



B O A R D O F S T U D I E S
NEW SOUTH WALES

2009 HSC Chemistry Marking Guidelines

Section I

Question	Correct Response
1	C
2	C
3	D
4	C
5	A
6	D
7	B
8	A
9	C
10	B
11	D
12	A
13	B
14	B
15	A

Section I, Part B**Question 16 (a)***Outcomes assessed: H12***MARKING GUIDELINES**

Criteria	Marks
<ul style="list-style-type: none">Identifies appropriate name of reactants (alkanol+alkanoic acid) and catalyst (concentrated sulfuric acid)Provides either the features of method, including reflux, or draws diagramIdentifies ONE relevant safety precaution	3
<ul style="list-style-type: none">Gives any TWO of the above	2
<ul style="list-style-type: none">Identifies any TWO of alkanolic acid, alkanol and sulfuric acid OR <ul style="list-style-type: none">Identifies method is reflux(ing) OR <ul style="list-style-type: none">Identifies condenser is required OR <ul style="list-style-type: none">Identifies a relevant safety precaution	1

Question 17*Outcomes assessed: H2, H4, H13, H14***MARKING GUIDELINES**

Criteria	Marks
<ul style="list-style-type: none">• Identifies water and ethanol are polar molecules that form hydrogen bonds which can dissolve polar substances• Identifies ethanol forms dispersion forces, therefore a good solvent for both polar and non-polar substances• Draws correct diagram showing hydrogen bonds for both molecules	4
<ul style="list-style-type: none">• TWO of the above	3
<ul style="list-style-type: none">• Identifies both water and ethanol are polar molecules that form hydrogen bonds OR <ul style="list-style-type: none">• States water dissolves polar substances, ethanol dissolves polar and non-polar OR <ul style="list-style-type: none">• Draws correct diagram for both molecules	2
<ul style="list-style-type: none">• Identifies water or ethanol as a polar molecule OR <ul style="list-style-type: none">• Identifies ethanol as a polar and non-polar molecule OR <ul style="list-style-type: none">• Draws correct diagram for one molecule	1

Question 18

Outcomes assessed: H4, H8, H6

MARKING GUIDELINES

Criteria	Marks
<ul style="list-style-type: none"> • Provides sources of evidence of increase and reason for monitoring • Provides sources of oxides of nitrogen • Provides balanced relevant equations • Describes TWO or more effects of oxide of nitrogen in the atmosphere • Provides a clear judgement based upon the above criteria 	4–5
<ul style="list-style-type: none"> • Describes TWO or more effects of oxide of nitrogen in the atmosphere <p>AND EITHER</p> <ul style="list-style-type: none"> • Provides relevant equations <p>OR</p> <ul style="list-style-type: none"> • Provides sources of NO₂ leading to ONE effect <p>OR</p> <ul style="list-style-type: none"> • Provides evidence for the increase 	2–3
<ul style="list-style-type: none"> • Identifies ONE oxide of nitrogen, eg NO₂ <p>OR</p> <ul style="list-style-type: none"> • Identifies ONE effect, eg photochemical smog <p>OR</p> <ul style="list-style-type: none"> • Identifies the industrial revolution and more cars have led to increased combustion and more nitrogen oxides <p>OR</p> <ul style="list-style-type: none"> • Identifies a piece of evidence to support increase <p>OR</p> <ul style="list-style-type: none"> • ONE relevant equation 	1

Question 19

Outcomes assessed: H9, H13, H14

MARKING GUIDELINES

Criteria	Marks
<ul style="list-style-type: none"> • Indicates all of the main chemical and physical processes from a raw material to a monomer to polymer to finished product from natural raw material • Demonstrates a thorough knowledge of the chemistry involved using relevant chemical equations • Presents in a logical and coherent manner 	5–6
<ul style="list-style-type: none"> • Indicates some of the main chemical and physical processes involved in the production of the finished product from natural raw material • Demonstrates knowledge of some of the chemistry involved using chemical equations 	3–4
<ul style="list-style-type: none"> • Indicates a feature in the manufacturing process of an identified product and provides an appropriate word equation <p>OR</p> <ul style="list-style-type: none"> • Indicates TWO features in the manufacturing process of identified product <p>OR</p> <ul style="list-style-type: none"> • Provides ONE correct formula and ONE feature of the manufacturing process <p>OR</p> <ul style="list-style-type: none"> • Provides a structural formula for a monomer and corresponding polymer 	2
<ul style="list-style-type: none"> • Indicates a feature in the manufacturing process of an identified product <p>OR</p> <ul style="list-style-type: none"> • Provides an appropriate word equation <p>OR</p> <ul style="list-style-type: none"> • Provides an appropriate structural formula 	1

Question 20 (a)*Outcomes assessed: H12***MARKING GUIDELINES**

Criteria	Marks
<ul style="list-style-type: none">• Correctly calculates the mass of ethanol burnt	3
<ul style="list-style-type: none">• Correctly calculates q• Correctly calculates the mass of ethanol WITHOUT consideration of heat loss not accounted for OR <ul style="list-style-type: none">• Uses THREE correct steps with incorrect answer(s)	2
<ul style="list-style-type: none">• Correctly calculates q with correct units OR <ul style="list-style-type: none">• Incorrectly calculates mass and/or moles but demonstrates understanding of heat loss in calculation OR <ul style="list-style-type: none">• Uses TWO correct steps with incorrect answers	1

Question 20 (b)*Outcomes assessed: H11***MARKING GUIDELINES**

Criteria	Marks
<ul style="list-style-type: none">• States TWO appropriate ways to limit heat loss	1

Question 21 (a)

Outcomes assessed: H12, H14

MARKING GUIDELINES

Criteria	Marks
<ul style="list-style-type: none"> Relates pH of equivalence point to the nature of each acid correctly Relates concentration to amount of base used 	3
<ul style="list-style-type: none"> One of the above for both acids OR <ul style="list-style-type: none"> States strong, less concentrated acid – Acid 1 States weak, more concentrated acid – Acid 2 	2
<ul style="list-style-type: none"> Identifies strength of one acid correctly OR <ul style="list-style-type: none"> Identifies relative concentration of one acid correctly OR <ul style="list-style-type: none"> Identifies equivalence point of either acid correctly OR <ul style="list-style-type: none"> States that Acid 2 uses more base than Acid 1 	1

Question 21 (b)

Outcomes assessed: H8, H10

MARKING GUIDELINES

Criteria	Marks
<ul style="list-style-type: none"> Correctly identifies the alkaline salt by name or formula relative to part (a) 	1

Question 21 (c)

Outcomes assessed: H12, H13

MARKING GUIDELINES

Criteria	Marks
<ul style="list-style-type: none"> Correctly calculates hydrogen ion concentration with correct units 	1

Question 21 (d)

Outcomes assessed: H10

MARKING GUIDELINES

Criteria	Marks
<ul style="list-style-type: none"> Correctly relates colour change range for phenolphthalein to equivalence point or inflexion point on graph or vertical section of curve 	1

Question 22 (a)*Outcomes assessed: H10, H13***MARKING GUIDELINES**

Criteria	Marks
• Gives correctly balanced equations	2
• Gives one correctly balanced equation	1

Question 22 (b)*Outcomes assessed: H10, H12, H13***MARKING GUIDELINES**

Criteria	Marks
• Correctly calculates moles of HCl	1

Question 22 (c)*Outcomes assessed: H10, H12, H13***MARKING GUIDELINES**

Criteria	Marks
• Correctly calculates moles of NH_3	2
• Correctly calculates total moles HCl	1

Question 22 (d)*Outcomes assessed: H12, H13, H14***MARKING GUIDELINES**

Criteria	Marks
• Correctly calculates % of N to three significant figures	2
• Correctly calculates mass of N using moles of NH_3 in Part (c) OR • Correctly calculates %N to incorrect number of significant figures OR • Correctly calculates % N with incorrect mass of N	1

Question 23*Outcomes assessed: H12, H14***MARKING GUIDELINES**

Criteria	Marks
• Recognises and gives reasons for changes at 4 mins, 10 mins and 14 mins	5–6
• Recognises and gives reasons for changes at two of three times	3–4
• Recognises and gives reasons for changes at one of three times	2
• Recognises changes at three times OR • Recognises horizontal lines indicate equilibrium has been achieved OR • Gives a cause for one change	1

Question 24*Outcomes assessed: H3, H13***MARKING GUIDELINES**

Criteria	Marks
<ul style="list-style-type: none">• Demonstrates thorough knowledge and understanding of the principles of AAS and its environmental applications• Includes a relevant fully labelled diagram	4–5
<ul style="list-style-type: none">• Demonstrates a sound knowledge and understanding of the principles of AAS and its environmental applications• Includes a relevant diagram	3
<ul style="list-style-type: none">• Demonstrates a basic knowledge of the principles of AAS and its environmental applications OR <ul style="list-style-type: none">• May include a basic diagram	2
<ul style="list-style-type: none">• Demonstrates a limited knowledge of the principles of AAS OR its environmental applications• May include a basic diagram	1

Question 25 (a)
Outcomes assessed: H12, H14
MARKING GUIDELINES

Criteria	Marks
<ul style="list-style-type: none"> • Correctly calculates means • Phosphate concentrations interpolated correctly 	2
<ul style="list-style-type: none"> • Correctly calculates means OR <ul style="list-style-type: none"> • Interpolation of phosphate concentrations from original absorbance 	1

Question 25 (b)
Outcomes assessed: H14
MARKING GUIDELINES

Criteria	Marks
<ul style="list-style-type: none"> • States how THREE streams compare to recommended level • Provides TWO different sources and how these can be elevated 	3
<ul style="list-style-type: none"> • States how THREE streams compare to recommended level • Provides any TWO sources 	2
<ul style="list-style-type: none"> • States how THREE streams compare to recommended level OR <ul style="list-style-type: none"> • Provides any TWO sources OR <ul style="list-style-type: none"> • Compares two streams and provides one source OR <ul style="list-style-type: none"> • Identifies one source and cause of elevated P 	1

Question 25 (c)
Outcomes assessed: H4, H14
MARKING GUIDELINES

Criteria	Marks
<ul style="list-style-type: none"> • States that elevated N or P causes eutrophication • States an effect of N or P 	2
<ul style="list-style-type: none"> • States that elevated N or P causes eutrophication OR <ul style="list-style-type: none"> • States an effect of N or P 	1

Question 26 (a)*Outcomes assessed: H10, H13***MARKING GUIDELINES**

Criteria	Marks
<ul style="list-style-type: none">• Gives correct oxidation and reduction half equations• Gives correct overall net ionic equation without half equations	2
<ul style="list-style-type: none">• Gives correct oxidation and reduction half equations OR <ul style="list-style-type: none">• Gives correct overall net ionic equation without half equations	1

Question 26 (b)*Outcomes assessed: H7, H12***MARKING GUIDELINES**

Criteria	Marks
<ul style="list-style-type: none">• Correctly calculates E^{\ominus}	1

Question 26 (c)*Outcomes assessed: H13***MARKING GUIDELINES**

Criteria	Marks
<ul style="list-style-type: none">• Correctly labels diagram	3
<ul style="list-style-type: none">• Correctly labels metals and ions with cathode and anode reversed	2
<ul style="list-style-type: none">• Correctly labels metals and ions without stating cathode and anode	1

Question 26 (d)*Outcomes assessed: H8, H11***MARKING GUIDELINES**

Criteria	Marks
<ul style="list-style-type: none">• Names an appropriate electrolyte	1

Section II

Question 27 (a) (i)

Outcomes assessed: H8

MARKING GUIDELINES

Criteria	Marks
• States correct use	1

Question 27 (a) (ii)

Outcomes assessed: H6, H8

MARKING GUIDELINES

Criteria	Marks
• Sketches in general terms extraction, roasting and contact processes • Identifies catalyst and temperature requirement • Correctly writes TWO balanced equations or summarises chemical reactions in words	3
• Sketches ANY TWO of extraction, roasting and contact process AND EITHER • Identifies catalyst and temperature requirement OR • Writes a correctly balanced relevant equation or summarises one chemical reaction in words	2
• Outlines any process OR • Writes a relevant equation or summarises one chemical reaction in words OR • Identifies the catalyst	1

Question 27 (a) (iii)

Outcomes assessed: H4, H8

MARKING GUIDELINES

Criteria	Marks
• Identifies TWO properties of sulfuric acid • Explains how the danger is minimised for each property	2
• As above for ONE property	1

Question 27 (b) (i)*Outcomes assessed: H12, H13***MARKING GUIDELINES**

Criteria	Marks
• Correctly writes the equilibrium constant expression	1

Question 27 (b) (ii)*Outcomes assessed: H12***MARKING GUIDELINES**

Criteria	Marks
• Correctly calculates K	3
• Incorrectly calculates K with at least TWO correct steps	2
• Identifies mole ratio	1

Question 27 (b) (iii)*Outcomes assessed: H7, H8, H14***MARKING GUIDELINES**

Criteria	Marks
• Identifies effect on both K and products and/ or reactants	2
• Identifies effect on either K or products/ reactants or pressure	1

Question 27 (c)*Outcomes assessed: H9***MARKING GUIDELINES**

Criteria	Marks
• Identifies a property of a named emulsion • States ONE use related to properties	2
• Identifies a property of a named emulsion	1

Question 27 (d) (i)*Outcomes assessed: H8, H9, H13***MARKING GUIDELINES**

Criteria	Marks
<ul style="list-style-type: none">Identifies soap as having hydrophobic (non-polar) tail and a hydrophilic polar headShows how an emulsion forms in terms of orientation of species involved	2
<ul style="list-style-type: none">ONE of the above	1

Question 27 (d) (ii)*Outcomes assessed: H9, H10, H13***MARKING GUIDELINES**

Criteria	Marks
<ul style="list-style-type: none">Correctly draws the structure and names the product	2
<ul style="list-style-type: none">Correctly names the product OR <ul style="list-style-type: none">Correctly draws the structure	1

Question 27 (e)*Outcomes assessed: H1, H4, H12, H13, H14***MARKING GUIDELINES**

Criteria	Marks
<ul style="list-style-type: none">• Demonstrates thorough knowledge and understanding of the significance of each criteria used to find a suitable location for an industrial plant to produce sodium carbonate• Refers to the flowchart• Supported by correct chemistry• Demonstrates coherence and logical progression and includes correct use of scientific principles and ideas	6–7
<ul style="list-style-type: none">• Demonstrates sound knowledge and understanding of the significance of each criteria to find a suitable location for an industrial plant to produce sodium carbonate• Refers to the flowchart• Communicates some scientific principles and ideas in a clear manner	4–5
<ul style="list-style-type: none">• Demonstrates a basic knowledge of the significance of the criteria used to find a suitable location for an industrial plant to produce sodium carbonate• Refers to the flowchart• Communicates ideas in a basic form using general scientific terms	2–3
<ul style="list-style-type: none">• Demonstrates a limited knowledge of the criteria used to find a suitable location for an industrial plant to produce sodium carbonate• Communicates simple ideas	1

Question 28 (a) (i)
Outcomes assessed: H6
MARKING GUIDELINES

Criteria	Marks
<ul style="list-style-type: none"> States aluminum is used in drink cans in Australia 	1

Question 28 (a) (ii)
Outcomes assessed: H6, H8
MARKING GUIDELINES

Criteria	Marks
<ul style="list-style-type: none"> Shows similarities or differences between the use and effectiveness of the three cans Relates use to coating 	3
<ul style="list-style-type: none"> Clearly explains the use and effectiveness for one can OR <ul style="list-style-type: none"> Outlines the use and effectiveness for three cans 	2
<ul style="list-style-type: none"> Identifies a coating used in tins OR <ul style="list-style-type: none"> States the coating acts as a barrier OR <ul style="list-style-type: none"> States the barrier is only effective whilst intact OR <ul style="list-style-type: none"> Identifies tin as a less reactive metal than iron 	1

Question 28 (b)
Outcomes assessed: H4, H6, H8
MARKING GUIDELINES

Criteria	Marks
<ul style="list-style-type: none"> States galvanised steel is zinc coated Identifies Zn as a passivating metal providing protective barrier States that zinc can provide electrons to iron since it is more reactive 	2
<ul style="list-style-type: none"> States zinc is passivating metal OR <ul style="list-style-type: none"> Zinc is more reactive than iron OR <ul style="list-style-type: none"> States galvanised steel is zinc coated 	1

Question 28 (c) (i)

Outcomes assessed: H10, H13

MARKING GUIDELINES

Criteria	Marks
<ul style="list-style-type: none"> Shows the cause of rusting by correctly writing the equation for the reduction of water Correctly writing the equation for the oxidation of iron 	2
<ul style="list-style-type: none"> Correctly writes ONE relevant equation OR <ul style="list-style-type: none"> States that iron is oxidised as the oxygen is reduced 	1

Question 28 (c) (ii)

Outcomes assessed: H8, H12, H13

MARKING GUIDELINES

Criteria	Marks
<ul style="list-style-type: none"> Relates reactivity of the three metals Al, Fe and Cu to their electrode potentials States consequences of galvanic coupling in terms of corrosion for both types of guttering Justifies the action taken 	4
<ul style="list-style-type: none"> Ranks the three metals in terms of reactivity States consequences of galvanic coupling in terms of corrosion for one type of guttering Justifies the action taken 	3
<ul style="list-style-type: none"> TWO of below 	2
<ul style="list-style-type: none"> Justifies the action taken OR <ul style="list-style-type: none"> Ranks the three metals in terms of reactivity OR <ul style="list-style-type: none"> States that the more active metal will corrode when two different metals are paired OR <ul style="list-style-type: none"> Gives standard electrode potentials for the three metals 	1

Question 28 (d) (i)

Outcomes assessed: H6, H8

MARKING GUIDELINES

Criteria	Marks
<ul style="list-style-type: none"> • Shows how the electrolytic process conserves this artefact by: <ul style="list-style-type: none"> – Stating that electrolysis is used to remove (embedded) Cl^- – Identifying artefact is cathode (and stainless steel is anode) – Outlining chemistry of process 	3
<ul style="list-style-type: none"> • TWO of the above 	2
<ul style="list-style-type: none"> • States Cl^- is removed by electrolysis OR <ul style="list-style-type: none"> • Identifies artefact is cathode OR <ul style="list-style-type: none"> • Outlines chemistry of process 	1

Question 28 (d) (ii)

Outcomes assessed: H6, H8, H13

MARKING GUIDELINES

Criteria	Marks
<ul style="list-style-type: none"> • Draws a fully labelled diagram • Describes the process 	3
<ul style="list-style-type: none"> • Draws a fully labelled diagram OR <ul style="list-style-type: none"> • Describes the process 	2
<ul style="list-style-type: none"> • Draws a diagram OR <ul style="list-style-type: none"> • Identifies the cathode or anode OR <ul style="list-style-type: none"> • Outlines the process 	1

Question 28 (e)*Outcomes assessed: H1, H2, H3, H7, H8***MARKING GUIDELINES**

Criteria	Marks
<ul style="list-style-type: none">• Demonstrates thorough knowledge and understanding of how the work of each scientist has led to a better understanding of electron transfer reactions• Refers to the flowchart• Supports by the use of an equation• Demonstrates coherence and logical progression and includes correct use of scientific principles and ideas	6–7
<ul style="list-style-type: none">• Demonstrates sound knowledge and understanding of how the work of each scientist has led to a better understanding of electron transfer reactions• Refers to the flowchart• Communicates some scientific principles and ideas in a clear manner	4–5
<ul style="list-style-type: none">• Demonstrates a basic knowledge of how the work of each scientist has led to a better understanding of electron transfer reactions• Refers to the flowchart• Communicates ideas in a basic form using general scientific terms	2–3
<ul style="list-style-type: none">• Demonstrates a limited knowledge of the work of the scientist(s) or an understanding of an electron transfer reactions• Communicates simple ideas	1

Question 29 (a) (i)

Outcomes assessed: H9

MARKING GUIDELINES

Criteria	Marks
<ul style="list-style-type: none"> • Correctly identifies a factor 	1

Question 29 (a) (ii)

Outcomes assessed: H6, H8, H9

MARKING GUIDELINES

Criteria	Marks
<ul style="list-style-type: none"> • Relates denaturation to disruption of the chemical bonding forces responsible for secondary and tertiary structures of proteins • Identifies the particular bonding forces disrupted 	2
<ul style="list-style-type: none"> • Relates denaturation to disruption of the chemical bonding forces responsible for secondary and tertiary structures of proteins OR <ul style="list-style-type: none"> • Identifies TWO bonding forces disrupted 	1

Question 29 (b)

Outcomes assessed: H9, H14

MARKING GUIDELINES

Criteria	Marks
<ul style="list-style-type: none"> • Identifies and related colour change to enzyme activity between pH 4.0–7.0 • Relates dark red at pH 6.0–7.0 to extent of oxidation • Concludes that experiment confirms enzymes act optimally within narrow pH ranges 	3
<ul style="list-style-type: none"> • TWO of the above 	2
<ul style="list-style-type: none"> • States most enzymes act optimally within narrow pH ranges OR <ul style="list-style-type: none"> • Relates dark red to optimal pH for enzyme activity OR <ul style="list-style-type: none"> • Relates experimental colour change to enzyme activity 	1

Question 29 (c) (i)*Outcomes assessed: H9, H10, H12***MARKING GUIDELINES**

Criteria	Marks
<ul style="list-style-type: none">Gives correctly balanced equationGives correct ΔH	2
<ul style="list-style-type: none">ONE of the above	1

Question 29 (c) (ii)*Outcomes assessed: H9, H12, H13***MARKING GUIDELINES**

Criteria	Marks
<ul style="list-style-type: none">Calculates correct answer OR <ul style="list-style-type: none">Correctly calculates answer from incorrect kJ	2
<ul style="list-style-type: none">Correct method with incorrect formula mass OR <ul style="list-style-type: none">Gives correct formula mass OR <ul style="list-style-type: none">Calculates correct answer without correct units	1

Question 29 (c) (iii)*Outcomes assessed: H12, H13***MARKING GUIDELINES**

Criteria	Marks
<ul style="list-style-type: none">Calculates correct answer OR <ul style="list-style-type: none">Calculates correct answer from incorrect kJ	2
<ul style="list-style-type: none">Uses correct steps with incorrect answer OR <ul style="list-style-type: none">Uses one step correctly OR <ul style="list-style-type: none">Calculates correct answer without correct units	1

Question 29 (d) (i)*Outcomes assessed: H6, H9***MARKING GUIDELINES**

Criteria	Marks
<ul style="list-style-type: none">Describes structure of glycerol or gives diagramRelates solubility due to polar natureRelates viscosity due to H-bonds	3
<ul style="list-style-type: none">TWO of the above	2
<ul style="list-style-type: none">ONE of the above	1

Question 29 (d) (ii)*Outcomes assessed: H6, H9***MARKING GUIDELINES**

Criteria	Marks
<ul style="list-style-type: none">States fatty acids have a hydrophilic end from carboxylic groupStates fatty acids have a hydrophobic end from hydrocarbon groupStates long chain fatty acids are insoluble in waterIdentifies triacylglycerols are esters with no O–H group, therefore non-polar not soluble in H₂O	3
<ul style="list-style-type: none">Identifies ONE property of both fatty acids and triacylglycerols related to solubility	2
<ul style="list-style-type: none">Identifies ONE property of either fatty acids or triacylglycerols related to solubility	1

Question 29 (e)*Outcomes assessed: H3, H8, H9, H13, H14***MARKING GUIDELINES**

Criteria	Marks
<ul style="list-style-type: none">• Demonstrates thorough knowledge and understanding of the biochemical reactions involved in muscle cell respiration that have led to improved training programs• Refers to flowchart• Includes relevant chemical equations• Demonstrates coherence and logical progression and includes correct use of scientific principles and ideas	6–7
<ul style="list-style-type: none">• Demonstrates sound knowledge and understanding of biochemical reactions involved in muscle cell respiration that have led to improved training programs• Refers to flowchart• Includes relevant chemical equations• Communicates some scientific principles and ideas in a clear manner	4–5
<ul style="list-style-type: none">• Demonstrates a basic knowledge of biochemical reactions involved in muscle cell respiration• Refers to flowchart• Communicates ideas in a basic form using general scientific terms	2–3
<ul style="list-style-type: none">• Demonstrates a limited knowledge of biochemical reactions involved in muscle cell respiration• Communicates simple ideas	1

Question 30 (a) (i)*Outcomes assessed: H9***MARKING GUIDELINES**

Criteria	Marks
• Gives a correct ligand	1

Question 30 (a) (ii)*Outcomes assessed: H6, H9***MARKING GUIDELINES**

Criteria	Marks
• Defines term ‘polydentate’	2
• Identifies donor atoms in EDTA	
• ONE of the above	1

Question 30 (a) (iii)*Outcomes assessed: H8, H9***MARKING GUIDELINES**

Criteria	Marks
• Identifies bonds as coordinate covalent bonds	3
• States that pairs of electrons come from the donor atoms	
• States that these electron pairs interact with d-orbitals of transition metals	
• TWO of the above	2
• ONE of the above	1

Question 30 (b) (i)*Outcomes assessed: H6***MARKING GUIDELINES**

Criteria	Marks
• Gives correct maximum number of electrons	1

Question 30 (b) (ii)*Outcomes assessed: H6, H13***MARKING GUIDELINES**

Criteria	Marks
• Gives all THREE electron configurations correctly	2
• Gives correct electron configuration for excited Ca atom or Ca ⁺ ion	1

Question 30 (c)*Outcomes assessed: H6, H12***MARKING GUIDELINES**

Criteria	Marks
• Provides explanation for increase in IE across a period • Gives explanation on each of the drops from 2–3, 10–11, 18–19 EITHER • Explains an irregularity within a period OR • Explains the difference between 2 nd period (2–10) and 3 rd period (11–18)	3
• TWO of the above	2
• ONE of the above	1

Question 30 (d) (i)*Outcomes assessed: H6***MARKING GUIDELINES**

Criteria	Marks
<ul style="list-style-type: none">States that atoms can exist in an excited electronic stateStates that light is emitted at particular wavelengths as the electrons fall back to the ground state, to a lower energy levelStates these observations were the basis of Planck's Quantum TheoryStates that particular wavelengths correspond to specific changes in energy levels which in turn correspond to particular colours of the spectrum	3
<ul style="list-style-type: none">TWO of the above	2
<ul style="list-style-type: none">ONE of the above	1

Question 30 (d) (ii)*Outcomes assessed: H6, H11***MARKING GUIDELINES**

Criteria	Marks
<ul style="list-style-type: none">Provides detailed explanation of appropriate method for analysisGives a reason why validity might be compromised	3
<ul style="list-style-type: none">Outlines a valid methodGives ONE reason why the validity might be compromised	2
<ul style="list-style-type: none">Gives ONE valid method <p>OR</p> <ul style="list-style-type: none">Gives ONE reason why the validity might be compromised	1

Question 30 (e)*Outcomes assessed: H1, H6, H9, H13, H14***MARKING GUIDELINES**

Criteria	Marks
<ul style="list-style-type: none">• Demonstrates thorough knowledge and understanding of the use of pigments (with atomic number in the range of 22–30) and the origin of the colour at the atomic level• Refers to the flowchart• Demonstrates coherence and logical progression and includes correct use of scientific principles and ideas	6–7
<ul style="list-style-type: none">• Demonstrates sound knowledge and understanding of the use of pigments (with atomic number in the range of 22–30) and the origin of the colour at the atomic level• Refers to the flowchart• Communicates some scientific principles and ideas in a clear manner	4–5
<ul style="list-style-type: none">• Demonstrates a basic knowledge of the use of pigments and the origin of the pigment colour• Refers to the flowchart• Communicates ideas in a basic form using general scientific terms	2–3
<ul style="list-style-type: none">• Demonstrates a limited knowledge of the use of pigments or the origin of the pigment colour• Communicates simple ideas	1

Question 31 (a) (i)*Outcomes assessed: H6, H9, H12***MARKING GUIDELINES**

Criteria	Marks
• Correctly names bond	1

Question 31 (a) (ii)*Outcomes assessed: H6, H9***MARKING GUIDELINES**

Criteria	Marks
• Identifies differences between 1°, 2°, 3° structures clearly	3
• Identifies differences between TWO levels of structure OR • Identifies 1° structure and indicates possible 2°, 3° structures being higher level of complexity overlaid	2
• Identifies ONE level of structure	1

Question 31 (a) (iii)*Outcomes assessed: H8, H9***MARKING GUIDELINES**

Criteria	Marks
• Outlines electrophoresis principle • States proteins in samples are subject to electrophoresis to allow comparison between known and unknown proteins	2
• Outlines principle OR • States that proteins can be compared via electrophoresis	1

Question 31 (b) (i)*Outcomes assessed: H12***MARKING GUIDELINES**

Criteria	Marks
• Identifies the ship responsible for spill	1

Question 31 (b) (ii)*Outcomes assessed: H6***MARKING GUIDELINES**

Criteria	Marks
• States each peak represents a separate component • Identifies that the signal intensity is proportional to the amount of component	2
• States each peak represents a separate component OR • Identifies that the signal intensity is proportional to the amount of component	1

Question 31 (c)*Outcomes assessed: H3, H6***MARKING GUIDELINES**

Criteria	Marks
• Provides features of THREE components of either GLC or HPLC systems that allow for smaller sample analysis	3
• Provides features of TWO components of either GLC or HPLC systems that allow for smaller sample analysis	2
• Provides features of ONE component of either GLC or HPLC system that allows for smaller sample analysis	1

Question 31 (d) (i)*Outcomes assessed: H9, H11***MARKING GUIDELINES**

Criteria	Marks
<ul style="list-style-type: none">Clearly details procedures in a logical orderCompares chromatogram for identification	3
<ul style="list-style-type: none">Clearly outlines method and comparison of chromatogram for identification OR <ul style="list-style-type: none">Clearly details procedures in a logical order	2
<ul style="list-style-type: none">Outlines method	1

Question 31 (d) (ii)*Outcomes assessed: H8, H9***MARKING GUIDELINES**

Criteria	Marks
<ul style="list-style-type: none">Provides features of the tests which conclusively identify each of 3 species unambiguously	3
<ul style="list-style-type: none">Outlines more than ONE test unambiguously OR <ul style="list-style-type: none">Outlines tests which confirm each of the 3 species	2
<ul style="list-style-type: none">Outlines a test	1

Question 31 (e)*Outcomes assessed: H3, H9, H14***MARKING GUIDELINES**

Criteria	Marks
<ul style="list-style-type: none">• Demonstrates thorough knowledge and understanding of the processes forensic scientists follow from sample collection to presenting results• Refers to flowchart• Demonstrates coherence and logical progression and includes correct use of scientific principles and ideas	6–7
<ul style="list-style-type: none">• Demonstrates sound knowledge and understanding of the processes forensic scientists follow from sample collection to presenting results• Refers to flowchart• Communicates some scientific principles and ideas in a clear manner	4–5
<ul style="list-style-type: none">• Demonstrates a basic knowledge of the processes forensic scientists follow• Refers to the flowchart• Communicates ideas in a basic form using general scientific terms	2–3
<ul style="list-style-type: none">• Demonstrates a limited knowledge of some of the processes forensic scientists follow• Communicates simple ideas	1

Chemistry

2009 HSC Examination Mapping Grid

Question	Marks	Content	Syllabus outcomes
Section I Part A			
1	1	9.2.5.2.1	H6
2	1	9.3.2.2.1, 9.3.2.2.5	H8
3	1	9.3.1.2.1	H8
4	1	9.4.3.3.1	H6
5	1	9.2.3.3.6, 11.2a	H11
6	1	9.2.1.3.2	H9
7	1	9.3.4.2.3, 9.3.4.2.5, 13.1d	H12, H13
8	1	9.4.3.3.1, 9.4.3.2.1, 11.3a	H8, H11
9	1	9.2.4.2.3, 12.3c, 12.4b	H6, H10, H12, H14
10	1	9.3.5.2.4, 9.2.1.3.1	H9
11	1	9.4.5.2.3, 9.4.5.3.3, 12.3c	H8, H12
12	1	9.4.4.2.9	H9, H13
13	1	9.2.3.2.6, 9.2.3.3.5, 12.4b	H9, H10, H12
14	1	9.3.4.3.3, 12.4b	H10, H12
15	1	9.4.5.2.1, 9.3.2.2.9, 12.4b	H10, H12
Section I Part B			
16	3	9.3.5.3.1, 9.3.5.2.4, 9.3.5.2.5, 9.3.5.2.6. 12.1a–d	H12
17	4	9.2.3.2.3, 13.1e, 14.1g,h	H2, H4, H13, H14
18	5	9.3.2.2.6, 9.3.2.2.7, 9.3.2.2.8, 9.3.2.2.10, 9.3.2.3.2, 9.4.1.2.3, 9.4.4.2.2	H4, H6, H8
19	6	9.2.1, 13.1d, 14.3b	H9, H13, H14
20 (a)	3	9.2.3.2.7, 9.2.3.3.6, 12.4b	H12
20 (b)	1	9.2.3.3.6, 11.2c,d,e, 11.3a	H11
21 (a)	3	9.3.4.3.3, 9.3.3.2.4, 12.3c, 14.1a-f	H12, H14
21 (b)	1	9.3.4.2.4, 9.3.4.3.3, 9.3.3.3.4	H8, H10
21 (c)	1	9.3.3.3.7, 12.3c, 12.4b, 13.1d	H12, H13
21 (d)	1	9.3.1.2.2, 9.3.1.3.2	H10
22 (a)	2	9.2.1.2.1, 9.3.4.3.3, 13.1d	H10, H13
22 (b)	1	9.3.4.3.3, 12.4b, 13.1d	H10, H12, H13
22 (c)	2	9.3.4.3.3, 12.4b, 13.1d	H10, H12, H13
22 (d)	2	9.4.3.1, 9.4.3.3.3, 12.4b, 13.1d, 14.1h	H12, H13, H14
23	6	9.3.2.2.3, 9.3.2.2.4, 9.4.2.1, 12.3c, 14.1a-h	H12, H14
24	5	9.4.3.2.2, 9.4.3.3.5, 9.4.5.3.2, 13.1e	H3, H13
25 (a)	2	9.4.3.3.1, 9.4.3.2.1, 12.3c	H12

Question	Marks	Content	Syllabus outcomes
25 (b)	3	9.4.5.2.2, 9.4.5.3.3, 14.1g	H14
25 (c)	2	9.4.5.2.1, 9.4.5.2.2, 9.4.3.3.2, 14.3d	H4, H14
26 (a)	2	9.2.4.2.1, 9.2.4.3.3, 13.1d	H10, H13
26 (b)	1	9.2.4.3.4, 12.4b	H7, H12
26 (c)	3	9.2.4.2.5, 9.2.4.2.6, 13.1e	H13
26 (d)	1	9.2.4.2.6, 9.4.3.3.1, 11.3a	H8, H11
Section II			
Question 27 Industrial Chemistry			
(a) (i)	1	9.5.3.2.1	H8
(a) (ii)	3	9.5.3.2.2, 9.5.3.2.3, 9.5.3.3.1	H6, H8
(a) (iii)	2	9.5.3.3.3	H4, H8
(b) (i)	1	9.5.2.2.2, 12.4b, 13.1a	H12, H13
(b) (ii)	3	9.5.2.3.3, 12.4b	H12
(b) (iii)	2	9.5.2.2.1, 9.5.2.2.3, 14.3d	H7, H8, H14
(c)	2	9.5.5.3.3	H9
(d) (i)	2	9.5.5.2.3, 9.5.5.2.4, 13.1e	H8, H9, H13
(d) (ii)	2	9.5.5.2.1, 13.1d	H9, H10, H13
(e)	7	9.5.6.2.1, 9.5.6.2.3, 9.5.6.2.4, 9.5.6.2.2, 9.5.6.3.3, 12.3c, 13.1d, 14.3b	H1, H4, H12, H13, H14
Section II			
Question 28 Shipwrecks, Corrosion and Conservation			
(a) (i)	1	9.6.2.2.1	H6
(a) (ii)	3	9.6.4.3.3	H6, H8
(b)	2	9.6.4.2.3/4, 9.6.4.3.3/4	H4, H6, H8
(c) (i)	2	9.6.2.2.4, 9.6.4.3.2, 13.1d	H10, H13
(c) (ii)	4	9.6.4.2.2, 12.4b, 13.1d	H8, H12, H13
(d) (i)	3	9.6.3.2.1, 9.6.7.2.1/3/4, 9.6.7.3.1	H6, H8
(d) (ii)	3	9.6.3.2.1/2, 13.1e	H6, H8, H13
(e)	7	9.6.1.2.2/3/4, 9.6.1.3.1, 14.3b	H1, H2, H3, H7, H8, H14
Section II			
Question 29 The Biochemistry of movement			
(a) (i)	1	9.7.4.2.6, 9.7.4.3.2	H9
(a) (ii)	2	9.7.4.2.5, 9.7.4.2.6	H6, H8, H9
(b)	3	9.7.4.3.2, 9.7.4.3.3, 14.1c	H9, H14
(c) (i)	2	9.7.7.9.7.8, 9.7.9, 9.7.7.1, 9.7.8.1, 9.7.8.3.1, 12.3c, 12.4b	H9, H10, H12
(c) (ii)	2	12.3c, 12.4b, 13.1d	H9, H12, H13
(c) (iii)	2	12.3c, 12.4b, 13.1d	H12, H13
(d) (i)	3	9.7.3.3.2	H6, H9
(d) (ii)	3	9.7.3.2.1, 9.7.3.3.1, 9.7.3.2.2, 9.7.3.2.5	H6, H9
(e)	7	9.7.2.2.2/3, 9.7.2.3.1, 9.7.5.1, 9.7.10.1, 13.1d, 14.3b	H3, H8, H9, H13, H14

Question	Marks	Content	Syllabus outcomes
Section II			
Question 30 The Chemistry of Art			
(a) (i)	1	9.8.5.2.5	H9
(a) (ii)	2	9.8.5.2.4, 9.8.5.2.6	H6, H9
(a) (iii)	3	9.8.5.2.3, 9.8.5.3.1, 9.8.5.2.6	H8, H9
(b) (i)	1	9.8.3.2.1, 9.8.3.2.2	H6
(b) (ii)	2	9.8.3.2.4, 9.8.3.2.5, 13.1b	H6, H13
(c)	3	9.8.3.2.6, 9.8.3.2.8, 9.8.3.3.1, 12.3c	H6, H12
(d) (i)	3	9.8.2.2.3	H6
(d) (ii)	3	9.8.2.3.1, 11.2c	H6, H11
(e)	7	9.8.1.1, 9.8.4.2.3, 9.8.4.2.4, 9.8.5.1, 13.1d, 14.3b	H1, H6, H9, H13, H14
Section II			
Question 31 Forensic Chemistry			
(a) (i)	1	9.9.3.2.4, 12.3c	H6, H9, H12
(a) (ii)	3	9.9.3.2.1, 9.9.3.3.1	H6, H9
(a) (iii)	2	9.9.3.2.5, 9.9.3.2.6	H8, H9
(b) (i)	1	9.9.5.2.1, 9.9.5.2.2, 12.3c	H12
(b) (ii)	2	9.9.5.2.2	H6
(c)	3	9.9.5.2.2	H3, H6
(d) (i)	3	9.9.3.3.4, 11.2c	H9, H11
(d) (ii)	3	9.9.1.2.3, 9.9.1.3.3	H8, H9
(e)	7	9.9.1.2.1, 9.9.2.1, 9.9.3.1, 9.9.4.1, 9.9.5.1, 14.3b	H3, H9, H14