3 dp 5	H3, H4, H9, H13
24 (c)	2	9.3.3 column 2 dp 6	H8, H9, H10, H13
25	5	9.2.2 column 2 dp 1, 2, 9.2.3 column 2 dp 4, 9.4.1 column 2, 9.4.4 column2	H1, H3, H4, H5, H9, H13
26	4	9.2.5 column 3 dp 2, 9,2,5 column 2 dp 6	H3, H4, H13
27	7	9.4.4 column 2 all 9.4.4 column 3 dp 1	H1, H2, H3, H4, H5, H7, H8, H9
Section II **Question 28 — Industrial Chemistry**			
28 (a) (i)	1	9.5.3 column 2 dp 8, 9.5.3 column 3 dp3	H7, H12
28 (a) (ii)	3	9.5.2 column 2 dp 1, 9.5.3 column 2 dp4, 5, 9.5.3 column 3 dp 1	H1, H5, H7, H8
28 (b) (i)	2	9.5.5 column 2 dp 3, 5, 6	H4, H9
28 (b) (ii)	4	9.5.5 column 3 dp 5	H4, H5, H9
28 (c)	7	9.5.4 column 2 dp 2, 3, 9.5.6 column 2 dp 1, 3, 4, 9.5.6 column 3 dp 3	H1, H3, H4, H5, H7, H8, H10
28 (d) (i)	1	9.5.5 column 3 dp 3	H6, H9
28 (d) (ii)	3	9.5.5 column 3 dp 3	H11, H12
28 (d) (iii)	4	9.5.5 column 2 dp 2	H2, H5, H7, H8, H9
Section II **Question 29 — Shipwrecks, Corrosion and Conservation**			
29 (a) (i)	1	9.6.1 column 2 dp 1	H6
29 (a) (ii)	3	9.6.7 column 2 dp 2	H1, H5
29 (b) (i)	2	9.6.3 column 2 dp 1	H13

Question	Marks	Content	Syllabus outcomes
29 (b) (ii)	4	9.6.1 column 2 dp 4, 9.6.1 column 3 dp 1	H1, H2, H7, H8
29 (c)	7	9.6.4 column 3 dp 1	H1, H3, H4, H5, H6, H8
29 (d) (i)	1	9,6,2 column 2 dp 1	H8
29 (d) (ii)	3	9.6.5 column 3 dp 1, 9.6.5 column 2 dp 2	H11, H12
29 (d) (iii)	4	9.6.5 column 3 dp 1, 9.6.5 column 2 dp 2	H2, H3, H5, H7, H8, H12
Section II **Question 30 — The Biochemistry of movement**			
30 (a) (i)	1	9.7.10 column 3 dp 3	H9, H12
30 (a) (ii)	3	9.7.10 column 2 dp 2	H2, H7, H9
30 (b) (i)	2	9.7.5 column 2 dp 2, 3	H2, H9, H12
30 (b) (ii)	4	9.7.8 column 2 dp 1, 9.7.10 column 2 dp 1	H4, H5, H7, H14
30 (c)	7	9.7.8 column2 dp 4, 5, 9.7.9 column 2 dp 1,2,3,4, 9.7.9 column 2 dp 3 dp 1	H3, H7, H8, H9
30 (d) (i)	1	9.7.4 column 3 dp 2	H9
30 (d) (ii)	3	9.7.4 column 3 dp 2	H11, H12
30 (d) (iii)	4	9.7.4 column 3 dp 2, 9.7.4 column 2 dp 4	H4, H6, H8, H9, H12
Section II **Question 31 — The Chemistry of Art**			
31 (a) (i)	1	9.8.4 column 3 dp 1	H6
31 (a) (ii)	3	9.8.5 column 3 dp 1	H2, H6
31 (b) (i)	2	9.8.2 column 3 dp 2	H6, H12, H13
31 (b) (ii)	4	9.8.2 column 2 dp 5, 9.8.4 column 3 dp 4	H1, H2, H6, H12
31 (c)	7	9.8.1 column 3 dp 1	H4, H8, H9
31 (d) (i)	1	9.8.4 column 2 dp 2	H6
31 (d) (ii)	3	9.8.4 column 3 dp 2	H11, H12
31 (d) (iii)	4	9.8.4 column 2 dp 3	H6

Question	Marks	Content	Syllabus outcomes
Section II **Question 32 — Forensic Chemistry**			
32 (a) (i)	1	9.9.3 column 2 dp 6	H3, H6
32 (a) (ii)	3	9.9.5 column 2 dp 3	H3, H11
32 (b) (i)	2	9.9.3 column 2 dp 5, 9.9.3 column 3 dp 3	H8, H14
32 (b) (ii)	4	9.9.3 column 2 dp 3	H8, H9
32 (c)	7	9.9.1 column 3 dp 4, 9.9.2 column 3 dp 1, 9.9.6 column 3 dp 1	H2, H9, H11, H12
32 (d) (i)	1	9.9.3 column 3 dp 4, 9,9.3 column 2 dp 5	H6, H9
32 (d) (ii)	3	9.9.3 column 3 dp 4	H9, H11
32 (d) (iii)	4	9.9.1 column 2 dp 1	H4, H12

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NEW SOUTH WALES

2004 HSC Chemistry
Marking Guidelines

Section I, Part B

Question 16 (a)

Outcomes assessed: H11, H13

MARKING GUIDELINES

Criteria	Marks
• Correctly outlines the procedure for the preparation of a standard solution	2–3
• Identifies an essential aspect in the procedure to prepare a standard solution	1

Question 16 (b)

Outcomes assessed: H10, H13

MARKING GUIDELINES

Criteria	Marks
• Correctly calculates the mass of sodium hydrogen carbonate showing working	2
• Correctly calculates the moles of sodium hydrogen carbonate	1

Question 17 (a)

Outcomes assessed: H9, H13

MARKING GUIDELINES

Criteria	Marks
• Correctly identifies one of the monomers	1

Question 17 (b)

Outcomes assessed: H3, H4, H9

MARKING GUIDELINES

Criteria	Marks
• Links at least TWO properties to at least TWO uses for a named polymer (must be formed from the monomers given)	2–3
• Gives a correct use for a named polymer OR • Gives a correct property for a named polymer OR • Gives a correct property and correct use consistent with one of unnamed polymers	1

Question 17 (c)

Outcomes assessed: H9, H13

MARKING GUIDELINES

Criteria	Marks
• Correctly draws a polymer made from one of the monomers given	1

Question 18

Outcomes assessed: H2, H6, H8

MARKING GUIDELINES

Criteria	Marks
• Correctly describes the trends in acid–base behaviour of oxides of elements and relates this to the position of elements in the Periodic Table	4
• Correctly describes trends in acid–base behaviour of oxides of elements	3
• Provides two correct statements about acid–base behaviour of oxides of elements OR • Two correct equations	2
• Provides one correct statement about acid–base behaviour of oxides of elements	1

Question 19 (a)

Outcomes assessed: H6, H10, H13

MARKING GUIDELINES

Criteria	Marks
• States reason for the change in colour of the solution and the formation of the red-brown deposit • Provides a balanced oxidation–reduction equation, including states of matter	3
• States a reason for EITHER the change in colour of the solution OR the formation of the red-brown deposit • Provides a balanced oxidation–reduction including states of matter OR • States a reason for the change in colour of the solution AND the formation of the red-brown deposit	2
• Provides a balanced oxidation–reduction equation, including states of matter OR • States a reason for EITHER the change in colour of the solution OR the formation of the red-brown deposit	1

Question 19 (b)

Outcomes assessed: H10, H13

MARKING GUIDELINES

Criteria	Marks
• Correctly calculates the concentration of copper sulfate AND shows working	3
• Correctly calculates the moles of copper ions remaining in solution after the reduction	2
• Correctly calculates either the moles of $CuSO_4$ in solution initially or the moles of Cu metal deposited	1

Question 20 (a)

Outcomes assessed: H3, H7

MARKING GUIDELINES

Criteria	Marks
• Correctly identifies the purpose of the light source AND the purpose of the flame	2
• Correctly identifies the purpose of the light source OR • Correctly identifies the purpose of the flame	1

Question 20 (b)

Outcomes assessed: H4, H11, H12, H14

MARKING GUIDELINES

Criteria	Marks
• Describes how different parts of the procedure affect both validity AND reliability • Provides a judgement	4
• Describes how different parts of the procedure affect both validity AND reliability OR • Describes how different parts of the procedure affect validity OR reliability • Provides a judgement	2–3
• Makes a correct statement about validity OR reliability OR • Describes how one part of the procedure increases or decreases either validity or reliability OR • Identifies that absorbance = 0.64 is an outlier	1

Question 21 (a)

Outcomes assessed: H11, H13

MARKING GUIDELINES

Criteria	Marks
• Correctly distinguishes between the terms qualitative analysis and quantitative analysis	2
• Defines either qualitative analysis or quantitative analysis	1

Question 21 (b)

Outcomes assessed: H8, H12

MARKING GUIDELINES

Criteria	Marks
• Describes TWO factors that affect the concentrations of ions in natural bodies of water	2
• Describes a factor that affects the concentrations of ions in natural bodies of water OR • Identify two factors	1

Question 21 (c)

Outcomes assessed: H4, H8, H13

MARKING GUIDELINES

Criteria	Marks
• Correctly identifies the reagent and observation for each of the specified anions	3
• Correctly identifies all 3 reagents OR 3 correct observations OR • Correctly identifies 2 reagents and their observations	2
• Correctly identifies a reagent and observation for one of the anions OR • Correctly identifies two reagents	1

Question 22 (a)

Outcomes assessed: H8, H13

MARKING GUIDELINES

Criteria	Marks
• Correctly defines the term amphiprotic	1

Question 22 (b)

Outcomes assessed: H8, H13

MARKING GUIDELINES

Criteria	Marks
• Writes TWO correct chemical equations	2
• Writes ONE correct chemical equation OR • Writes TWO equations without solvent	1

Question 23

Outcomes assessed: H5, H11, H12, H14

MARKING GUIDELINES

Criteria	Marks
• Describes the properties of the indicator over the range of pH values (in acid, neutral and base) • Provides a judgement	3
• Describes the properties of the indicator over the range of pH values (in acid, neutral and base) but does not provide a judgement OR • Describes the properties of the indicator over range of pH values (in acid, neutral and base solutions) and provides a judgement which is inconsistent with the description, weak or unclear OR • Describes the properties of the indicator for some pH values and provides a consistent judgement	2
• Identifies that an indicator changes colour at different pH values of solutions being tested OR • Identifies that either ammonia or oven cleaner is basic OR • Identifies that lemon juice is a weak acid	1

Question 24 (a)

Outcomes assessed: H10, H13

MARKING GUIDELINES

Criteria	Marks
• Correctly calculates the pH or states correct equation with substitution of correct concentration	1

Question 24 (b)

Outcomes assessed: H3, H4, H9, H13

MARKING GUIDELINES

Criteria	Marks
• Relates the use of these acids as food additives to at least one property	2
• Gives a property of either acetic acid and citric acid and relates it to its use as a food additive OR • Gives a use of either acetic acid and citric acid as food additives OR • Gives a property of acetic acid and citric acid	1

Question 24 (c)

Outcomes assessed: H8, H9, H10, H13

MARKING GUIDELINES

Criteria	Marks
• Relates the differences in pH between the three solutions to variations in ionisation	2
• Relates the differences in pH between two solutions to variations in ionisation OR • Recognises that differences in pH are due to different H^+ ions concentration OR • Identifies that acetic acid and citric acid are weak acids and HCl is a strong acid	1

Question 25

Outcomes assessed: H1, H3, H4, H5, H9, H13

MARKING GUIDELINES

Criteria	Marks
• Explains the problems and benefits arising from the use of ethanol • Makes use of data from the table • Provides a judgement of the potential for ethanol to be used as an alternative fuel	4–5
• Describes the problems and benefits arising from the use of ethanol and uses data from the table AND makes use of data in table OR • Provides a judgement of the potential of ethanol as an alternative fuel	2–3
• Identifies one reason for the need for alternative fuels OR • Identifies one aspect of data in table with an advantage or disadvantage of ethanol	1

Question 26

Outcomes assessed: H3, H4, H13

MARKING GUIDELINES

Criteria	Marks
• Provides points for and/or against both the benefits and problems associated with the use of a named radioisotope in industry	4
• Describes a benefit and/or problem(s) associated with the use of a named radioisotope in industry OR • Describes benefits and problems in an industry for an incorrect isotope of the element (for 2 marks maximum)	2–3
• Identifies a benefit of a named radioisotope in industry/medicine OR • Identifies a problem of a named radioisotope in industry/medicine OR • Identifies a use of a named radioisotope in industry/medicine	1

Question 27

Outcomes assessed: H1, H2, H3, H4, H5, H7, H8, H9

MARKING GUIDELINES

Criteria	Marks
• Provides points for and/or against the uses of CFCs • Describes mechanism of ozone degradation by CFCs • Provides points for and against chemicals used as alternatives to CFCs, using data in the table and explains why they can be used as replacements • Provides a judgement about suitability of replacements	6–7
• Provides points for and/or against the uses of CFCs • Explains why other chemicals are used as replacements for CFCs, using data in the table • Provides a judgement about the suitability of replacements OR • Describes mechanism of ozone degradation by CFCs	4–5
• Describes the uses of CFCs and the problems associated with their use AND/OR • Describes alternatives to CFCs, using data in the table	2–3
• Identifies that CFCs destroy ozone in the stratosphere OR • Identifies what either HCFC or HFC stands for OR • Identifies one use of CFCs OR • Identifies one type of replacement chemical not in the table	1

Section II

Question 28 (a) (i)

Outcomes assessed: H7, H12

MARKING GUIDELINES

Criteria	Marks
• Identifies one safety precaution relevant to the dilution of concentrated sulfuric acid	1

Question 28 (a) (ii)

Outcomes assessed: H1, H5, H7, H8

MARKING GUIDELINES

Criteria	Marks
• Identifies a reaction in the Contact process • Provides a thorough description of how yield can be maximised • Writes a balanced equation for the reaction identified	2–3
• Correctly identifies how yield can be maximised OR • Correctly identifies one reaction	1

Question 28 (b) (i)

Outcomes assessed: H4, H9

MARKING GUIDELINES

Criteria	Marks
• States reasons for the cleaning action of anionic detergents	2
• Identifies the polar end of the detergent and that it is attracted to water OR • Identifies the non-polar end of the detergent and that it is attracted to grease/oil	1

Question 28 (b) (ii)

Outcomes assessed: H4, H5, H9

MARKING GUIDELINES

Criteria	Marks
• Discusses at least one environmental impact of each class of detergent • Provides a judgement about environment impact	4
• Describes at least one environmental impact for each of two classes of detergents • Provides a judgement	2–3
• States one correct environmental impact of detergents OR • States one property of one detergent class	1

Question 28 (c)

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

MARKING GUIDELINES

Criteria	Marks
• Describes the Solvay process and the production of sodium hydroxide • Discusses each site in relation to its suitability for each production process • Provides a judgement	6–7
• Outlines the Solvay process and the production of sodium hydroxide • Discusses two sites in relation to their suitability for each production process • Provides a judgement	4–5
• Outlines the Solvay process or the production of sodium hydroxide and relates this to the sites located on the map	2–3
• Outlines the Solvay process or the production of sodium hydroxide	1

Question 28 (d) (i)

Outcomes assessed: H6, H9

MARKING GUIDELINES

Criteria	Marks
• Correctly defines an emulsion	1

Question 28 (d) (ii)

Outcomes assessed: H11, H12

MARKING GUIDELINES

Criteria	Marks
• Correctly outlines the procedure used • States the results for the procedure used	2–3
• Partially outlines the procedure used	1

Question 28 (d) (iii)

Outcomes assessed: H2, H5, H7, H8, H9

MARKING GUIDELINES

Criteria	Marks
• Explains the difference between the industrial method of soap production and the production of soap in school laboratories	4
• Describes the industrial method of soap production and how soap is produced in a school laboratory • States a difference between the two methods	2–3
• Partially outlines the industrial method of soap production OR • Partially outlines the method of soap production used in school laboratories OR • States a difference between production of each	1

Question 29 (a) (i)

Outcomes assessed: H6

MARKING GUIDELINES

Criteria	Marks
• Correctly identifies one origin of minerals in oceans	1

Question 29 (a) (ii)

Outcomes assessed: H1, H5

MARKING GUIDELINES

Criteria	Marks
• Explains the damage that occurs when drying long-submerged wood artefacts • Relates the damage to the crystallisation of salts in the porous wood	2–3
• Identifies one correct aspect of the damage caused to wooden artefacts by drying	1

Question 29 (b) (i)

Outcomes assessed: H13

MARKING GUIDELINES

Criteria	Marks
• Correct half equations with anode/cathode correctly identified	2
• Two correct half equations or 1 correct half equation with correct electrode	1

Question 29 (b) (ii)

Outcomes assessed: H1, H2, H7, H8

MARKING GUIDELINES

Criteria	Marks
• Discusses Faraday's work and relates it to an impact	4
• Describes Faraday's work and attempts to relate it to an impact	2–3
• Provides a correct statement about Faraday's work OR • Identifies an impact	1

Question 29 (c)

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

MARKING GUIDELINES

Criteria	Marks
• Discusses the use of metals and alloys used in ship construction • Provides a judgement of how our increased knowledge of alloys and metals has influenced ship construction	6–7
• Describes the use of metals and alloys used in ship construction • Provides a judgement of how our increased knowledge of alloys and metals has influenced ship construction	4–5
• Outlines the use of metals and alloys in ship construction	2–3
• Identifies some metals or alloys used to construct a ship OR • Identifies an aspect of our increasing knowledge of metals and alloys	1

Question 29 (d) (i)

Outcomes assessed: H8

MARKING GUIDELINES

Criteria	Marks
• Correctly defines the term corrosion	1

Question 29 (d) (ii)

Outcomes assessed: H11, H12

MARKING GUIDELINES

Criteria	Marks
• Correctly outlines the procedure used • States the results for the procedure used	2–3
• Outlines the procedure used	1

Question 29 (d) (iii)

Outcomes assessed: H2, H3, H5, H7, H8, H12

MARKING GUIDELINES

Criteria	Marks
• Explains differences in corrosion of the two wrecks in the different environments and relates the corrosion rates to differing temperatures and oxygen concentrations	4
• Describes differences in the corrosion of the wrecks in the different environments • Identifies differences in temperature and/or oxygen concentration in the different environments • Explains one factor	2–3
• Identifies that the submerged wreck has corroded more slowly than the shoreline wreck OR • Indicates that the temperature or oxygen concentration is higher on land	1

Question 30 (a) (i)

Outcomes assessed: H9, H12

MARKING GUIDELINES

Criteria	Marks
• Correctly identifies lactic acid or 2–hydroxypropanoic acid	1

Question 30 (a) (ii)

Outcomes assessed: H2, H7, H9

MARKING GUIDELINES

Criteria	Marks
• Provides at least three points of similarity and/or difference between the formation of lactic acid by anaerobic respiration and the process of fermentation	3
• Provides one point of similarity or difference between anaerobic respiration and fermentation	2
• Identifies that fermentation is performed by yeast OR • Identifies that anaerobic respiration is performed by animals other than yeast OR • Identifies that lactic acid is produced from pyruvate in anaerobic respiration OR • Identifies that sugars are converted into ethanol during fermentation	1

Question 30 (b) (i)

Outcomes assessed: H2, H9, H12

MARKING GUIDELINES

Criteria	Marks
• Identifies both proteins and the metal ion	2
• Identifies one of protein *A*, protein *B* or metal ion *C*	1

Question 30 (b) (ii)

Outcomes assessed: H4, H5, H7, H14

MARKING GUIDELINES

Criteria	Marks
• Provides reasons why different energy sources are used in sprinting and light exercise • Identifies two non-oxygen/non-mitochondrial based systems of ATP production	4
• Describes different energy sources used in sprinting and light exercise • Identifies one non-oxygen/non-mitochondrial based system of ATP production	2–3
• Identifies that muscles only contain a limited amount of ATP OR • Identifies that the source of energy for all exercise is ATP OR • Identifies one non-oxygen/non-mitochondrial based system of ATP production	1

Question 30 (c)

Outcomes assessed: H3, H7, H8, H9

MARKING GUIDELINES

Criteria	Marks
• Discusses oxidative phosphorylation, including reference to the roles of cytochromes and oxygen • Provides a judgement of the importance of oxidative phosphorylation as an energy source	6–7
• Describes oxidative phosphorylation, including reference to the roles of cytochromes and oxygen OR • Describes oxidative phosphorylation • Provides a judgement of the importance of oxidative phosphorylation as an energy source	4–5
• Provides an outline of oxidative phosphorylation	2–3
• Identifies that oxygen accepts electrons and is reduced to water during oxidative phosphorylation OR • Identifies the role of cytochromes in oxidative phosphorylation OR • Identifies that oxidative phosphorylation produces ATP	1

Question 30 (d) (i)

Outcomes assessed: H9

MARKING GUIDELINES

Criteria	Marks
• Provides a correct definition	1

Question 30 (d) (ii)

Outcomes assessed: H11, H12

MARKING GUIDELINES

Criteria	Marks
• Correctly outlines the procedure used • States the results for the procedure used	2–3
• Outlines the procedure used	1

Question 30 (d) (iii)

Outcomes assessed: H4, H6, H8, H9, H12

MARKING GUIDELINES

Criteria	Marks
• Describes primary, secondary and tertiary structures of enzymes and relates a change in pH to the effect on all structures in enzymes	4
• Outlines primary, secondary and tertiary structures of enzymes • Outlines the effect of changes in pH on one enzyme structure	2–3
• Outlines the primary, secondary or tertiary structure of an enzyme OR • Outlines an effect of pH on an enzyme	1

Question 31 (a) (i)

Outcomes assessed: H6

MARKING GUIDELINES

Criteria	Marks
• Gives the correct configuration	1

Question 31 (a) (ii)

Outcomes assessed: H2, H6

MARKING GUIDELINES

Criteria	Marks
• Draws a correct structure, and explains the bonding	2–3
• Gives a correct structure or correctly describes the bonding	1

Question 31 (b) (i)

Outcomes assessed: H6, H12, H13

MARKING GUIDELINES

Criteria	Marks
• Draws a correctly labelled, energy level diagram	2
• Draws a basic energy level diagram	1

Question 31 (b) (ii)

Outcomes assessed: H1, H2, H6, H12

MARKING GUIDELINES

Criteria	Marks
• Correctly explains how the hydrogen emission spectrum led to the Bohr model, and points out limitations of the Bohr model	4
• Partially explains how the hydrogen emission spectrum led to the Bohr model, and points out limitations of the Bohr model	2–3
Gives one correct aspect of the Bohr model OR • A feature of the emission spectrum of H OR • A limitation of the Bohr Model	1

Question 31 (c)

Outcomes assessed: H4, H8, H9

MARKING GUIDELINES

Criteria	Marks
• Discusses potential health risks, and mentions relevant chemicals and their application by an ancient culture • Provides a judgement	6–7
• Describes potential health risks of chemicals found in cosmetics of an ancient culture	4–5
• Outlines potential health risks of chemicals found in cosmetics of an ancient culture	2–3
• Identifies one appropriate health risk of some chemicals in cosmetics OR • Identifies one correctly used cosmetic used by an ancient culture OR • Identifies a correct formula/name of an appropriate chemical causing a health risk in cosmetics	1

Question 31 (d) (i)

Outcomes assessed: H6

MARKING GUIDELINES

Criteria	Marks
• Gives the correct definition	1

Question 31 (d) (ii)

Outcomes assessed: H11, H12

MARKING GUIDELINES

Criteria	Marks
• Correctly outlines the procedure used • States the results for the procedure used	2–3
• Outlines the procedure used	1

Question 31 (d) (iii)

Outcomes assessed: H6

MARKING GUIDELINES

Criteria	Marks
• Explains that different oxidation states can arise from successive loss of *d* and *s* electrons, owing to the similarity in energy of valence *s* and *d* subshells	4
• Describes how the different oxidation states arise from successive loss of electrons	2–3
• Makes a correct statement about the oxidation states of the transition elements	1

Question 32 (a) (i)

Outcomes assessed: H3, H6

MARKING GUIDELINES

Criteria	Marks
• Correctly identifies the technique used to separate amino acids on the basis of their charge	1

Question 32 (a) (ii)

Outcomes assessed: H3, H11

MARKING GUIDELINES

Criteria	Marks
• Provides a description of how a mass spectrometer operates • Identifies the usefulness of the mass spectrometer	2–3
• Correctly identifies the usefulness of the mass spectrometer OR • Identifies one aspect of how a mass spectrometer operates	1

Question 32 (b) (i)

Outcomes assessed: H8, H14

MARKING GUIDELINES

Criteria	Marks
• Identifies two differences	2
• Identifies one difference	1

Question 32 (b) (ii)

Outcomes assessed: H8, H9

MARKING GUIDELINES

Criteria	Marks
• Describes the composition and structure of proteins • Relates differences in structure to differences in use eg globular; fibrous	4
• Describes the composition and structure of proteins OR • Outlines the composition and structure of proteins • Identifies one biological function of proteins other than in muscle contraction	2–3
• Identifies the major functional groups in amino acid OR • Draws the general formula for amino acids OR • Identifies one biological function of proteins other than in muscle contraction OR • Identifies that differences in the sequence of amino acids present in proteins (primary sequence) result in different properties	1

Question 32 (c)

Outcomes assessed: H2, H9, H11, H12

MARKING GUIDELINES

Criteria	Marks
Provides a judgement accompanied by a detailed description of the • Distinguishing tests for carbohydrates and metal ions used in the school laboratory • Technology used by forensic chemists in laboratories to distinguish carbohydrates and metal ions	6–7
• Describes distinguishing tests used in the school laboratory and technology used by forensic chemists in laboratories, to distinguish carbohydrates and metal ions • Provides a judgement	4–5
• Outlines distinguishing tests for carbohydrates and metal ions used in the school laboratory OR • Outlines technology used by forensic chemists in laboratories to distinguish carbohydrates and metal ions	2–3
• Identifies one test used in the school laboratory to distinguish carbohydrates OR • Identifies one test used in the school laboratory to distinguish metal ions OR • Identifies one type of technology used by forensic chemists in laboratories to distinguish carbohydrates OR • Identifies one type of technology used by forensic chemists in laboratories to distinguish metal ions OR • Identifies one type of technology used by forensic chemists in laboratories which is better than that in schools without reference to any group of compounds	1

Question 32 (d) (i)

Outcomes assessed: H6, H9

MARKING GUIDELINES

Criteria	Marks
• Correctly defines the term chromatography	1

Question 32 (d) (ii)

Outcomes assessed: H9, H11

MARKING GUIDELINES

Criteria	Marks
• Correctly outlines the procedure used • States the results for the procedure used	2–3
• Partially outlines the procedure used	1

Question 32 (d) (iii)

Outcomes assessed: H4, H12

MARKING GUIDELINES

Criteria	Marks
• Describes precautions used and explains why they are needed	4
• Outlines precautions used and states why they are needed	2–3
• Outlines a precaution used to prevent contamination OR • Outlines why precautions are needed	1