BOARD OF STUDIES
NEW SOUTH WALES

2012 HSC Chemistry Marking Guidelines

Section I, Part A

Multiple-choice Answer Key

Question	Answer
1	B
2	D
3	A
4	C
5	B
6	C
7	D
8	D
9	B
10	B
11	B
12	D*
13	D
14	A
15	C
16	A
17	C
18	C
19	A
20	A

* D was the best answer for Question 12.

However, the correct answer is *2-chloro-3-fluorobutane*, which was not one of the alternatives.

Teachers are reminded that IUPAC provides a system for the clear communication of chemical nomenclature.

Section I, Part B

Question 21 (a)

Criteria	Marks
• Writes a correct balanced structural chemical equation, including catalyst	2
• Has correct structural formulae for reactants and products, may omit H_2O or catalyst OR • All correct but small error in a structural formula	1

Question 21 (b)

Criteria	Marks
• Identifies a precaution and provides a valid reason	2
• Identifies a precaution	1

Question 22 (a)

Criteria	Marks
• Correctly identifies the chemical process	1

Question 22 (b)

Criteria	Marks
• Gives specific reasons for the usefulness of a model	2
• Gives a reason for the usefulness of the model	1

Question 23

Criteria	Marks
• Demonstrates thorough knowledge and understanding of disturbances to pressure and temperature on the solubility of CO_2 in an equilibrium • Includes correct equation	3
• Demonstrates a sound knowledge and understanding of disturbances to pressure and temperature on the solubility of CO_2 in an equilibrium OR • Demonstrates thorough knowledge and understanding of the solubility of CO_2 in an equilibrium	2
• Demonstrates a sound knowledge and understanding of the solubility of CO_2 in an equilibrium	1

Question 24

Criteria	Marks
• Demonstrates a thorough knowledge of the importance of ammonia as a raw material	3
• Demonstrates a sound knowledge of the importance of ammonia as a raw material	2
• Demonstrates a basic knowledge of the importance of ammonia as a raw material	1

Question 25

Criteria	Marks
• Demonstrates thorough knowledge and understanding of the process of monitoring of eutrophication in waterways • Describes tests which could be performed	3
• Demonstrates a sound knowledge and understanding of the process of monitoring of eutrophication in waterways • Gives details of the tests which could be performed	2
• Demonstrates some knowledge and understanding of the monitoring of eutrophication in waterways OR • Gives basic details of the tests which could be performed	1

Question 26 (a)

Criteria	Marks
• Demonstrates a thorough knowledge of both processes • Communicates information in a logical progression of ideas using a flow chart	5
• Demonstrates a sound knowledge of both processes • Communicates information in a logical progression of ideas using a flow chart	4
• Demonstrates a basic knowledge of both processes OR demonstrates a thorough knowledge of ONE process • Communicates information in a logical progression of ideas using a flow chart	3
• Demonstrates a limited knowledge of both processes OR • Demonstrates a basic knowledge of ONE process	2
• Demonstrates a limited knowledge of ONE process	1

Question 26 (b)

Criteria	Marks
• Demonstrates a thorough knowledge of the sustainability of ethanol production from a comparison of the two sources	3
• Demonstrates a sound knowledge of the sustainability of ethanol production from a comparison of the two sources	2
• Demonstrates a basic knowledge of the sustainability of ethanol production from the two sources	1

Question 27 (a)

Criteria	Marks
• Justifies the different uses of the radioisotopes, by demonstrating an understanding of penetration and energy transfer for both types of emission	2
• Justifies the different uses of the radioisotopes, by demonstrating an understanding of penetration or energy transfer for ONE type of emission or a partial understanding of both types	1

Question 27 (b)

Criteria	Marks
• Correct equation is given	1

Question 28

Criteria	Marks
• Correctly calculates pH of resultant solution	3
• Completes calculation with ONE error	2
• Supplies balanced chemical equation OR • Calculates moles of H_3O^+ or OH^- initially OR • Correctly performs a pH calculation	1

Question 29

Criteria	Marks
• Thorough understanding of structure of atmosphere, position and source of pollutants	4–5
• Sound understanding of structure of atmosphere, position and source of pollutants	3
• Basic understanding of structure of atmosphere, position and source of pollutants	2
• Limited understanding of structure of atmosphere, position and source of pollutants	1

Question 30 (a)

Criteria	Marks
• Correctly calculates NaOH molarity	2
• Calculates [NaOH] with ONE error OR • Calculates moles of HCl or NaOH	1

Question 30 (b) (i)

Criteria	Marks
• Correctly calculates the mass of aspirin (average)	3
• Calculates mass of aspirin with ONE error OR • Calculates moles of $NaOH/C_9H_8O_4$ and molar mass aspirin	2
• Calculates moles of $NaOH/C_9H_8O_4$ OR • Calculates molar mass aspirin ($C_9H_8O_4$)	1

Question 30 (b) (ii)

Criteria	Marks
• Correctly identifies the solvent role of ethanol	1

Question 31 (a)

Criteria	Marks
• Correct axes/labels. Data correctly plotted	3
• Data correctly plotted without gap for butan-l-ol	2
• Data correctly plotted without gap. No labels	1

Question 31 (b)

Criteria	Marks
• Correctly predicts the boiling point from graph	1

Question 31 (c)

Criteria	Marks
• Correctly relates increasing dispersion forces to increasing boiling points	1

Question 32

Criteria	Marks
• Identifies correct concentration from calibration curve • Calculates correct concentration with correct units • Makes correct conclusion	3
• Identifies correct concentration from calibration curve and performs partial calculation and provides relevant conclusion OR • Performs calculation on incorrect concentration and provides relevant conclusion	2
• Uses calibration curve correctly and provides relevant conclusion OR • Gives partial calculation	1

Question 33

Criteria	Marks
• Demonstrates a thorough knowledge and understanding of the identified roles of chemists and the environmental impact of a correctly named electrochemical cell • Assesses the need for collaboration between chemists • Demonstrates coherence and logical progression of ideas with correct scientific terminology used	6
• Demonstrates a sound knowledge and understanding of the identified roles of chemists and the environmental impact of a correctly named electrochemical cell • Discusses collaboration between chemists • Communicates some scientific principles and ideas clearly	4–5
• Demonstrates a basic knowledge and understanding of the role of chemists and the environmental impact of a named electrochemical cell • Communicates ideas in a basic form using general scientific language	2–3
• Demonstrates a limited knowledge and understanding of the role of chemists OR the environmental impact of a named electrochemical cell • Communicates simple ideas	1

Section II

Question 34 (a)

Criteria	Marks
• Correctly identifies electrolysis • Correctly identifies gases at correct electrodes	3
• Correctly identifies electrolysis • Correctly identifies gases at incorrect electrodes OR • Correctly identifies electrolysis • Correctly identifies one gas at correct electrode OR • Correctly identifies two gases at correct electrodes	2
• Correctly identifies electrolysis OR • Correctly identifies one gas	1

Question 34 (b) (i)

Criteria	Marks
• Correctly writes equation from equilibrium constant expression	1

Question 34 (b) (ii)

Criteria	Marks
• Correctly calculates K and infers position of equilibrium	3
• Calculation of K with ONE error and infers position of equilibrium OR • Correctly calculates K	2
• Identifies equilibrium concentration of one species other than N_2 OR • Substitutes calculated data into expression for K OR • Correctly infers position of equilibrium from incorrect value of K	1

Question 34 (b) (iii)

Criteria	Marks
• Gives correct answer	1

Question 34 (c) (i)

Criteria	Marks
• Description of the process including correct equations for the production of oleum and sulfuric acid	3
• Description of the process and one correct equation for the production of oleum or sulfuric acid OR • No description and two correct equations OR • Description only and one correct equation	2
• Description only OR • One correct equation OR • Two balanced equations, no states	1

Question 34 (c) (ii)

Criteria	Marks
• States direct reaction is exothermic • Identifies difficulty in collecting $H_2SO_4(l)$	2
• States direct reaction is exothermic OR • Identifies difficulty in collecting $H_2SO_4(l)$	1

Question 34 (d) (i)

Criteria	Marks
• Description of chemical step, linked to Solvay process • Appropriate equation included	3
• Description of chemical step not linked to Solvay process • Appropriate equation included OR • Description of chemical step, linked to the Solvay process – no equation	2
• Description of chemical step only OR • Chemical equation only	1

Question 34 (d) (ii)

Criteria	Marks
• Identifies one risk factor and one relevant difficulty in modelling this step	2
• Identifies one risk factor OR • Identifies one relevant difficulty in modelling this step	1

Question 34 (e)

Criteria	Marks
• Demonstrates thorough knowledge and understanding of the relationship between structure and uses of soaps and detergents • Accounts for the development of modern detergents in terms of supply of raw materials, effectiveness in hard water, environmental concerns • Uses correct and relevant chemistry • Demonstrates coherence and logical progression and includes correct use of scientific principles and ideas	6–7
• Demonstrates sound knowledge and understanding of relationship between structure and uses of soap and detergents • Outlines the development of modern detergents in terms of some aspects above • Uses some correct and relevant chemistry • Communicates some scientific principles and ideas in a clear manner	4–5
• Demonstrates a basic knowledge and understanding of soaps and detergents and their uses • Identifies some factors relating to the development of detergents • Communicates ideas in a basic form using general scientific terms	2–3
• Demonstrates a limited knowledge and understanding of soaps and/or detergents and their uses and/or structures • Communicates simple ideas	1

Question 35 (a)

Criteria	Marks
• Demonstrates a thorough understanding of the processes occurring when a saturated solution evaporates and the damage this causes	3
• Demonstrates a sound understanding of the processes occurring when a saturated solution evaporates	2
• Identifies that drying the artefact could cause damage OR • Displays a limited understanding of the processes occurring when a saturated solution evaporates	1

Question 35 (b) (i)

Criteria	Marks
• Demonstrates coherence and logical progression of ideas • Demonstrates a thorough knowledge of cathodic protection by the use of applied current	3
• Communicates ideas in a clear manner • Sound understanding of cathodic protection without identification of 'impressed current' OR • Impressed current identified but explanation lacks coherence	2
• Limited understanding of cathodic protection OR • Simple statement of rust prevention	1

Question 35 (b) (ii)

Criteria	Marks
• Uses correct half-equations to describe the actions of a sacrificial anode	2
• Identifies use of a sacrificial anode without supporting equations	1

Question 35 (c) (i)

Criteria	Marks
• Correctly identifies locations as deep sea environments • Provides a factor for this process	2
• Correctly identifies locations as deep sea environments OR • Provides a factor for this process	1

Question 35 (c) (ii)

Criteria	Marks
• Correctly balanced equation given • Mass of iron correctly calculated with all working shown	3
• Overall equation attempted, but incorrectly balanced • Calculations correct based on equation shown OR • Overall equation correct • Calculations attempted with minimal error OR • Half-equation present and working shown for calculation of mass • Calculations contain errors in stoichiometry only	2
• Moles of H_2S calculated OR • Provides balanced equation	1

Question 35 (d) (i)

Criteria	Marks
• Gives reason relating variables to validity	1

Question 35 (d) (ii)

Criteria	Marks
• Correctly draws beakers to illustrate valid investigation of TWO factors • Lists expected results for BOTH factors	4
• Correctly draws beakers to illustrate valid investigation of TWO factors • Lists one expected result OR • Draws beakers to illustrate investigation with minor error and • Lists expected results for BOTH factors	3
• Draws beakers only OR • Draws beakers and labels results for ONE investigation OR • Lists expected results for TWO factors	2
• Describes a valid investigation OR • Lists one expected result for an identified experiment	1

Question 35 (e)

Criteria	Marks
• Demonstrates a thorough knowledge and understanding of the history of ocean-going vessels, the composition of types of steel and methods of preventing corrosion • Provides a judgment about the use of steel for ship building in light of these concepts • Writes logically, providing a coherent progression of ideas	6–7
• Demonstrates a sound knowledge and understanding of the history of ocean-going vessels, the composition of types of steel and methods of preventing corrosion • Identifies benefits of using steel in ship building • Communicates ideas in a clear manner	4–5
• Demonstrates a thorough knowledge and understanding of EITHER the history of ocean-going vessels OR the composition of steel OR methods of preventing corrosion OR • Demonstrates a basic knowledge and understanding of the history of ocean-going vessels, the composition of types of steel and methods of preventing corrosion • Communicates ideas using general scientific terms	2–3
• Demonstrates a limited understanding of the history of ship building OR • Demonstrates a limited knowledge of the composition of steel OR methods to prevent corrosion	1

Question 36 (a)

Criteria	Marks
• Identifies all THREE components correctly	3
• Identifies TWO components correctly OR • Names THREE components	2
• Identifies ONE component	1

Question 36 (b) (i)

Criteria	Marks
• Provides correct formula	1

Question 36 (b) (ii)

Criteria	Marks
• Provides correct formula	1

Question 36 (b) (iii)

Criteria	Marks
• Demonstrates a sound knowledge of the THREE types of compounds	3
• Demonstrates a sound knowledge of TWO types of compounds OR • Demonstrates a basic knowledge of all THREE types of compounds	2
• Demonstrates a basic knowledge of TWO types of compounds OR • Demonstrates a limited knowledge of all THREE types of compounds	1

Question 36 (c) (i)

Criteria	Marks
• Recognises relative level of oxidation	1

Question 36 (c) (ii)

Criteria	Marks
• Shows flow diagram complete with at least the eight components • Shows CO_2 from Krebs cycle • Shows ATP from Electron transport chain	4
• Shows correct order, majority of components given • Shows either CO_2 from Krebs or ATP from Electron transport chain	3
• Shows some elements of flow diagram in correct order	2
• Shows some elements of flow diagram	1

Question 36 (d) (i)

Criteria	Marks
• Identifies bond type in primary structure • Identifies forces and bonds that determine secondary and tertiary structure	3
• Identifies bond type in primary structure • Identifies TWO factors or bonds that determine secondary and tertiary structure	2
• Identifies bond type in primary structure OR • Identifies TWO factors or bonds that determine secondary and tertiary structure	1

Question 36 (d) (ii)

Criteria	Marks
• Shows how secondary structure is denatured by pH change	2
• Identifies secondary structure denatured	1

Question 36 (e)

Criteria	Marks
• Demonstrates a thorough knowledge and understanding of the biochemical pathways releasing energy during different forms of exercise • Demonstrates coherence and logical progression of scientific principles and ideas	6–7
• Demonstrates a sound knowledge and understanding of the biochemical pathways releasing energy during exercise • Communicates some scientific ideas in a clear manner	4–5
• Demonstrates a basic knowledge and understanding of the biochemical pathways releasing energy during exercise • Communicates ideas in a basic form using general scientific terms	2–3
• Demonstrates a limited knowledge of the biochemical pathways releasing energy • Communicates simple ideas	1

Question 37 (a) (i)

Criteria	Marks
• Provides correct oxidation state	1

Question 37 (a) (ii)

Criteria	Marks
• Structure is drawn correctly, including charge if present. Ligands show appropriate orientation (ie not bonded through hydrogen) • Explanation of bonding is correct in essential features	2
• Either structure is drawn correctly or explanation of bonding is correct in essential features	1

Question 37 (b) (i)

Criteria	Marks
• A correct reason is given, with both sufficient description of the problem and the conditions under which it would occur to show knowledge of the chemistry of $CuSO_4.5H_2O$.	2
• A simple description of the potential problem is given without reference to the chemistry of $CuSO_4.5H_2O$.	1

Question 37 (b) (ii)

Criteria	Marks
• Demonstrates a thorough knowledge of the process, such as naming the process, naming the binder and describing the method by which the pigment is fixed to the substrate.	3
• Demonstrates a basic knowledge of the process, such as naming the process and binding agent.	2
• Demonstrates limited knowledge, such as the name of a process.	1

Question 37 (c)

Criteria	Marks
• Demonstrates a thorough knowledge of the topic, and presents all relevant factors, including electron-electron repulsion and inner shell stability vs valence shell stability	5
• Demonstrates a sound knowledge of topic, and presents a majority of relevant factors	4
• Demonstrates a basic knowledge of the topic, and presents one factor	3
• Demonstrates a limited knowledge of the topic	1–2

Question 37 (d) (i)

Criteria	Marks
• States: need to dissolve salt, need to oxidise Fe^{2+}, importance of using a non-contributing oxidising agent	3
• States two significant factors of the experiment design	2
• States one significant factor of the experiment design	1

Question 37 (d) (ii)

Criteria	Marks
• Both configurations correct	2
• One configuration correct or two partially correct	1

Question 37 (e)

Criteria	Marks
• Demonstrates a thorough knowledge and understanding of the place of the Bohr model of the atom including both positive and negative aspects of the model • Demonstrates coherent and logical progression of scientific principles and ideas	6–7
• Demonstrates a sound knowledge and understanding of the place of the Bohr model of the atom, including positive and/or negative aspects of the model • Communicates some scientific ideas in a clear manner	4–5
• Demonstrates a basic knowledge and understanding of the place of the Bohr model of the atom, with limited reference to positive and negative aspects of the model • Communicates ideas in a basic form using general scientific terms	2–3
• Demonstrates a limited knowledge and understanding of the place of the Bohr model of the atom, and does not address positive and negative aspects of the model • Communicates simple ideas	1

Question 38 (a)

Criteria	Marks
• Demonstrates a thorough knowledge of the types of inorganic characteristics present in soil • Links characteristics to the origins of the sample	3
• Demonstrates a sound knowledge of the types of characteristics in soil OR • Gives a list of various characteristics and links them to the origins of the samples	2
• Identifies some characteristics of soil	1

Question 38 (b) (i)

Criteria	Marks
• Identifies how accuracy and reliability make the sample admissible in court • Demonstrates a thorough knowledge of precautions/ procedures necessary in a forensic investigation and links them directly to the urine samples/ sample bottles • Relates procedures to accuracy and reliability	3
• Demonstrates a sound knowledge of procedures/precautions in a forensic investigation and links them to urine testing bottles OR • Identifies precautions procedures and relates them to accuracy or reliability required for admission in court	2
• Identifies precautions or procedures OR • Identifies a precaution/procedure and relates it to validity or reliability	1

Question 38 (b) (ii)

Criteria	Marks
• Gives details of a recent case • Shows how a change in technology could advance/did change the verdict	2
• Shows how changes in technology can change the outcome of a forensic investigation	1

Question 38 (c) (i)

Criteria	Marks
• Identifies correct pigment • Gives a valid justification	2
• Identifies correct pigment OR • Gives a valid justification	1

Question 38 (c) (ii)

Criteria	Marks
• Demonstrates a thorough understanding of the relationship between the solvent and the separation	3
• Demonstrates a sound understanding of the relationship between the solvent and the separation	2
• Describes how a separation could be changed	1

Question 38 (d) (i)

Criteria	Marks
• Gives correct structural formula for all products	2
• Gives correct structural equation but omits water OR • Gives structural formula with a small error; includes water	1

Question 38 (d) (ii)

Criteria	Marks
• Demonstrates a through knowledge of an appropriate chemical test • Includes an equation • Identifies results for specified sugars	3
• Demonstrates a sound knowledge of an appropriate chemical test; May state results for reducing sugars only	2
• Identifies a suitable reagent	1

Question 38 (e)

Criteria	Marks
• Demonstrates a clear and thorough understanding of the features of DNA that relate to forensic science • Provides a clear description of how the DNA molecule is manipulated • The molecular properties/features of DNA are linked to each manipulation involved in obtaining DNA profile • Describes how non-coding DNA varies from person to person • Demonstrates coherence and logical progression of ideas in a scientific manner • Describes how DNA profiles are unique	6–7
• Demonstrates a sound understanding of the features of DNA that relate to forensic science • Some steps in the process of obtaining a DNA profile are described • Demonstrates a sound understanding of most factors linking the molecular properties/features of DNA to a step involved in obtaining a DNA profile • States how a DNA profile allows for the identification of an individual	4–5
• Demonstrates basic understanding of the features of DNA that relate to forensic science • A step in the process of obtaining a DNA profile is described • States how a DNA profile allows for the identification of a person OR • Shows sound understanding of some factors linking the molecular properties/features of DNA to a step involved in obtaining a DNA profile	2–3
• Demonstrates a limited understanding of the features of DNA OR • A step in the process of obtaining a DNA profile is outlined OR • States how a DNA profile allows for the identification of a person	1

Chemistry

2012 HSC Examination Mapping Grid

Section I
Part A

Question	Marks	Content	Syllabus outcomes
1	1	9.4.5.2.1	H13
2	1	9.2.1.2.7	H9
3	1	9.4.2.2.8	H8
4	1	9.3.4.3.3	H11
5	1	9.2.3.2.56	H9, H10
6	1	9.2.5.2.3	H6, H13
7	1	9.3.1.2.2	H13, H14
8	1	9.3.4.2.9	H8
9	1	9.4.4.2.5	H6
10	1	9.4.3.3.1, 9.4.3.2.1, 9.4.3.3.4	H12, H14
11	1	9.3.3.2.6	H8
12	1	9.4.4.2.9	H10
13	1	9.2.4.2.3	H8
14	1	9.2.4.3.4	H10
15	1	9.3.2.2.1, 9.3.2.2.2	H6
16	1	9.3.2.2.4	H12
17	1	9.2.3.2.7, 9.2.3.3.6	H10, H12
18	1	9.3.3.2.6, 9.3.3.2.1, 9.3.3.3.4	H12
19	1	9.3.4.3.3	H12
20	1	9.4.5.3.1/2	H12

Section I
Part B

Question	Marks	Content	Syllabus outcomes
21 (a)	2	9.3.5.2.4	H10, H13
21 (b)	2	9.3.5.3.1	H11
22 (a)	1	9.2.1.3.3, 9.2.1.2.6	H10
22 (b)	2	9.2.1.3.3	H2, H14
23	3	9.3.2.2.5, 9.3.2.2.4	H8, H10
24	3	9.4.2.2.1	H4
25	3	9.4.5.3.2	H8
26 (a)	5	9.2.1.2.2, 9.2.3.3.2	H10, H7
26 (b)	3	9.2.2.2.1, 9.2.3.2.8	H4
27 (a)	2	9.2.5.2.6	H12
27 (b)	1	9.2.5.2.6, 9.2.1.3.1	H10, H13
28	3	9.3.3.2.5, 9.3.3.3.7	H10, H12, H13

Question	Marks	Content	Syllabus outcomes
29	5	9.4.4.2.1, 9.4.4.2.2	H13
30 (a)	2	9.3.4.3.3	H10, H12
30 (b) (i)	3	9.3.4.3.3	H10, H12
30 (b) (ii)	1	9.2.3.2.3	H8
31 (a)	3	9.2.3.2.9, 9.3.5.2.3	H13
31 (b)	1	9.3.5.2.3	H12
31 (c)	1	9.3.5.2.3	H8
32	3	9.4.3.3.5	H12, H14
33	6	9.2.4.3.3, 9.4.1.2.2	H3, H4, H7, H8, H12

Section II

Question	Marks	Content	Syllabus outcomes
Question 34		**Industrial Chemistry**	
(a)	3	9.5.4.3.1	H7
(b) (i)	1	9.5.2.2.2	H10, H12
(b) (ii)	3	9.5.2.3.3	H10, H12
(b) (iii)	1	9.5.2.2.3	H8
(c) (i)	3	9.5.3.2.3	H10, H14
(c) (ii)	2	9.5.3.2.3, 9.5.3.2.7	H7, H8
(d) (i)	3	9.5.6.3.1	H8, H10, H11
(d) (ii)	2	9.5.6.3.1	H12, H11
(e)	7	9.5.5.2.1, 9.5.5.3.5, 9.5.5.2.5, 9.5.5.2.3, 9.5.5.2.6	H3, H4, H9, H13
Question 35		**Shipwrecks, Corrosion and Conservation**	
(a)	3	9.6.7.2.2	H8
(b) (i)	3	9.6.4.2.3	H8
(b) (ii)	2	9.6.4.2.3, 9.6.4.3.4	H3, H8
(c) (i)	2	9.6.6.2.1, 9.6.6.2.2	H8
(c) (ii)	3	9.6.6.2.2, 9.6.6.3.1	H8, H10
(d) (i)	1	9.6.3.3.1	H11
(d) (ii)	4	9.6.3.2.2, 9.6.3.3.1	H11, H13
(e)	7	9.6.2.2.3, 9.6.2.3.3, 9.6.4.2.1, 9.6.4.3.1	H3, H4, H8, H13

Question 36		**The Biochemistry of movement**	
(a)	3	9.7.5.2.2, 9.7.5.2.3	H6
(b) (i)	1	9.7.3.2.1	H9
(b) (ii)	1	9.7.3.2.4	H9
(b) (iii)	3	9.7.3.2.2/3, 9.7.3.3.2	H9, H8
(c) (i)	1	9.7.3.2.6, 9.7.7.2.2	H7, H9
(c) (ii)	4	9.7.8.3.1, 9.7.6.2.2/3	H7, H9, H13
(d) (i)	3	9.7.4.2.3/4, 9.7.4.2.5	H6, H9
(d) (ii)	2	9.7.4.3.2	H6, H9
(e)	7	9.7.7.3.1, 9.7.8.2.2, 9.7.10.2.1	H4, H7, H8, H9
Question 37		**The Chemistry of Art**	
(a) (i)	1	9.8.4.2.3	H6
(a) (ii)	2	9.8.5.2.2/3/4, 9.8.5.3.1	H6, H13
(b) (i)	2	9.8.1.2.2	H8
(b) (ii)	3	9.8.1.2.4, 9.8.1.2.5	H8
(c)	5	9.8.3.2.8, 9.8.3.3.1	H6, H12c, H14
(d) (i)	3	9.8.2.2.4, 9.8.4.3.2	H6, H11
(d) (ii)	2	9.8.4.3.1	H6
(e)	7	9.8.2.2.5, 9.8.2.3.4	H2, H6
Question 38		**Forensic Chemistry**	
(a)	3	9.9.1.2.4	H14
(b) (i)	3	9.9.1.2.1	H14
(b) (ii)	2	9.9.1.2.5	H4
(c) (i)	2	9.9.3.3.4	H6
(c) (ii)	3	9.9.3.3.4	H8
(d) (i)	2	9.9.2.2.2	H9
(d) (ii)	3	9.9.2.3.1, 9.9.2.2.3	H9, H11
(e)	7	9.9.4	H4