**Chemistry 2011**

**Marking Guidelines**

**Section I, Part A**

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

**Question 21**

|  |  |
| --- | --- |
| **Criteria** | **Marks** |
| * **Correctly describes a solution of a weak acid or a weak base and its salt** * **Correctly describes the ability to resist changes in pH** * **Must contain a relatively large concentration of acid to react with any OH ions** | **3** |
| * **Any TWO of the above** | **2** |
| * **Any ONE of the above** | **1** |

**Question 22 (a) (i)**

|  |  |
| --- | --- |
| **Criteria** | **Marks** |
| * **Correctly derives the correct formula** | **1** |

**Question 22 (a) (ii)**

|  |  |
| --- | --- |
| **Criteria** | **Marks** |
| * **Correctly states the molecular formula** | **1** |

**Question 22 (a) (iii)**

|  |  |
| --- | --- |
| **Criteria** | **Marks** |
| * **Correctly draws THREE possible structures** | **3** |
| * **Correctly draws TWO possible structures** | **2** |
| * **Correctly draws ONE possible structure** | **1** |

**Question 22 (b)**

|  |  |
| --- | --- |
| **Criteria** | **Marks** |
| * **Correctly suggests an appropriate mechanism** | **1** |

**Question 23 (a)**

|  |  |
| --- | --- |
| **Criteria** | **Marks** |
| * **Correctly draws an appropriate formula** | **1** |

**Question 23 (b)**

|  |  |
| --- | --- |
| **Criteria** | **Marks** |
| * **Correctly calculates the correct pressure** * **Uses the correct equation** | **2** |
| * **Uses the correct equation** | **1** |

**Question 24 (a)**

|  |  |
| --- | --- |
| **Criteria** | **Marks** |
| * **Correctly describes both terms** | **2** |
| * **Correctly describes one term** | **1** |

**Question 24 (b)**

|  |  |
| --- | --- |
| **Criteria** | **Marks** |
| * **Correctly provides an example of both a saturated and an unsaturated hydrocarbon** | **2** |
| * **Correctly provides an example of one of the above** | **1** |

**Question 25 (a)**

|  |  |
| --- | --- |
| **Criteria** | **Marks** |
| * **Correctly describes global warming** | **1** |

**Question 25 (b)**

|  |  |
| --- | --- |
| **Criteria** | **Marks** |
| * **Correctly describes nuclear reactor safety** | **1** |

**Question 25 (c)**

|  |  |
| --- | --- |
| **Criteria** | **Marks** |
| * **Correctly describes nuclear weapon risks** | **1** |

**Question 25 (d)**

|  |  |
| --- | --- |
| **Criteria** | **Marks** |
| * **Correctly describes nuclear waste disposal** | **1** |

**Question 26**

|  |  |
| --- | --- |
| **Criteria** | **Marks** |
| * **Draws correct structural formulae and correctly names reactant compounds** * **Gives balanced chemical equations** * **Substitutes correctly into equations** * **Calculates the correct yield of metal** | **3-4** |
| * **Gives balanced chemical equations** * **Substitutes correctly into equations** | **1-2** |

**Question 27**

|  |  |
| --- | --- |
| **Criteria** | **Marks** |
| * **Correctly derives the correct ionic equation** | **2** |
| * **Identifies type of reaction** | **1** |

**Question 28 (a)**

|  |  |
| --- | --- |
| **Criteria** | **Marks** |
| * **Correctly derives the correct formula** * **Correctly determines the type of reaction** | **3-4** |
| * **One of the above** | **1-2** |

**Question 28 (b)**

|  |  |
| --- | --- |
| **Criteria** | **Marks** |
| * **Correctly derives a balanced equation for the reaction** | **1-2** |

**Question 28 (c)**

|  |  |
| --- | --- |
| **Criteria** | **Marks** |
| * **Correctly describes a method to minimize hazard and wastage of resources** | **1-2** |

**Question 29 (a)**

|  |  |
| --- | --- |
| **Criteria** | **Marks** |
| * **Writes correct equation** * **Correctly calculates volume** | **2** |
| * **Writes correct equation**   **OR**   * **Correctly calculates volume** | **1** |

**Question 29 (b)**

|  |  |
| --- | --- |
| **Criteria** | **Marks** |
| * **Writes correct equation** * **Correctly calculates temperature** | **2** |
| * **Writes correct equation**   **OR**   * **Correctly calculates temperature** | **1** |

**Question 29 (c)**

|  |  |
| --- | --- |
| **Criteria** | **Marks** |
| * **Draws appropriate sketch** * **Describes dipole-dipole interaction** | **2** |
| * **Draws appropriate sketch**   **OR**   * **Describes dipole-dipole interaction** | **1** |

**Question 30 (a) (i)**

|  |  |
| --- | --- |
| **Criteria** | **Marks** |
| * **Correctly draws an appropriate structure** | **1** |

**Question 30 (a) (ii)**

|  |  |
| --- | --- |
| **Criteria** | **Marks** |
| * **Correctly draws an appropriate structure** | **1** |

**Question 30 (b)**

|  |  |
| --- | --- |
| **Criteria** | **Marks** |
| * **Explains how it would require a C atom that formed 5 bonds** | **1** |

**Question 30 (c)**

|  |  |
| --- | --- |
| **Criteria** | **Marks** |
| * **Correctly draws FIVE structural isomers** | **5** |
| * **Correctly draws FOUR structural isomers** | **4** |
| * **Correctly draws THREE structural isomers** | **3** |
| * **Correctly draws TWO structural isomers** | **2** |
| * **Correctly draws ONE structural isomer** | **1** |

**Question 31 (a) (i)**

|  |  |
| --- | --- |
| **Criteria** | **Marks** |
| * **Correctly derives a balanced equation for the reaction** * **Correctly calculates the total percentage** | **2-3** |
| * **Correctly derives a balanced equation for the reaction**   **OR**   * **Correctly calculates the total percentage** | **1** |

**Question 31 (a) (ii)**

|  |  |
| --- | --- |
| **Criteria** | **Marks** |
| * **Correctly describes an appropriate chemical test** * **Correctly derives a balanced equation for the reaction** | **2** |
| * **Correctly derives a balanced equation for the reaction**   **OR**   * **Correctly describes an appropriate chemical test** | **1** |

**Question 31 (b)**

|  |  |
| --- | --- |
| **Criteria** | **Marks** |
| * **Correctly names an appropriate ion** * **Describes the effect of the nominated ion in the waterway** | **2** |
| * **Correctly names an appropriate ion**   **OR**   * **Describes the effect of the nominated ion in the waterway** | **1** |

**Question 32 (a)**

|  |  |
| --- | --- |
| **Criteria** | **Marks** |
| * **Correctly distinguishes between mercury, diaphragm and membrane processes** * **Outlines technical risk associated with the THREE electrolysis methods** | **5 -6** |
| * **Correctly distinguishes between TWO of the THREE electrolysis methods** * **Outlines technical risk associated with TWO of the electrolysis methods** | **3-4** |
| * **Describes ONE of the electrolysis methods** * **Outlines technical risk associated with ONE of the electrolysis methods** | **1-2** |

**Question 32 (b) (i)**

|  |  |
| --- | --- |
| **Criteria** | **Marks** |
| * **Provides all half reactions** | **2** |
| * **Provides one half reaction** | **1** |

**Question 32 (b) (ii)**

|  |  |
| --- | --- |
| **Criteria** | **Marks** |
| * **Correctly substitutes into equation** * **Uses correct equation** | **2** |
| * **Uses correct equation** | **1** |

**Question 32 (c) (i)**

|  |  |
| --- | --- |
| **Criteria** | **Marks** |
| * **Provides the correct equilibrium constant expression** | **1** |

**Question 32 (c) (ii)**

|  |  |
| --- | --- |
| **Criteria** | **Marks** |
| * **Correctly predicts change in equilibrium** | **1** |

**Question 32 (c) (iii)**

|  |  |
| --- | --- |
| **Criteria** | **Marks** |
| * **Correctly predicts change in equilibrium** | **1** |

**Question 32 (d)**

|  |  |
| --- | --- |
| **Criteria** | **Marks** |
| * **Correctly distinguishes between anionic, cationic and non-ionic synthetic detergents** * **Demonstrates coherence and logical progression of ideas and includes correct use of scientific principles and ideas** | **4-5** |
| * **Correctly distinguishes between TWO of the THREE detergents** * **States ONE feature of TWO of the detergents** | **2-3** |
| * **Describes ONE of the detergents in terms of chemical composition and use** | **1** |

**Question 32 (e)**

|  |  |
| --- | --- |
| **Criteria** | **Marks** |
| * **Demonstrates thorough knowledge and understanding of the extraction processes and the resulting environmental impact** * **Provides relevant equations** * **Provides a judgement on importance and environmental impact** * **Demonstrates coherence and logical progression and includes correct use of scientific principles and ideas** | **6-7** |
| * **Demonstrates sound knowledge and understanding of the extraction processes and the resulting environmental impact** * **Provides a relevant equation** * **Communicates some scientific ideas in a clear manner** | **4-5** |
| * **Demonstrates basic knowledge of the extraction processes and the resulting environmental impact** * **Communicates ideas in a basic form using general scientific terms** | **2-3** |
| * **Demonstrates a limited knowledge of the extraction process** * **Communicates simple ideas** | **1** |

**Question 33 (a)**

|  |  |
| --- | --- |
| **Criteria** | **Marks** |
| * **Provides a thorough explanation of the function of these coatings and the electro-chemistry of the corrosion reactions** * **Communicates ideas using scientific principles in a logical manner with reference to the steel substrate** | **4** |
| * **Provides a sound explanation of the function of these coatings and the electro-chemistry of the corrosion reactions** * **Communicates ideas using scientific principles with reference to the steel substrate** | **3** |
| * **Demonstrates a basic knowledge of the function of these coatings** | **2** |
| * **Demonstrates a limited knowledge of the function of these coatings** | **1** |

**Question 33 (b)**

|  |  |
| --- | --- |
| **Criteria** | **Marks** |
| * **Correctly describes the corrosion of most metals by oxygen being accelerated at low pH** * **Gives a correctly balanced equation** | **2** |
| * **Describes the key reaction as reduction of the metal by oxygen** | **1** |

**Question 33 (c)**

|  |  |
| --- | --- |
| **Criteria** | **Marks** |
| * **Provides correct overall reaction equation** * **Correctly substitutes all values into equation** * **Correctly determines percentage by mass of iron** | **3-4** |
| * **Provides correct overall reaction equation**   **OR**   * **Correctly substitutes all values into equation**   **OR**   * **Correctly determines percentage by mass of iron** | **1-2** |

**Question 33 (d) (i)**

|  |  |
| --- | --- |
| **Criteria** | **Marks** |
| * **Draws fully labelled diagram** * **Provides relevant half equations** * **Provides overall reaction equation** | **4** |
| * **Draws labelled diagram with some errors** * **Provides relevant half equation and full overall equation**   **OR**   * **Draws fully labelled diagram** * **Provides relevant half equation** | **3** |
| * **Draws a diagram with some correct labels** * **Provides relevant half equation** | **2** |
| * **Draws a diagram with some correct labels**   **OR**   * **Provides relevant half equation** | **1** |

**Question 33 (d) (ii)**

|  |  |
| --- | --- |
| **Criteria** | **Marks** |
| * **Correctly describes the cathode** | **1** |

**Question 33 (e)**

|  |  |
| --- | --- |
| **Criteria** | **Marks** |
| * **Demonstrates a sound knowledge of sulfate-reducing bacteria and their effect around deep wrecks** | **3** |
| * **Demonstrates a basic knowledge of sulfate-reducing bacteria and their effect around deep wrecks** | **2** |
| * **Demonstrates a limited knowledge of sulfate-reducing bacteria and their effect around deep wrecks** | **1** |

**Question 33 (f)**

|  |  |
| --- | --- |
| **Criteria** | **Marks** |
| * **Demonstrates thorough knowledge and understanding of conservation and restoration techniques for the TWO projects** * **Compares process for the TWO projects** * **Uses equations to describe restoration of materials** * **Provides a judgement on suitability of techniques** * **Demonstrates coherence and logical progression and includes correct use of scientific principles and ideas** | **6-7** |
| * **Demonstrates sound knowledge and understanding of conservation and restoration for the TWO projects** * **Provides a judgement on suitability of techniques** * **Communicates scientific principles clearly** | **4-5** |
| * **Demonstrates basic knowledge and understanding of conservation and restoration techniques for ONE project** * **Communicates in basic form using general scientific principles** | **2-3** |
| * **Demonstrates a limited knowledge of either conservation or restoration techniques for ONE project** * **Communicates simple ideas** | **1** |

**Question 34 (a)**

|  |  |
| --- | --- |
| **Criteria** | **Marks** |
| * **Correctly relates ADP to ATP** * **Correctly describes hydrolysis** * **States importance of energy transfer and storage** | **3** |
| * **TWO of the above** | **2** |
| * **ONE of the above** | **1** |

**Question 34 (b)**

|  |  |
| --- | --- |
| **Criteria** | **Marks** |
| * **Correctly describes FOUR general stages of the process by which biochemical energy is obtained from food** | **4** |
| * **Correctly describes THREE general stages of the process by which biochemical energy is obtained from food** | **3** |
| * **Correctly describes TWO general stages of the process by which biochemical energy is obtained from food** | **2** |
| * **Correctly describes ONE general stages of the process by which biochemical energy is obtained from food** | **1** |

**Question 34 (c)**

|  |  |
| --- | --- |
| **Criteria** | **Marks** |
| * **Demonstrates thorough knowledge of TAGs as an energy dense store for humans** * **Describes the chemical composition of TAGs** * **Provides equations which describe the hydrolysis of TAGs** * **Demonstrates coherence and logical progression and includes correct use of scientific principles and ideas** | **4-5** |
| * **Demonstrates sound knowledge of TAGs as an energy dense store for humans** * **Describes the chemical composition of TAGs** * **Provides equations which describe the hydrolysis of TAGs** * **Communicates scientific principles clearly** | **2-3** |
| * **Demonstrates limited knowledge of TAGs as an energy dense store for humans** * **Communicates simple ideas** | **1** |

**Question 34 (d)**

|  |  |
| --- | --- |
| **Criteria** | **Marks** |
| * **Correctly describes peptide bonds** * **Provides ONE correct example of a peptide bond** * **Demonstrates coherence and logical progression and includes correct use of scientific principles and ideas** | **3-4** |
| * **Correctly describes peptide bonds**   **OR**   * **Provides ONE correct example of a peptide bond** * **Communicates scientific ideas clearly** | **1-2** |

**Question 34 (e)**

|  |  |
| --- | --- |
| **Criteria** | **Marks** |
| * **Demonstrates a thorough knowledge and understanding of skeletal muscles** * **Describes the formation of temporary bonds between the actin and myosin fibres** * **Explains the importance of ATP to the process of limb movement** * **Demonstrates coherence and logical progression and includes correct use of scientific principles and ideas** | **4** |
| * **Demonstrates a sound knowledge and understanding of skeletal muscles** * **Describes the formation of temporary bonds between the actin and myosin fibres**   **OR**   * **Explains the importance of ATP to the process of limb movement** * **Communicates scientific principles clearly** | **3** |
| * **Demonstrates a basic knowledge and understanding of skeletal muscles** * **Communicates ideas in basic form using general scientific terms** | **2** |
| * **Demonstrates a limited knowledge of skeletal muscles** * **Communicates simple ideas** | **1** |

**Question 34 (f)**

|  |  |
| --- | --- |
| **Criteria** | **Marks** |
| * **Using a simple flowchart correctly describes the TCA cycle** * **Describes the principal processes involved in respiration** * **Demonstrates coherence and logical progression and includes correct use of scientific principles and ideas** | **4-5** |
| * **Using a simple flowchart partially describes the TCA cycle** * **Communicates scientific principles clearly** | **2-3** |
| * **Constructs a simple flowchart** | **1** |

**Question 35 (a)**

|  |  |
| --- | --- |
| **Criteria** | **Marks** |
| * **Correctly explains the relationship between the electron structure and its electro-negativity** * **Communicates ideas in basic form using general scientific terms** | **3** |
| * **Describes electrons in element structure and relates it to electro-negativity** | **2** |
| * **Defines electro-negativity** | **1** |

**Question 35 (b) (i)**

|  |  |
| --- | --- |
| **Criteria** | **Marks** |
| * **Correctly identifies a chelated ligand** | **1** |

**Question 35 (b) (ii)**

|  |  |
| --- | --- |
| **Criteria** | **Marks** |
| * **Correctly describes the use of models in developing an understanding of ligands** * **Demonstrates coherence and logical progression and includes correct use of scientific principles and ideas** | **3-4** |
| * **Partially describes the use of models in developing an understanding of ligands** * **Communicates ideas in a general form using general scientific terms** | **1-2** |

**Question 35 (c) (i)**

|  |  |
| --- | --- |
| **Criteria** | **Marks** |
| * **Outlines the use of UV light in the analysis and identification of pigments** * **Outlines the use of UV light in the chemical composition of pigments** | **2** |
| * **Outlines the use of UV light in the analysis and identification of pigments**   **OR**   * **Outlines the use of UV light in the chemical composition of pigments** | **1** |

**Question 35 (c) (ii)**

|  |  |
| --- | --- |
| **Criteria** | **Marks** |
| * **Identifies absorption spectra** * **Identifies reflective spectra** * **Explains the relationship between absorption and reflective spectra** * **Describes the effect of light on pigments** | **2-3** |
| * **Identifies absorption spectra**   **OR**   * **Identifies reflective spectra**   **OR**   * **Explains the relationship between absorption and reflective spectra**   **OR**   * **Describes the effect of light on pigments** | **1** |

**Question 35 (d)**

|  |  |
| --- | --- |
| **Criteria** | **Marks** |
| * **Correctly describes complex ions of a transition metal** * **Uses a transition metal as an example** * **Identifies relevant properties associated with strong oxidizing agents** | **4-5** |
| * **TWO of the above** | **2-3** |
| * **ONE of the above** | **1** |

**Question 35 (e)**

|  |  |
| --- | --- |
| **Criteria** | **Marks** |
| * **Demonstrates thorough knowledge and understanding of the use of pigments in indigenous decoration** * **Provides a judgement on the use of pigments available to Aboriginal people** * **Demonstrates coherence and logical progression and includes TWO pigments with chemical names and formulas** | **6-7** |
| * **Demonstrates sound knowledge and understanding of the use of pigments in indigenous decoration** * **Provides a judgement on the use of pigments available to Aboriginal people** * **Demonstrates coherence and logical progression and includes ONE pigments with chemical name and formula** | **4-5** |
| * **Demonstrates a basic knowledge of the use of pigments in indigenous decoration** * **Communicates ideas in a basic form using general scientific terms** | **2-3** |
| * **Demonstrates a limited knowledge of the use of pigments in indigenous decoration** * **Communicates simple ideas** | **1** |

**Question 36 (a)**

|  |  |
| --- | --- |
| **Criteria** | **Marks** |
| * **Outlines THREE precautions necessary to ensure accuracy for forensic analysis** | **3** |
| * **Outlines TWO precautions necessary to ensure accuracy for forensic analysis** | **2** |
| * **Outlines ONE precaution necessary to ensure accuracy for forensic analysis** | **1** |

**Question 36 (b)**

|  |  |
| --- | --- |
| **Criteria** | **Marks** |
| * **Outlines the process of chromatography** * **Outlines the process of electrophoresis** * **Compares chromatography and electrophoresis** * **Identifies the properties of mixtures that allows their separation** | **4-5** |
| * **TWO of the above** | **2-3** |
| * **ONE of the above** | **1** |

**Question 36 (c)**

|  |  |
| --- | --- |
| **Criteria** | **Marks** |
| * **Correctly draws the structure for the THREE component amino acids** * **Correctly draws the structure for the tripeptide** | **2-3** |
| * **ONE of the above** | **1** |

**Question 36 (d)**

|  |  |
| --- | --- |
| **Criteria** | **Marks** |
| * **Correctly draws the structure of a mass spectrometer** * **Correctly describes the use of a mass spectrometer in forensic chemistry** * **Demonstrates coherence and logical progression and includes correct use of scientific principles and ideas** | **4-5** |
| * **Correctly draws the structure of a mass spectrometer**   **OR**   * **Correctly describes the use of a mass spectrometer in forensic chemistry** * **Communicates some scientific principles and ideas in a clear manner** | **2-3** |
| * **Provides a simple drawing of a mass spectrometer** * **Communicates simple ideas** | **1** |

**Question 36 (e)**

|  |  |
| --- | --- |
| **Criteria** | **Marks** |
| * **Correctly describes the process used to analyse DNA** * **Correctly accounts for the use of DNA in identifying relationships between people** | **3-4** |
| * **Correctly describes the process used to analyse DNA**   **OR**   * **Correctly accounts for the use of DNA in identifying relationships between people** | **1-2** |

**Question 36 (f)**

|  |  |
| --- | --- |
| **Criteria** | **Marks** |
| * **Demonstrates thorough knowledge of a distinguishing test for proteins** * **Provides a range of applications for this test** * **Demonstrates coherence and logical progression and includes correct use of scientific principles and ideas** | **4-5** |
| * **Demonstrates sound knowledge of a distinguishing test for proteins** * **Provides a range of applications for this test** * **Demonstrates some scientific principles and ideas in a clear manner** | **2-3** |
| * **Demonstrates a limited knowledge of a distinguishing test for proteins** * **Communicates simple ideas** | **1** |

**Chemistry 2011**

**Examination Mapping Grid**

|  |  |  |  |
| --- | --- | --- | --- |
| **Question** | **Mark** | **Content** | **Syllabus outcomes** |

**Section I**

**Part A**

|  |  |  |  |
| --- | --- | --- | --- |
| **1** | **1** | **9.2.2.2.3** | **H9** |
| **2** | **1** | **9.2.5.2.2** | **H6** |
| **3** | **1** | **9.3.1.2.2** | **H8** |
| **4** | **1** | **9.4.4.2.9** | **H9** |
| **5** | **1** | **9.4.5.3.2** | **H8** |
| **6** | **1** | **9.2.1.2.7** | **H9** |
| **7** | **1** | **9.3.3.2.2** | **H10** |
| **8** | **1** | **9.3.4.2.1** | **H2** |
| **9** | **1** | **9.4.2.2.2** | **H8** |
| **10** | **1** | **9.4.3.3.1** | **H8,H14** |
| **11** | **1** | **9.2.3.2.1** | **H9** |
| **12** | **1** | **9.2.4.2.3** | **H10,H12** |
| **13** | **1** | **9.2.4.2.4** | **H8** |
| **14** | **1** | **14.1a** | **H9,H14** |
| **15** | **1** | **9.2.3.3.4** | **H12,H10** |
| **16** | **1** | **9.4.4.2.5** | **H6** |
| **17** | **1** | **12.4b** | **H12** |
| **18** | **1** | **9.3.2.2.4** | **H8** |
| **19** | **1** | **9.3.2.2.9** | **H10,H12** |
| **20** | **1** | **12,3c** | **H10,H12.H14** |

**Section I**

**Part B**

|  |  |  |  |
| --- | --- | --- | --- |
| **21** | **3** | **9.3.3.2.3** | **H8,H14** |
| **22 (a) (i)** | **1** | **9.3.5.3.2** | **H9** |
| **22 (a) (ii)** | **1** | **9.3.5.2.6** | **H8,H9** |
| **22 (a) (iii)** | **3** | **9.3.5.2.2** | **H9,H10,H13** |
| **22 (b)** | **1** | **9.2.3.3.6** | **H9,H10** |
| **23 (a)** | **1** | **9.2.1.2.3** | **H9,H10** |
| **23 (b)** | **2** | **9.2.3.3.6** | **H9,H10,H12** |
| **24 (a)** | **2** | **9.2.1.2.3** | **H9,H10** |
| **24 (b)** | **2** | **9.2.1.3.2** | **H9** |
| **25 (a)** | **1** | **9.4.5.2.1** | **H4** |
| **25 (b)** | **1** | **9.4.5.2.1** | **H4** |
| **25 (c)** | **1** | **9.4.5.2.1** | **H4** |
| **25 (d)** | **1** | **9.4.5.2.1** | **H4** |
| **26** | **4** | **9.2.1.3.1** | **H8,H10,H12** |
| **27** | **2** | **9.2.4.2.4** | **H8,H10** |
| **28 (a)** | **4** | **9.3.4.2.8** | **H8,H10,H11** |
| **28 (b)** | **2** | **9.3.4.2.8** | **H8,H10,H11** |
| **28 (c)** | **2** | **9.3.4.2.8** | **H8,H10,H11** |
| **29 (a)** | **2** | **9.4.3.3.3** | **H8,H10** |
| **29 (b)** | **2** | **9.4.3.3.3** | **H8,H10** |
| **29 (c)** | **2** | **9.4.3.3.3** | **H8,H10** |
| **30 (a) (i)** | **1** | **9.2.1.2.5** | **H9** |
| **30 (a) (ii)** | **1** | **9.2.1.2.5** | **H9** |
| **30 (b)** | **1** | **9.2.1.2.8** | **H4** |
| **30 (c)** | **5** | **9.2.2.4** | **H4,H9,H14** |
| **31 (a) (i)** | **3** | **9.4.5.2.1** | **H12** |
| **31 (a) (ii)** | **2** | **9.4.3.3.1** | **H8,H10** |
| **31 (b)** | **2** | **9.4.3.3.2** | **H4** |
| **Section 11**  **Question 32 – Industrial Chemistry** |  |  |  |
| **32 (a)** | **6** | **9.5.4.2.2** | **H7,H8,H12** |
| **32 (b) (i)** | **2** | **9.5.4.3.1** | **H13** |
| **32 (b) (ii)** | **2** | **9.5.2.2.2** | **H12,H13** |
| **32 (c) (i)** | **1** | **9.5.2.2.2** | **H12,H13** |
| **32 (c) (ii)** | **1** | **9.5.2.2.1** | **H9,H10** |
| **32 (c) (iii)** | **1** | **9.5.2.2.1** | **H9,H10** |
| **32 (d)** | **5** | **9.5.5.3.1** | **H11.H12** |
| **32 (e)** | **7** | **9.5.6.2.1** | **H4,H13** |
| **Section II**  **Question 33 –**  **Shipwrecks, Corrosion & Conservation** |  |  |  |
| **33 (a)** | **4** | **9.6.7.2.1** | **H8,H14** |
| **33 (b)** | **2** | **9.6.3.2.1** | **H7,H8** |
| **33 (c)** | **4** | **9.6.3.2.1** | **H7,H14** |
| **33 (d) (i)** | **4** | **9.6.2.2.3** | **H8,H12** |
| **33 (d) (ii)** | **1** | **9.6.2.2.3** | **H8,H12** |
| **33 (e)** | **3** | **9.6.5.2.1** | **H4,H6** |
| **33 (f)** | **7** | **9.6.7.2.3** | **H3,H8,H13,H14** |
| **Section II**  **Question 34 – Biochemistry of Movement** |  |  |  |
| **34 (a)** | **3** | **9.7.1.2.3** | **H7,H14** |
| **34 (b)** | **3** | **9.7.8.2.2** | **H7,H8** |
| **34 (c)** | **5** | **9.7.10.2.2** | **H9,H10** |
| **34 (d)** | **4** | **9.7.4.2.1** | **H9,H14** |
| **34 (e)** | **4** | **9.7.8.3.1** | **H7,H9,H10** |
| **34 (f)** | **5** | **9.7.10.2.1** | **H1,H3,H7,H14** |
| **Section II**  **Question 35 – Chemistry of Art** |  |  |  |
| **35 (a)** | **3** | **9.8.3.2.7** | **H6,H14** |
| **35 (b) (i)** | **1** | **9.8.5.2.5** | **H14** |
| **35 (b) (ii)** | **4** | **9.8.4.2.4** | **H14** |
| **35 (c) (i)** | **2** | **9.8.2.2.4** | **H12** |
| **35 (c) (ii)** | **3** | **9.8.2.2.4** | **H14** |
| **35 (d)** | **5** | **9.8.2.3.4** | **H1,H2,H6,H14** |
| **35 (e)** | **7** | **9.8.1.3.2** | **H1,H4,H14** |
| **Section II**  **Question 36 – Forensic Chemistry** |  |  |  |
| **36 (a)** | **3** | **9.9.2.2.2** | **H9,H13** |
| **36 (b)** | **5** | **9.9.3.2.2** | **H8,H9,H11** |
| **36 (c)** | **3** | **9.9.6.2.2** | **H7,H14** |
| **36 (d)** | **5** | **9.9.6.2.1** | **H7,H14** |
| **36 (e)** | **4** | **9.9.1.1.1** | **H4,H8,H11** |
| **36 (f)** | **5** | **9.9.4.2.2** | **H4,H9,H14** |