2007 HSC Notes from the Marking Centre Chemistry

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2007 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 contains comments on candidate responses to the 2007 Higher School Certificate examination, indicating the quality of the responses and highlighting their relative strengths and weaknesses.

This document should be read along with the relevant syllabus, the 2007 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 2007, approximately 10 300 candidates attempted the Chemistry examination. The most popular options were Industrial Chemistry (42.4%), Shipwrecks, Corrosion and Conservation (39.6%) and Forensic Chemistry (12%).

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, including the Prescribed Focus Area and the first-hand investigations. 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. It is important to understand that the Preliminary HSC course is assumed knowledge for the HSC course.

Teachers and candidates are reminded that mandatory skills content in Module 9.1 is examinable in both the Core and Option questions.

Teachers and candidates need to be reminded that the answer space provided and the marks allocated are guides to the maximum length of response required. Candidates should use examination time to analyse the question, plan their responses carefully, and then work within that framework to produce clear, logical and concise responses. The plan may include the use of dot points, diagrams and/or tables, and will help avoid internal contradictions. This is particularly so in holistic questions which need to be logical, well constructed and relevant to the questions asked.

Better responses indicate that candidates are following the instructions provided on the examination paper. In these responses, candidates:

- set out all working for numerical questions
- thought carefully about the units to be used and the quantities to be substituted into formulae
- did not repeat the question as part of the response

- looked at the structure of the whole question and noted that in some questions the parts follow on from each other, ie responses in part (a) lead to the required response in part (b) etc
- used appropriate equipment, for example, pencils and a ruler to draw graphs. (A clear plastic ruler would aid candidates to plot points that are further from the axes and rule straight lines of best fit where relevant.)
- accurately transcribed and used values from the periodic table and data sheet for calculations
- included balanced chemical equations where appropriate.

In Section II, 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. In part (b) of the 2007 Option questions, the best responses presented ideas coherently and included the correct use of scientific principles and ideas. Many candidates wrote a lot of information that was not relevant to the question. There was some indication that the concept of 'models' contributing to our understanding in Chemistry was not well understood. Candidates are strongly advised to answer the Option they have studied in class.

Section I – Core

Part A – Multiple-choice questions

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

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

Part B

Question 16

(b) Better responses explained the protective role ozone has in the stratosphere, often supporting their answer with an equation showing ozone absorbing ultraviolet radiation to form oxygen and the oxygen-free radical, thereby preventing skin cancers.

Question 17

(a) Better responses identified solutions 1 and 2 and wrote the correct balanced equation including the states of matter.

(b) Correct responses identified

Solution	Identity
1	sodium carbonate
2	hydrochloric acid
3	lead nitrate
4	barium nitrate

(c) Better responses identified the toxic nature of lead and therefore the danger of spraying it into the flame. Some responses also noted that hydrochloric acid would not produce a flame colour and a dangerous vapour would be produced if sprayed into a flame.

Question 18

The better responses described the role of a chemist in industry and used examples such as analytical, environmental or industrial chemists. They also described the chemical principle used by the chemist in their role.

Question 19

In the better responses, candidates demonstrated a thorough knowledge of both the characteristics of the respective radioisotopes and provided a link as to how these properties related to their use. Better responses included an appropriate evaluation. They also showed evidence of planning to ensure all aspects of the holistic question were attempted.

Question 20

(a) Weaker responses did not identify the electrode lead as the anode, instead referring to the oxidation equation.

(b) Better responses clearly linked the benefit to a property of lead or sulfuric acid. Weaker responses did not give a specific benefit, but rather general statements that could have many meanings, such as 'convenient and reliable'. The better responses explained such words in the context of their answers.

Question 21

(a) Better responses included clear working, showing the correct calculation of pH with the correct link to colour and recognition of successive ionization of diprotic acids, with suggestions of pH changes over a small range corresponding to ionization levels. Weaker responses provided intuitive guesses of colour without reference to pH and confused representations of log formula. Weaker responses included a simple statement of pH, without any working. They also ignored the need to double the acid concentration and double the pH value (based on acid concentration) to find the pH of H^+ in H_2SO_4.

(b) Better responses included clear recognition of the effect of dilution on pH.
Weaker responses included a simple pH statement with no colour or colour with no link to pH.

(c) Better responses included balanced equations, a clear statement of formulae and well set-out working. Weaker responses showed a lack of understanding of the mole relationship and a poor ability to balance equations. Mid-range responses included an understanding of the mole relationship, but lack of recognition of 2:1 mole ratio, along with limited working.

Question 22

(a) In better responses, candidates demonstrated the ability to manipulate parts per million calculations, determine moles from masses and molar mass then apply the gas/mole formula to determine gas volume. They included a clear recognition of the Sulfur Standard corresponding to the specific year, a clear understanding of parts per million in relation to determination of mass and clearly set-out working.

Weaker responses did not determine mass from parts per million and confused determination of moles using molar mass of SO_2 instead of sulfur. Mid-level responses included the use of an incorrect standard in the parts per million calculation and use of incorrect units in the answer.

(b) Better responses considered the consequences of high levels of sulfur, namely that SO_2 dissolves in water to create acid rain, which can have a negative impact on the environment. Better responses included a clear chemical link between SO_2 and acid rain with balanced equations, well-explained effects with supporting equations, such as reaction of acid on carbonates or metals, or impacts of specific pH on metabolic processes in living things, along with a clearly expressed evaluation of the Sulfur Reduction Policy. They often used headings to structure the response.

Weaker responses included the simple identification of an effect of SO_2 in the atmosphere. Mid-range responses included simple explanations of the effects of acid rain or SO_2 pollution without linking to the chemical reaction of SO_2 combining with water.

Question 23

The better responses correctly named both the products as well as clearly drawing their structural formulae that showed all bonds between atoms. These responses also identified the need for concentrated sulfuric acid. Weaker responses simply referred to sulfuric acid. Weaker responses also tended to refer to refluxing without identifying the need to heat.

Question 24

(a) The better responses plotted the points accurately by marking the point with a cross or circle and used a pencil and ruler to draw the line of best fit. They included scales that were linear and clearly labelled axes. Weaker responses did not correctly calculate the molecular weights.

(b)(i) The better responses clearly showed on the graph how the heat of combustion was calculated. The weaker responses determined an approximate value or did not include units.

(ii) Weaker responses did not give a chemical reason but tended to refer to non-standard conditions. They also tended to use the term burning rather than combustion.

Question 25

The better responses explained the amphiprotic nature of the hydrogen carbonate ion using correctly balanced equations. These equations showed an identified acid and base reacting with the hydrogen carbonate ion. The better responses also described other chemical properties that contributed to the effectiveness of the ion in neutralising both acidic and basic spills and included a judgment.

Mid-range responses referred to the hydrogen carbonate ion as amphiprotic but did not illustrate this using acid/base equations. They indicated that the hydrogen carbonate ion could neutralise acidic and basic spills but failed to expand on this. They did however identify other relevant chemical properties that made the ion suitable to the role. Weaker responses tended to focus solely on neutralising acid spills and identified sodium hydrogen carbonate as a weak base. Some weaker responses incorrectly referred to the hydrogen carbonate ion as a buffer.

Question 26

The better responses addressed the question being asked and identified a structural feature of each polymer. They related the feature to a property and linked that property to a use. Some responses described the formation of the polymer, which was not required by the question. Some better responses included a table and related structure to a property and to a use. They also drew the formulae correctly which assisted in demonstrating a clear understanding. The better responses were succinct and used the space allocated.

Weaker responses incorrectly stated that polystyrene was styrofoam and became confused in relating the function of the large side group to low density.

Weaker responses recited large volumes of information about the properties of polymers and their uses without directly relating one to the other. These responses did not addressed the question asked.

Question 27

(a) The better responses identified that the silver nitrate needed to be added in excess and that the precipitate had to be dried to constant mass. Better responses wrote the balanced equation. Weaker responses used extra space and referred to titrations and end points.

(b) Weaker responses rounded the answer too early or did not round it to the correct number of significant figures. Weaker responses were rewarded if they showed correct working in either calculating the correct mass of chlorine or the correct concentration in the 50 mL sample.

(c) Better responses clearly drew a relationship between chloride ion concentration and a specific effect on humans or the environment. The best responses explained the importance of determining the chloride ion concentration in a short statement.

Weaker responses often used general terms like ‘harmful’ or ‘dangerous’ without explaining further. Some weaker responses referred to the chloride ion having a large effect on the acidity of the sample being tested.

Section II – Options

General Comments

Part (e) of each question in the Section II Options related to first-hand investigations. Weaker responses to these questions suggested that some candidates had not performed the mandated first-hand investigations and therefore could not provide risks and procedures.

Specific Comments

Question 28 – Industrial Chemistry

(a) Better responses included identification of the conditions necessary for precipitation of sodium hydrogen carbonate. Weaker responses attempted to work out the overall equation from the information provided in the question which invariably resulted in an incorrect response.

(b) Weaker responses did not show an understanding of the whole NaOH production process. They demonstrated limited understanding of specific areas, but could not form coherent links between concepts.

Better responses addressed the chemistry involved in NaOH production, as well as the progression between methods quite well. They linked the concepts involved and logically and coherently developed their response.

Weaker responses only addressed the issues involved with changes to the processes, without adequately addressing the processes themselves. Some responses erroneously thought that the diaphragm and the membrane were a filtering device to separate NaOH from the brine, without understanding their significance in the production process. In a process that involves electrochemistry, weaker responses made little or no reference to the electrochemical nature of the NaOH production processes.

(i), (ii), (iii) The best responses included full workings to demonstrate how the value of each of the equilibrium concentrations was determined. The best responses recognised that the equilibrium position was not affected by the removing the solid sulfur. Weaker responses incorrectly included the concentration of the solid sulfur in the equilibrium expression.

(d) The best responses correctly identified the products of saponification (ie soap and glycerol). Weaker responses incorrectly identified detergent.

(e)(i) Better responses provided very good descriptions of physical models that modeled an equilibrium reaction. They also provided the result of their modeling.

(ii) Better responses identified a valid risk involved in a chemical reaction. For responses that presented a physical model, they demonstrated that after a risk assessment, no valid risks were involved in their procedure.

(iii) Better responses demonstrated how their procedure models equilibrium and clearly stated a limitation of the model.

Question 29 – Shipwrecks, Corrosion and Conservation

(a) (i) Better responses identified that graphite is inert/unreactive and mentioned its conductivity.

(ii) The better responses identified P as the cathode and wrote a suitable half-equation that showed the reduction of copper ions and did the same for the oxidation of water at the anode.

(b) The better responses indicated a thorough understanding of the chemistry related to the use of specific metals. They identified factors in aquatic environments and identified specific metals. The better responses indicated a link between the factors and the specific metals used and how they had changed over time.

Weaker responses did not focus on the choice of metals but included methods such as painting and impressed currents or listed the development of different methods of protection, which was not required by the question.

(c)(i) The better responses identified NaCl as the electrolyte.

(ii) The better responses identified the correct half-equation for the reduction of water and linked this to the pink colour in phenolphthalein due to the hydroxide ions and wrote an equation for the oxidation of Fe as the cause of the blue colour.

(iii) The better responses explained how the electrons from the Mg reduced any Fe ions formed to keep the nail intact.

(d) The better responses described impacts on society, not just uses.

(e) (i) The better responses identified the specific metals and solutions used. Weaker responses did not include results as part of the answer.

(ii) The better responses identified a specific risk, for example ‘acid is corrosive’.

(iii) Better responses identified the acidic environment and related their results from the first-hand investigation in part (e) (i) to why shipwrecks at great depth experience accelerated corrosion.

Question 30 – Biochemistry of Movement

(a) (i) Better responses identified mitochondria as the site while weaker candidates incorrectly identified the cytoplasm as the site.

(ii) Better responses accounted for the net production of ATP in glycolysis rather than just stating a net production of 2 ATP molecules. Some responses described in detail the total number of ATP produced in the aerobic respiration process, which was not required in the question.

(b) Better responses provided detailed descriptions of fats, carbohydrates and proteins and related the structures to chemical properties, including naming functional groups, and linking these to polarity and solubility. Some included accurate diagrams representing the monomer or polymer units or they named monomer and polymer units and the process of polymerization.

Mid-range responses gave adequate structural descriptions of fats, carbohydrates and proteins but did not provide strong links with the chemical properties or did not give clear indications on how models contribute to the understanding of structure and/or chemical properties.

Generally responses were stronger on providing structures of molecules and weaker on chemical properties. Weaker responses described the use of models or the historical development of models but did not provide any details of the structure of fats, carbohydrates and protein by making general statements.

(c) (i) The best responses named the substance as 2-hydroxypropanoic acid.

(ii) Better responses correctly drew the structures of the reactant and products and correctly balanced the equation. Weaker responses correctly wrote a balanced molecular equation but did not include a structural formula.

(iii) Better responses correctly stated that lactic acid caused a reduction in pH. The better responses described the effect as resulting in the inability of the muscles to contract.

(d) Better responses described aerobic respiration in detail, provided several features of type one muscles and explained the use of aerobic respiration in type one muscles. Mid-range responses outlined links between type one muscles and aerobic respiration. A small number of responses incorporated lactic acid into their responses, which was unnecessary.

(e) (i) The better responses correctly identified both the name of the enzyme and the substrate. Better responses provided a sufficiently detailed investigation that would test the effect of pH on the activity of enzymes. Some responses related this to the production of oxygen when hydrogen peroxide was used while a small number of responses drew a graph or provided numerical results in a tabulated format.

Weaker responses named the substance, which contained the enzyme, but not the name of the enzyme. A small number of weaker responses described an investigation not relevant to the question using temperature as the variable.

(ii) Better responses indicated the HCl was corrosive and could burn the skin.

(iii) Better responses gave detailed descriptions of enzymes using relevant bonds such as hydrogen bonding, disulfide links, electrostatic forces and the hydrophobic nature. They described the effect that a change of pH has on the shape of the enzyme in terms of their secondary and tertiary structures and related this to the change of activity of the enzyme. Weaker responses stated the change of shape of the enzyme and the loss of activity of the enzyme related to the change of shape, but didn't use specific terms such as the relevant bonding forces in the enzyme structure.

A number of responses described the lock and key model, though some did not relate this to the change of shape of the enzyme.

Question 31 – Chemistry of Art

(a) (i) Better responses determined the identity of the element from its orbital-spin diagram and demonstrated sound understanding of Hund's rule and the Pauli Exclusion Principle. Better responses successfully applied the rules to explain the configuration shown for iron. Weaker responses confused the two rules or answered generally without distinguishing the rules.

(ii) Better responses drew an orbital-spin diagram and showed that three electrons would be lost to form the ion. Weaker responses incorrectly showed removal of 3d electrons, rather than the 4s electrons and one 3d electron.

(b) Better responses used examples and clearly linked the use of the models to how they have improved our understanding of complex ions.

Weaker responses included unnecessary information about models and theories beyond the Lewis model and inclusion of this material often reduced the clarity of the responses.

(c) Better responses offered an explanation in terms of oxidation/reduction. Better responses used single-headed arrows and reversed the equation provided on the data sheet and identified an oxidant that could bring about the oxidation described.

(d) Better responses included the use of chemical names and formulae in examples. Better responses linked pigments with specific health effects.

Weaker responses stated that health concerns about some pigments that were once used were the reason they are no longer used today, for example in cosmetics.

(e) (i) Better responses identified the colour of the flame that would indicate strontium's presence.

(ii) Better responses identified a risk specific to the method they described in e (i).

(iii) Better responses explained how the flame colour of an ion was related to its emission spectra.

Question 32 – Forensic Chemistry

(a) (ii) Better responses identified the carbonyl group as the location of oxidation in the explanation of reducing sugars. Weaker responses indicated a lack of understanding of the glycosidic bond within sucrose and therefore the unavailability of the carbonyl group.

(b) Better responses showed a clear link between the analysis of DNA and its implications with a relevant evaluation. Weaker responses did not provide a description of the analysis of the DNA molecule and its link to the use.

(c) (ii) Better responses drew correct structural formulae with all reactants and products.

(iii) Better responses correctly linked an enzyme breaking the protein at a specific peptide bond.

(d) Better responses linked the features of mass spectrometry with its uses and the improvements it brings to forensic chemistry. These responses showed good understanding of the process of mass spectrometry. Weaker responses only provided descriptions of the features of mass spectrometry or generalised improvements.

(e) (i) Better responses provided a concise and accurate procedure that could be reproduced in the laboratory. Weaker responses provided a brief outline of the chromatography procedure.

(ii) Weaker responses provided a procedural error rather than a safety risk.

(iii) Better responses clearly explained how these properties were used in each separation process. Weaker responses could not distinguish between the two processes.

Chemistry

2007 HSC Examination Mapping Grid

Question	Marks	Content	Syllabus outcomes
Section I Part A			
1	1	9.2.3.2.4	H9
2	1	9.2.2.2.4	H9
3	1	9.2.4.2.5	H7
4	1	9.2.3.2.9, 13.1(d)	H9, H13
5	1	9.2.4.3.2, 9.2.4.3.4, 12.4(b)	H8, H12
6	1	9.3.1.2.2, 9.3.1.2.1	H6, H8
7	1	9.3.4.2.7, 12.3(c), 14.1(a)	H7, H12, H14
8	1	9.3.3.2.4, 9.3.3.2.5, 9.3.3.2.6, 14.1(f)	H8, H10, H14
9	1	9.3.3.2.2, 9.3.4.2.4	H8
10	1	9.3.3.2.5, 9.3.3.3.7, 12.4(b)	H10, H12
11	1	9.4.5.2.1, 14.1(g)	H8, H14
12	1	9.4.1.2.3	H8, H9
13	1	9.4.2.2.7, 9.4.2.2.9, 12.4(b)	H7, H8, H10, H12
14	1	9.4.3.2.2	H6
15	1	9.4.4.3.1, 14.1(g)	H6, H10, H14
Section I Part B			
16 (a)	1	9.4.4.2.1, 14.1(a)	H14
16 (b)	4	9.4.4.2.3, 14.1(g)	H4, H14
17 (a)	1	9.4.3.2.1, 9.4.3.3.1, 13.1(d)	H9, H10, H13
17 (b)	2	9.4.3.2.1, 9.4.3.3.1	H6, H9
17 (c)	1	9.4.3.3.1, 11.3(b)	H11
18	3	9.4.1.2.1	H5
19	7	9.2.5.2.5, 9.2.5.2.6, 9.2.5.3.2, 14.3(b)	H4, H8, H14

Question	Marks	Content	Syllabus outcomes
20 (a)	2	9.2.4.2.6, 13.1(d)	H7, H8, H10, H13
20 (b)	2	9.2.4.3.3	H3, H4
21 (a)	1	9.3.1.2.3, 9.3.3.2.3, 9.3.3.2.4, 9.3.3.2.5, 12.3(c), 12.4(b)	H10, H12
21 (b)	1	9.3.1.2.3, 9.3.3.2.5, 12.4(b), 14.1(a)	H10, H12, H14
21 (c)	3	9.3.4.3.3, 12.4(b), 13.1(d)	H10, H12, H13
22 (a)	3	9.3.2.2.7, 9.3.2.2.9, 12.4(b), 13.1(d)	H10, H12, H13
22 (b)	4	9.3.2.3.2, 9.4.4.2.2, 14.2(d), 14.1(g)	H14
23	3	9.3.5.2.1, 9.3.5.2.2, 9.3.5.2.4, 13.1(d)	H9, H10, H13
24 (a)	3	9.2.3.3.6, 12.3(c), 12.4(b), 13.1(f, g)	H7, H9, H13
24 (b) (i)	1	9.2.3.3.6, 12.3(c), 13.1(d)	H7, H9, H12, H13
24 (b) (ii)	1	9.2.3.3.6, 9.4.1.2.3, 14.1(d), 14.3(c)	H7, H9, H14
25	5	9.3.4.2.4, 9.3.4.2.6, 9.3.4.2.7, 9.3.4.3.5, 13.1(d)	H3, H7, H8, H10, H13
26	4	9.2.1.2.6, 9.2.1.2.7, 9.2.1.2.8, 9.2.1.3.3	H9
27 (a)	3	9.4.2.3.1, 9.4.5.3.1, 11.2(c)	H8, H10, H11
27 (b)	3	9.4.2.3.1, 9.4.5.3.1	H10, H12
27 (c)	2	9.4.5.1, 9.4.5.2.1, 9.4.5.3.3, 14.2(a)	H4, H14
Section II **Question 28 — Industrial Chemistry**			
28 (a) (i)	2	9.5.6.2.1, 9.5.6.2.3, 13.1(d)	H10, H13
28 (a) (ii)	2	9.5.6.2.3, 9.5.6.3.2, 14.1(d)	H7, H8, H10, H14
28 (b)	6	9.5.4.1.3, 9.5.4.2.2, 9.5.4.2.3, 14.3(b)	H1, H7, H8, H14
28 (c) (i)	1	9.5.2.2.2, 13.1(d)	H10, H13
28 (c) (ii)	2	9.5.2.2.2, 9.5.2.3.3, 12.4(b)	H10, H12
28 (c) (iii)	2	9.5.2.2.1, 9.5.2.3.2, 14.1(f)	H10, H14
28 (d)	4	9.5.5.2.3, 9.5.5.3.2, 9.5.5.3.5	H4, H9
28 (e) (i)	2	9.5.2.3.1, 11.2(a), 13.1(a)	H11, H13
28 (e) (ii)	1	9.5.2.3.1, 11.3(b)	H11

Question	Marks	Content	Syllabus outcomes
28 (e) (iii)	3	9.5.2.2.1, 9.5.2.3.1, 14.1(f), 14.3(c)	H10, H14
Section II **Question 29 — Shipwrecks, Corrosion and Conservation**			
29 (a) (i)	2	9.6.3.2.2	H8
29 (a) (ii)	2	9.6.3.2.1, 13.1(d)	H7, H13
29 (b)	6	9.6.5.2.1, 9.6.5.3.1, 9.6.2.2.3, 9.6.2.3.3, 14.3(b)	H3, H7, H8, H14
29 (c) (i)	1	9.6.1.2.3	H7
29 (c) (ii)	2	9.6.1.2.3, 9.6.4.2.2, 13.1(d)	H7, H13
29 (c) (iii)	2	9.6.4.2.4, 9.6.4.3.3, 14.1(g)	H7, H8, H14
29 (d)	4	9.6.1.2.2, 9.6.4.2.1, 9.6.4.2.2	H4, H7, H8
29 (e) (i)	2	9.6.6.3.1, 11.2(d), 13.1(a)	H11, H13
29 (e) (ii)	1	9.6.6.3.1, 11.3(b)	H11
29 (e) (iii)	3	9.6.6.2.1, 9.6.6.2.2, 9.6.6.2.3, 14.1(g)	H7, H14
Section II **Question 30 — The Biochemistry of movement**			
30 (a) (i)	2	9.7.1.2.5, 9.7.7.2.3, 12.3(c)	H9, H12
30 (a) (ii)	2	9.7.1.2.1, 9.7.7.2.2, 9.7.7.3.1	H10
30 (b)	6	9.7.2.2.2, 9.7.2.2.3, 9.7.2.3.1, 9.7.3.2.4, 9.7.3.2.5, 9.7.3.2.6, 9.7.3.3.1, 9.7.3.3.2, 9.7.4.2.4, 9.7.4.2.5, 9.7.4.2.6, 14.3(b)	H2, H7, H8, H9, H14
30 (c) (i)	1	9.7.10.3.3	H9
30 (c) (ii)	2	9.7.2.2.1, 9.7.10.2.2, 9.7.10.3.1, 13.1(d)	H9, H10, H13
30 (c) (iii)	2	9.7.10.2.2, 14.1(g)	H8, H14
30 (d)	4	9.7.5.2.1, 9.7.5.3.1, 9.7.8.1	H3, H8, H9
30 (e) (i)	2	9.7.4.2.7, 11.2(d), 13.1(a)	H11, H13
30 (e) (ii)	1	9.7.4.3.3, 11.3(b)	H11
30 (e) (iii)	3	9.7.4.2.5, 9.7.4.3.2, 9.7.4.2.7, 14.1(g)	H6, H14

Section II **Question 31 — The Chemistry of Art**			
31 (a) (i)	3	9.8.3.2.1, 9.8.3.2.2, 9.8.3.2.3, 9.8.3.2.4, 9.8.3.3.2, 9.8.4.3.1, 14.1(g)	H7, H14
31 (a) (ii)	1	9.8.3.3.1, 13.1(e)	H13
31 (b)	6	9.8.5.2.1, 9.8.5.2.2, 9.8.5.2.4, 9.8.5.3.1, 9.8.5.3.2, 14.3(b)	H2, H6, H7, H14
31 (c) (i)	1	9.8.4.2.4, 12.4(b)	H6, H12
31 (c) (ii)	2	9.8.4.2.5, 9.8.4.3.4, 14.1(g)	H8, H14
31 (c) (iii)	2	9.8.4.3.3, 13.1(d)	H10, H13
31 (d)	4	9.8.1.2.1, 9.8.1.2.7, 9.8.1.3.2	H4, H6
31 (e) (i)	2	9.8.2.2.1, 9.8.2.3.1, 11.2(d)	H11
31 (e) (ii)	1	9.8.2.2.2, 9.8.2.2.3, 9.8.2.2.4, 11.3(b)	H11
31 (e) (iii)	3	9.8.2.3.1, 14.1(g)	H6, H14
Section II **Question 32 — Forensic Chemistry**			
32 (a) (i)	1	9.9.2.2.1, 9.9.2.3.2	H9
32 (a) (ii)	3	9.9.2.2.2, 9.9.2.2.3, 14.1(g)	H9, H10, H14
32 (b)	6	9.9.4.2.1, 9.9.4.2.2, 9.9.4.2.3, 9.9.4.3.1, 14.3(b)	H4, H8, H14
32 (c) (i)	1	9.9.3.2.3, 13.1(d)	H9, H13
32 (c) (ii)	2	9.9.3.2.3, 9.9.3.2.4, 13.1(e)	H9, H10, H13
32 (c) (iii)	2	9.9.3.2.4, 9.9.3.3.1	H8, H9
32 (d)	4	9.9.1.2.5, 9.9.5.2.3, 9.9.5.3.1	H3, H4, H6
32 (e) (i)	2	9.9.3.2.5, 9.9.3.3.3, 9.9.3.3.4, 11.2(d)	H8, H11
32 (e) (ii)	1	9.9.3.3.4, 13.1(b)	H11
32 (e) (iii)	3	9.9.3.2.5, 9.9.3.3.3, 9.9.3.3.4, 9.9.3.3.5, 14.1(a)	H8, H14

BOARD OF STUDIES
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2007 HSC Chemistry Marking Guidelines

Section I, Part B

Question 16 (a)

Outcomes assessed: H14

MARKING GUIDELINES

Criteria	Marks
• Correctly identifies *X* and *Y*	1

Question 16 (b)

Outcomes assessed: H4, H14

MARKING GUIDELINES

Criteria	Marks
• Identifies correct effects for layer X and Y • Gives relevant explanations	4
• Identifies correct effects for layer X and Y • Gives a relevant explanation	3
• Identifies correct effect • Gives a relevant explanation OR • Identifies correct effects	2
• Identifies a correct effect or gives a relevant explanation	1

Question 17 (a)

Outcomes assessed: H9, H10, H13

MARKING GUIDELINES

Criteria	Marks
• Writes correctly balanced equation with correct states of matter	1

Question 17 (b)

Outcomes assessed: H6, H9

MARKING GUIDELINES

Criteria	Marks
• Correctly identifies four solutions (formula or name)	2
• Correctly identifies two solutions (formula or name)	1

Question 17 (c)

Outcomes assessed: H11

MARKING GUIDELINES

Criteria	Marks
• Gives a correct explanation for lead solution or HCl solution	1

Question 18

Outcomes assessed: H5

MARKING GUIDELINES

Criteria	Marks
• Provides features and characteristics of the role and principle used by a chemist	3
• States role and principle used by a chemist	2
• States either role or principle used by a chemist	1

Question 19

Outcomes assessed: H4,H8, H14

MARKING GUIDELINES

Criteria	Marks
• Demonstrates a thorough knowledge and understanding of a named radioisotope and its use in industry and a named radioisotope and its use in medicine • Describes the use in industry and medicine of the named radioisotopes • Shows the link between the described properties of the radioisotopes and their use in industry and medicine • Describes the benefits and problems of their use on society • Provides a judgement • Demonstrates coherence and logical progression and includes correct use of scientific principles and ideas	6-7
• Demonstrates a sound knowledge and understanding of named radioisotopes • Outline the use in industry and medicine of the named radioisotopes • Describes the properties of the radioisotopes • Outlines the benefits and problems of their use	4-5
• Demonstrates an understanding of a named radioisotope • Identifies the use in industry or medicine of a named radioisotope • Outlines the property of the radioisotope • Outlines the benefit(s) and/or problem(s) of its use	2-3
• Identifies a radioisotope used in medicine/industry OR • Identifies a benefit or problem of the use of a radioisotope OR • Identifies a property of a radioisotope	1

Question 20 (a)

Outcomes assessed: H7, H8, H10, H13

MARKING GUIDELINES

Criteria	Marks
• Identifies the anode • Writes the balanced equation	2
• Identifies the anode or writes the balanced equation	1

Question 20 (b)

Outcomes assessed: H3, H4

MARKING GUIDELINES

Criteria	Marks
• Identifies a benefit and gives a reason why it is a benefit	2
• Outlines a reason OR • Identifies a benefit	1

Question 21 (a)

Outcomes assessed: H10, H12

MARKING GUIDELINES

Criteria	Marks
• Identifies the colour of the indicator with working shown	1

Question 21 (b)

Outcomes assessed: H10, H12, H13

MARKING GUIDELINES

Criteria	Marks
• Correctly calculates the pH of the diluted H_2SO_4 solution and relates to the cabbage indicator colour	1

Question 21 (c)

Outcomes assessed: H10, H12, H13

MARKING GUIDELINES

Criteria	Marks
• Correctly calculates the volume of KOH showing working	3
• Correctly calculates the number of moles of KOH	2
• Correctly calculates the number of moles of H_2SO_4 via either method OR • Writes balanced equation OR • Identifies 2:1 mole ratio of base to acid OR • Makes 2 errors but applies basic titration calculation	1

Question 22 (a)

Outcomes assessed: H10, H12, H13

MARKING GUIDELINES

Criteria	Marks
• Correctly calculates volume of $SO_2 (2.3L)$ showing working	3
• Uses correct method but has one error eg. Incorrect mols, incorrect diesel standard	2
• Correctly calculates mass of sulfur OR • Uses correct method but has two errors OR • Writes correct equation	1

Question 22 (b)

Outcomes assessed: H14

MARKING GUIDELINES

Criteria	Marks
• Makes a value judgement on the effect of the policy on the environment • Identifies AND explains effects	3–4
• Identifies AND explains an effect OR • Identifies effects	2
• Identifies an effect	1

Question 23

Outcomes assessed: H9, H10, H13

MARKING GUIDELINES

Criteria	Marks
• States concentrated H_2SO_4 • States reflux conditions • Names TWO products and gives correct structural formula for ester and formula for water	3
• States concentrated H_2SO_4 • States reflux conditions • Gives correct name OR structure of the ester OR • Names TWO products and gives correct structural formula for ester and formula for water	2
• Gives correct name of ester OR • States concentrated H_2SO_4 OR • States reflux conditions OR • Gives correct structural formula of the ester	1

Question 24 (a)

Outcomes assessed: H7, H9, H12, H13

MARKING GUIDELINES

Criteria	Marks
• Selects appropriate *X* and *Y* scales • Correctly labels *Y* axis • Correctly determines molecular weights • Correctly plots heat of combustion vs molecular weight and draws the line of best fit	3
• Selects appropriate *X* and *Y* scales • Correctly labels *Y* axis • Correctly determines all molecular weights	2
• Selects appropriate *X* and *Y* scales OR • Correctly calculates molecular weight OR • Shows correct molecular weights with incorrect plot of heat of combustion OR • Includes incorrect molecular weights on C1, C2, … with correct heats of combustion plotted	1

Question 24 (b) (i)

Outcomes assessed: H7, H9, H12, H13

MARKING GUIDELINES

Criteria	Marks
• Determines the correct heat of combustion for MW = 60 (using their graph)	1

Question 24 (b) (ii)

Outcomes assessed: H7, H9, H14

MARKING GUIDELINES

Criteria	Marks
• Puts forward a valid chemical reason other than heat loss to explain the difference in the two values	1

Question 25

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

MARKING GUIDELINES

Criteria	Marks
• Identifies HCO_3^- ion as being an amphiprotic substance • Demonstrates an understanding of amphiprotic/amphoteric nature • Provides a judgement about effectiveness of HCO_3^- in cleaning up acidic and basic chemical spills • Writes balanced chemical equations to show HCO_3^- ion acting – as a proton donor – as a proton acceptor • States the effect of neutralization • Justifies its effectiveness to neutralise chemical spills	4-5
• Demonstrates an understanding of amphiprotic/amphoteric nature • Provides judgement about effectiveness of HCO_3^- in cleaning up acidic and basic chemical spills (can be in form of an equation clearly identifying it acting as acid or base)	2-3
• Defines the word amphiprotic/amphoteric OR • Identifies HCO_3^- ion as being amphiprotic OR • Provides a relevant property of HCO_3^- in terms of effectiveness OR • States that HCO_3^- can neutralise both acids and bases OR • Writes one correct relevant balanced equation	1

Question 26

Outcomes assessed: H9

MARKING GUIDELINES

Criteria	Marks
• Draws correct structure of each polymer unit • Identifies a property related to each structure • Identifies a use of each polymer related to the above properties	4
• Draws correct structure of each polymer unit • Identifies a property related to one structure • Identifies a use related to above property	2–3
• Draws a correct structure of either polymer unit OR • Identifies a property related to one polymer • Identifies a use related to above property	1

Question 27 (a)

Outcomes assessed: H8, H10, H11

MARKING GUIDELINES

Criteria	Marks
• Recognises that $AgNO_3$ is added in excess to the water sample • Writes correct balanced equation • AgCl precipitate filtered, dried and weighed • Mass of AgCl can be used to calculate mass of Cl^- ions • Ag^+ ions react with Cl^- ions to form a precipitate	3
• THREE of the above points	2
• ONE of the above points	1

Question 27 (b)

Outcomes assessed: H10, H12

MARKING GUIDELINES

Criteria	Marks
• Calculates correct concentration of chloride ions in ppm to three significant figures	3
• Calculates correct mass of chloride in water sample	2
• Calculates correct formula mass for AgCl	1

Question 27 (c)

Outcomes assessed: H4, H14

MARKING GUIDELINES

Criteria	Marks
• Relates a high concentration of Cl^- ions in water to a negative effect on society or the environment	2
• Identifies need to provide safe water for humans or to protect the habitat of other organisms	1

Section II

Question 28 (a) (i)

Outcomes assessed: H10, H13

MARKING GUIDELINES

Criteria	Marks
• Recognises and names the industrial process correctly • Writes a correctly balanced equation (states of matter not important)	2
• Recognises and names the industrial process correctly OR • Writes a correctly balanced equation (states of matter not important)	1

Question 28 (a) (ii)

Outcomes assessed: H7, H8, H10, H14

MARKING GUIDELINES

Criteria	Marks
• Provides the features of the separation that is based on differing solubilities • Includes reducing the temperature with $NaHCO_3$ precipitating and NH_4Cl remaining in solution	2
• Outlines the separation that is based on differing solubilities	1

Question 28 (b)

Outcomes assessed: H1, H7, H8, H14

MARKING GUIDELINES

Criteria	Marks
• Describes the three processes • Identifies reasons/factors that led to changes in the production process of sodium hydroxide • Relates the implications of the factors to the change in production process • Demonstrates coherence and logical progression and includes correct use of scientific principles and ideas	5-6
• Outlines the processes • Outlines reasons for a change in the production process	3-4
• Outlines the process(es) AND/OR • Provides reason(s) for a change in the production process	1-2

Question 28 (c) (i)

Outcomes assessed: H10, H13

MARKING GUIDELINES

Criteria	Marks
• Correctly writes the equilibrium constant expression	1

Question 28 (c) (ii)

Outcomes assessed: H10, H12

MARKING GUIDELINES

Criteria	Marks
• Calculate the correct equilibrium concentrations of H_2S and SO_2 • Correctly determine the equilibrium constant value	2
• Calculates the correct equilibrium concentrations of H_2S and SO_2	1

Question 28 (c) (iii)

Outcomes assessed: H10, H14

MARKING GUIDELINES

Criteria	Marks
• Correctly identifies all FOUR factors	2
• Correctly identifies any TWO factors	1

Question 28 (d)

Outcomes assessed: H4, H9

MARKING GUIDELINES

Criteria	Marks
• Outlines the use of saponification products • Provides the features and characteristics of the impact that the products have had on society and the environment	3-4
• States the use of saponification products • Outlines the impact that the products have had on society or environment	2
• Identifies an impact of the products OR • Outlines the use of the saponification products	1

Question 28 (e) (i)

Outcomes assessed: H11, H13

MARKING GUIDELINES

Criteria	Marks
• Sketches in general terms the procedure used and results obtained	2
• Sketches in general terms EITHER the procedure OR results	1

Question 28 (e) (ii)

Outcomes assessed: H11

MARKING GUIDELINES

Criteria	Marks
• Identifies a valid risk consistent with investigation	1

Question 28 (e) (iii)

Outcomes assessed: H10, H14

MARKING GUIDELINES

Criteria	Marks
• Provides features that show how the procedure model's equilibrium • Provides a limitation of the model	3
• Outlines features that show how the procedure model's equilibrium • Provides a limitation	2
• Outlines features that show how the procedure model's equilibrium OR • Provides a limitation	1

Question 29 (a) (i)

Outcomes assessed: H8

MARKING GUIDELINES

Criteria	Marks
• Shows that graphite is an electrical conductor but is not a participant in the chemical reaction	2
• Identifies graphite as an inert electrode OR • States that graphite does not participate in the reaction OR • Identifies graphite as a conductor	1

Question 29 (a) (ii)

Outcomes assessed: H7, H13

MARKING GUIDELINES

Criteria	Marks
• Identifies anode *Q* and cathode *P* • Writes correct anodic and cathodic half equations	2
• Writes half equation correctly for oxidation of water or reduction of copper OR • Identifies both products (Cu(*s*) and $O_2(g)$) OR • States that copper ions are reduced and water is oxidised	1

Question 29 (b)

Outcomes assessed: H3, H7, H8, H14

MARKING GUIDELINES

Criteria	Marks
• Describes the choice of metals used in the construction of vessels over time • Identifies the corrosive factors of aquatic environments • Relates the implications of the aquatic environment to the choice of metals used over time • Demonstrates coherence and logical progression and includes correct use of scientific principles and ideas	5–6
• Outlines the choice of metals used in the construction of vessels over time • Identifies the corrosive factors of aquatic environments	3–4
• Identifies the choice of metals used in vessels over time AND • Identifies the corrosive factors of aquatic environments OR • Outlines the choice of metals in construction	2
• Identifies the choice of metals used in vessels over time OR • Identifies the corrosive factors of aquatic environments	1

Question 29 (c) (i)

Outcomes assessed: H7

MARKING GUIDELINES

Criteria	Marks
• Provides correct reason for the mixture containing NaCl(aq)	1

Question 29 (c) (ii)

Outcomes assessed: H7, H13

MARKING GUIDELINES

Criteria	Marks
• Writes half equations to explain the presence of the blue and pink colours respectively	2
• Writes a correct half equation to explain one colour OR • States that phenolphthalein indicates presence of OH^- ions	1

Question 29 (c) (iii)

Outcomes assessed: H7, H8, H14

MARKING GUIDELINES

Criteria	Marks
• Shows the way in which Mg behaves as a sacrificial anode for the iron nail protection • Identifies that Mg/Mg^{2+} couple has lower electrode potential or Mg is more reactive than iron	2
• Identifies Mg is a more reactive metal than Fe OR • Outlines the way in which Mg protects the iron nail as a sacrificial anode	1

Question 29 (d)

Outcomes assessed: H4, H7, H8

MARKING GUIDELINES

Criteria	Marks
• Outlines the work of early scientists that has increased our understanding of electron transfer reactions • Provides features and characteristics of the impact that this work has had on society	3-4
• States the work of an early scientist that has increased our understanding of electron transfer reactions OR • Provides TWO clearly stated impacts with no scientists mentioned OR • Outlines the impact that this work has had on society	2
• Identifies the work of an early scientist and relates it to electron transfer reaction OR • Identifies an impact of electron transfer reactions on society OR • Identifies a product and a process/or two products/ or two processes based on electron transfer reactions	1

Question 29 (e) (i)

Outcomes assessed: H11, H13

MARKING GUIDELINES

Criteria	Marks
• Sketches in general term the relevant procedure or investigation identifying different conditions • Sketches in general terms the results obtained	2
• Sketches in general terms the procedure OR • Sketches in general terms the results obtained	1

Question 29 (e) (ii)

Outcomes assessed: H11

MARKING GUIDELINES

Criteria	Marks
• Identifies a risk consistent with investigation	1

Question 29 (e) (iii)

Outcomes assessed: H7, H14

MARKING GUIDELINES

Criteria	Marks
• Draws conclusion by relating results of investigation to accelerated corrosion of shipwrecks at depth • Shows how acidic microenvironment occurs at great depth • Writes one relevant equation for corrosion at great depth	3
• Draws conclusion by relating results to accelerated corrosion of shipwrecks at depth AND EITHER • Shows how acidic microenvironments occur OR • Writes one relevant equation for corrosion at great depth	2
• Identifies organisms relevant to acidic microenvironments OR • Relates accelerated corrosion rate to low pH environment OR • Draws conclusion relating results of experiment to corrosion of iron	1

Question 30 (a) (i)

Outcomes assessed: H9, H12

MARKING GUIDELINES

Criteria	Marks
• Correctly identifies *W* • Names the site where the product of glycolysis undergoes oxidation to form Acetyl–CoA	2
• Correctly identifies *W* OR • Names the site where the product undergoes oxidation to form Acetyl–CoA	1

Question 30 (a) (ii)

Outcomes assessed: H10

MARKING GUIDELINES

Criteria	Marks
• Names the molecular form in which energy is stored • States reasons for the overall number of molecules produced during glycolysis	2
• Provides either one of above	1

Question 30 (b)

Outcomes assessed: H2, H7, H8, H9, H14

MARKING GUIDELINES

Criteria	Marks
• Describes the structure and chemical features of carbohydrates, fats and proteins • Identifies features of models that contribute to an understanding of the structure • Relates the features of models to the structure which show how models contribute to an understanding of the chemical properties • Demonstrates coherence and logical progression and includes correct use of scientific principles and ideas	5–6
• Outlines the structure and chemical features of carbohydrates, fats and proteins • Identifies features of models that contribute to an understanding of structure	3–4
• Outlines the structure and chemical features of carbohydrates and/or fats and/or proteins AND/OR • Identifies how models contribute to an understanding of the structure or chemical properties	1–2

Question 30 (c) (i)

Outcomes assessed: H9

MARKING GUIDELINES

Criteria	Marks
• Provides a correct IUPAC name	1

Question 30 (c) (ii)

Outcomes assessed: H9, H10, H13

MARKING GUIDELINES

Criteria	Marks
• Writes correct balanced equation using structural formulae	2
• Writes correct balanced equation using molecular formulae	1

Question 30 (c) (iii)

Outcomes assessed: H8, H14

MARKING GUIDELINES

Criteria	Marks
• Shows that an increase in lactic acid lowers pH of the muscle which reduces capacity of the muscle to contract	2
• Identifies that an increase in lactic acid lowers the pH of the muscle OR an increase in lactic acid reduces the capacity of the muscle to contract	1

Question 30 (d)

Outcomes assessed: H3, H8, H9

MARKING GUIDELINES

Criteria	Marks
• Provides features and characteristics of aerobic respiration • Shows how this knowledge has increased our understanding of muscle activity during gentle exercise	3-4
• Outlines aerobic respiration or muscle activity during gentle exercise • Shows a link between aerobic respiration and muscle activity during gentle exercise	2
• Outlines requirements of aerobic respiration OR • Outlines muscle activity during gentle exercise	1

Question 30 (e) (i)

Outcomes assessed: H11, H13

MARKING GUIDELINES

Criteria	Marks
• Sketches in general terms the procedure used and results obtained	2
• Sketches in general terms EITHER the procedure OR results	1

Question 30 (e) (ii)

Outcomes assessed: H11

MARKING GUIDELINES

Criteria	Marks
• Identifies a risk consistent with their investigation	1

Question 30 (e) (iii)

Outcomes assessed: H6, H14

MARKING GUIDELINES

Criteria	Marks
• Identifies that a change in pH changes shape of enzyme • States that secondary and tertiary structures are broken • Identifies that increased H^+ affects forces holding structure (any 3 of the following): – H-bonds – electrostatic forces – S-S bridges – hydrophobic • Links enzyme not functioning to structure	3
• Identifies that a change in pH changes shape of enzyme • As for 1 but only mentions 2 forces holding shape • States that enzymes don't function because of change in structure	2
• Identifies that a change in pH changes the shape of the enzyme OR • States that secondary and/or tertiary structure are broken	1

Question 31 (a) (i)

Outcomes assessed: H7, H14

MARKING GUIDELINES

Criteria	Marks
• Identifies element • States Pauli's exclusion principle and Hund's rule • Uses rules to show how the arrangement of electrons occurs	3
• Identifies element • Shows how the electron arrangement occurs in terms of one of the above rules OR • States both Pauli's exclusion principle and Hund's rule OR • Demonstrates how electron arrangement occurs in basic terms for both rules	2
• Identifies element OR • States either Pauli's exclusion principle or Hund's rule OR • Applies basic understanding of Hunds Rule and Pauli's Exclusion Principle to the electronic configuration	1

Question 31 (a) (ii)

Outcomes assessed: H13

MARKING GUIDELINES

Criteria	Marks
• Draws a correct diagram to represent the ion	1

Question 31 (b)

Outcomes assessed: H2, H6, H7, H14

MARKING GUIDELINES

Criteria	Marks
• Draws two or more Lewis structures to model the relationship between ligands and cations for specific examples of complex ions • Relates the use of Lewis models to the development of our understanding of complex ions • Demonstrates coherence and logical progression and includes correct use of scientific principles, and ideas	5–6
• Draws and names the Lewis structure of a complex ion • Identifies the use of Lewis models in the development of our understanding of complex ions	3–4
• Identifies a complex ion AND/OR • Identify features of complex ions formed by transition metals AND/OR • Identifies how Lewis models contribute to an understanding of complex ions	1–2

Question 31 (c) (i)

Outcomes assessed: H6, H12

MARKING GUIDELINES

Criteria	Marks
• Provides correct oxidation states for identified species	1

Question 31 (c) (ii)

Outcomes assessed: H8, H14

MARKING GUIDELINES

Criteria	Marks
• Correctly identifies MnO_4^- and shows why, by including a definition of oxidation	2
• Correctly identifies MnO_4^- OR • Defines oxidation	1

Question 31 (c) (iii)

Outcomes assessed: H10, H13

MARKING GUIDELINES

Criteria	Marks
• Writes a correctly balanced half equation • Provides an example of an oxidising agent that could drive this reaction	2
• Provides an example of an oxidising agent that could drive this reaction OR • Writes a correctly balanced half equation	1

Question 31 (d)

Outcomes assessed: H4, H6

MARKING GUIDELINES

Criteria	Marks
• Provides features and characteristics of the chemistry of pigments used by an ancient culture • Shows how this understanding has influenced the way they are used today	3-4
• Outlines the chemistry of pigments used by an ancient culture • States how the pigment is used today	2
• Outlines the chemistry of TWO pigments used by a named culture OR • Outlines the chemistry of a pigment used by an ancient culture • Accounts for a change in the way pigments use is based on a relevant property	1

Question 31 (e) (i)

Outcomes assessed: H11

MARKING GUIDELINES

Criteria	Marks
• Sketches in general terms the procedure used to identify Sr^{2+} ions • Identifies the colour of the Sr^{2+} ion from a flame test	2
• Sketches in general terms the procedure used to identify Sr^{2+} ions OR • Identifies the colour of the Sr^{2+} ion from a flame test	1

Question 31 (e) (ii)

Outcomes assessed: H11

MARKING GUIDELINES

Criteria	Marks
• Identifies a risk consistent with investigation	1

Question 31 (e) (iii)

Outcomes assessed: H6, H14

MARKING GUIDELINES

Criteria	Marks
• Shows how flame colour relates to electron excitation and emission by stating – electron excitation – quantum drop – quanta released to specific EM wave length – flame colour observed is a mixture of these wavelengths	3
• Shows how flame colour relates to electron excitation and emission by stating THREE of – electron excitation – quantum drop – quanta released to specific EM wave length – flame colour observed is a mixture of these wavelengths	2
• Shows how flame colour relates to electron excitation and emission by stating TWO of – electron excitation – quantum drop – quanta released to specific EM wave length – flame colour observed is a mixture of these wavelengths	1

Question 32 (a) (i)

Outcomes assessed: H9

MARKING GUIDELINES

Criteria	Marks
• Writes correct molecular formula	1

Question 32 (a) (ii)

Outcomes assessed: H9, H10, H14

MARKING GUIDELINES

Criteria	Marks
• Names glucose as the other monomer • Identifies that both glucose and fructose have a reactive carbonyl group (C=O) which is readily oxidized • Identifies that in sucrose the two carbonyl groups of the linking monosaccharides have joined to form the glycosidic bond	3
• Identifies glucose as the other monomer • Identifies that both glucose and fructose have a reactive carbonyl group (–C=O) OR • Identifies glucose as the other monomer • Identifies that in sucrose the two carbonyl groups of the linking monosaccharides have joined to form the glycosidic bond	2
• Provides one of the above	1

Question 32 b

Outcomes assessed: H4, H8, H14

MARKING GUIDELINES

Criteria	Marks
• Identifies the section of DNA molecule that makes it unique to individuals • States how it can be analysed and linked to individuals • Describes the use of DNA as an identification molecule • Describes the implications for society of the use of DNA as an identification molecule • Makes a judgement of the implications for society • Demonstrates coherence and logical progression and includes correct use of scientific principles and ideas	5–6
• Outlines the use of DNA as an identification molecule • Outlines the implication(s) for society of the use of DNA as an identification molecule • States how it can be analysed and linked to individuals	3–4
• Identifies the use of DNA as an identification molecule AND/OR • Identifies the implication(s) for society AND/OR • Identifies a feature of DNA	1–2

Question 32 (c) (i)

Outcomes assessed: H9, H13

MARKING GUIDELINES

Criteria	Marks
• Writes correct general structural formula for an amino acid	1

Question 32 (c) (ii)

Outcomes assessed: H9, H10, H13

MARKING GUIDELINES

Criteria	Marks
• Using structural formulae, correctly writes the reactants and products	2
• Using structural formulae, writes the correct products OR • Using structural formulae writes a correct product and water	1

Question 32 (c) (iii)

Outcomes assessed: H8, H9

MARKING GUIDELINES

Criteria	Marks
• Sketches in general terms how specific enzymes break the protein at the peptide bond	2
• Identifies that an enzyme breaks the peptide bond OR • Identifies that the chain is broken at the peptide bond OR • Identifies the lock and key model	1

Question 32 (d)

Outcomes assessed: H3, H4, H6

MARKING GUIDELINES

Criteria	Marks
• Provides features and characteristics of mass spectrometry • Shows how the results of some forensic investigations are improved by the use of mass spectrometry	3–4
• Outlines mass spectrometry • States how it can be used in forensic investigation	2
• Identifies a feature of mass spectrometry OR • States a use of mass spectrometry in forensic investigation	1

Question 32 (e) (i)

Outcomes assessed: H8, H11

MARKING GUIDELINES

Criteria	Marks
• Provides features and characteristics of a chromatography procedure used to separate mixtures in a school lab	2
• Outlines a chromatography procedure used to separate mixtures in a school lab	1

Question 32 (e) (ii)

Outcomes assessed: H11

MARKING GUIDELINES

Criteria	Marks
• Identifies a risk consistent with investigation	1

Question 32 (e) (iii)

Outcomes assessed: H8, H14

MARKING GUIDELINES

Criteria	Marks
• Shows how the different properties of mixtures enables them to be separated by chromatography and electrophoresis	3
• Outlines the properties of mixtures that are separated by chromatography • Outlines the properties of mixtures that are separated by electrophoresis	2
• Outlines the properties of mixtures that are separated by either chromatography or electrophoresis	1