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| Exam Choice **2010**  **TRIAL HIGHER SCHOOL CERTIFICATE EXAMINATION** ChemistryGeneral Instructions  * Reading time – 5 minutes * Working time – 3 hours * Write using black or blue pen * Draw diagrams using pencil * Approved calculators may be used * Write your student number in the space provided | Student NumberTotal marks – 100 **Section I**  Pages 2 - 20  **75 marks**  This section has two parts, Part A and Part B  Part A – 20 marks   * Attempt Questions 1-20 * Allow about 35 minutes for this part   Part B – 55 marks   * Attempt Questions 21-32 * Allow about 1 hour and 40 minutes for this part   **Section II** Pages 22 - 31  **25 marks**   * Attempt **ONE** Question from Questions 33-37 * Allow about 45 minutes for this section |

# Section I

**75 marks**

**Part A – 20 marks**

**Attempt Questions 1-20**

**Allow about 35 minutes for this part**

Use the multiple-choice answer sheet.

Select the alternative A,B,C or D that best answers the question. Fill in the response oval completely.

Sample: 2 + 4 = (A) 2 (B) 6 (C) 8 (D) 9

A B C D

If you think you have made a mistake, put a cross through the incorrect answer and fill in the new answer.

A B C D

If you change your mind and have crossed out what you consider to be the correct answer, then indicate the correct answer by writing the word **correct** and drawing an arrow as follows.

A B C D

**correct**

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|  | How many products may be formed when water reacts with 3-hexene? |
|  | 1. 1 2. 2 3. 3 4. 4 |

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|  | Which of the following is a method for increasing our supply of ethylene? |
|  | 1. thermal cracking of ethane 2. catalytic cracking of ethane 3. fermentation of ethane 4. dehydration of ethane |
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|  | Which of the following pairs of compounds could be used to produce a condensation polymer?   |  |  |  | | --- | --- | --- | |  |  |  | |  |  |  | |  |  |  | |  |  |  | |

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|  | A student measured the heat of combustion of 1-propanol, by heating 200 g of water initially at 21.0 oC. 0.60 g of 1-propanol was burnt in the reaction. The heat of combustion of 1-propanol is 2020 kJ/mol. Assuming that 50% of the heat produced was lost to the environment, what would the final temperature of the water be? |
|  | (A) 22.6 oC  (B) 25.1 oC  (C) 33.1 oC  (D) 34.7 oC |

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|  | Which of the following pairs of chemicals could spontaneously react to form products? |
|  | (A) I2 and Br-  (B) H+ and Cu  (C) MnO4- and F2  (D) Ag+ and Fe2+ |

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| **Y**  **Z**  Y2+  Z2+  **-\_--**  **+**  **Z**  **X**  Z2+  X2+  **-\_--**  **+**  **0.43V**  **1.15V** | This question refers to the half-cells shown in the diagram below. X, Y and Z are symbols of fictitious metals. |
|  | (A)  The reduction potential of Y is known to be -0.24V  Assuming standard conditions, what is the reduction potential of X?  (A) 0.48 V  (B) 0.96 V  (C) 1.34 V  (D) 1.82 V |

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|  | A student researching the use of nuclear power found that there are over 400 nuclear power stations operating on earth-more than 100 of them operating in the United States alone. They also found that there are currently no nuclear power stations operating in Australia.  Which of the following may be one factor contributing towards the Australian Government’s reluctance to construct nuclear power stations? |
|  | (A) Concern about how to deal with radioactive waste produced at such reactors.  (B) Australia does not have enough uranium and would have to import it.  (C) The technology to enrich uranium for use in reactors is not well developed.  (D) Nuclear reactors from overseas have had a poor safety record and many accidents have occurred at these plants. |

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|  | The pH range of a number of acid-base indicators are shown in the table below: |

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| Indicator | pH range | Colour |
| Congo red | 3.0-5.0 | Blue-red |
| Methyl orange | 3.1-4.4 | Red-orange |
| Phenol red | 6.8-8.4 | Yellow-red |
| Cresol red | 7.2-8.8 | Yellow-red |

Which of the following indicators may be able to distinguish between distilled water and unpolluted rain water?

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|  | 1. congo red 2. methyl orange 3. phenol red 4. cresol red |

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|  | A chemist uses a pH probe to determine the pH of a 0.1M solution of sodium hydroxide.  Which of the following chemical species does the pH probe detect and measure? |
|  | 1. Na+ 2. OH- 3. H2O 4. H+ |

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|  | Four monoprotic acids, W, X, Y and Z were tested and the following data collected:   |  |  |  | | --- | --- | --- | | Acid | Concentration (mol/L) | pH | | W | 0.01 | 2.0 | | X | 0.01 | 3.8 | | Y | 0.10 | 3.5 | | Z | 0.05 | 1.35 |   Which one is the weakest acid? |
|  | (A) W  (B) X  (C) Y  (D) Z |

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|  | Three organic chemicals are:   * ethene * ethanol * ethyl butanoate   Which of the following correctly identifies a common use of each substance? |

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|  | ethene | ethanol | ethyl butanoate |
| (A) | petrochemical feedstock | solvent | artificial flavouring |
| (B) | fuel | solvent | fuel |
| (C) | petrochemical feedstock | fuel | solvent |
| (D) | fuel | fuel | artificial flavouring |

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|  | An alkanol with a molar mass of 74g/mol was added to an alkanoic acid with a molar mass of 60g/mol, forming an ester.  Which of the following must be the molar mass of the ester produced? |
|  | (A) 116 g/mol  (B) 118 g/mol  (C) 134 g/mol  (D) The molar mass cannot be determined from the data provided. |

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|  | Which of the following species is a conjugate base of a strong acid? |
|  | 1. NO2- 2. OH- 3. CH3COO- 4. HSO3- |

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|  | Which of the following species contains a coordinate covalent bond? |
|  | (A) NaCl  (B) NH4+  (C) H­2O  (D) O2 |

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|  | | Consider an equilibrium system: A + B ↔ C.  Which of the following graphs represents a system reaching equilibrium by *shifting the equilibrium position to the right*? | | |
| (A) |  | | (B) |  | |
| (C) |  | | (D) |  | |

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|  | Which of the following is an important industrial use of ammonia? |
|  | 1. production of addition polymers 2. production of explosives 3. production of sulfuric acid 4. production of CFCs |

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|  | Combustion reactions are the basis for our modern way of life, and are inherently polluting. Which of the following statements outlines a reason why these reactions need to be monitored? |
|  | 1. When there is inadequate oxygen present, combustion reactions can also produce sulfur dioxide. 2. When there is excess oxygen present, combustion reactions can also produce oxides of nitrogen. 3. When there is excess oxygen present, combustion reactions can also produce sulfur dioxide. 4. When there is inadequate oxygen present, combustion reactions can also produce carbon monoxide |

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|  | Which of the following is a description of *turbidity*? |
|  | 1. It gives an indication of the dissolved solids in a sample. 2. It gives an indication of the concentration of suspended solids in a sample. 3. It gives an indication of the dissolved oxygen concentration in a sample. 4. It gives an indication of the concentration of dissolved and suspended solids in a sample. |
|  | Which of the following test results could be used to determine that the CO32- ion is present in a sample? |
|  | 1. addition of HCl(aq) causes a yellow precipitate to form 2. addition of H2SO4(aq) causes a white precipitate to form 3. addition of HNO3(aq) causes gas bubbles to form 4. addition of H3PO4(aq) causes a blue precipitate to form |

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|  | CFC molecules can be identified by a numbered code. To assign the numbered code for each molecule, the following rules are followed:   1. Count the numbers of each C, H and F atom present in the molecule. 2. Write this number as a three digit number. For example, in the molecule CCl2F2, there is 1 carbon atom, 0 hydrogen atoms and 2 fluorine atoms, so the number becomes 102. 3. Subtract 90 from this number to determine the code for the molecule.   Using this rule, which of the following would be the correct code for 2,2-dichloro-1,1,1,2-tetrafluoroethane? |

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|  | (A) 112  (B) 114  (C) 204  (D) 208 |

**Part B (55 marks)**

**Questions: 21 – 32**

**Marks: 55**

**Time: Allow approximately 1 hour and 40 minutes for this Part.**

Answer the questions in the spaces provided.

Show all relevant working in questions involving calculations.

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| **Question 21** (3 marks)  (a) Explain the different reactivity of butane and 1-butene with aqueous  bromine, illustrating your answer with a chemical equation using structural  formulas.  ..........................................................................................................................  ..........................................................................................................................  ..........................................................................................................................  ..........................................................................................................................  ..........................................................................................................................  ..........................................................................................................................  (b) Name the product of the reaction you summarised above. | **Marks**  **2**  **1** |

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| **Question 22** (4 marks)  You have studied polymers made from vinyl chloride and styrene.  (a) Give the systematic name of one of these monomers.  ..........................................................................................................................  ..........................................................................................................................    (b) Draw the structure of the polymer made from this monomer, showing three  repeating units.  (c) Account for a use of this polymer.  ..........................................................................................................................  ..........................................................................................................................  ..........................................................................................................................  .......................................................................................................................... | **Marks**  **1**  **1**  **2** |

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| **Question 23** (4 marks)  A 1.15 g sample of copper metal is placed into a beaker containing a 100.0mL of 0.50M solution of silver nitrate. The remaining mixture was left to stand for several days.  (a) Write a balanced equation for the reaction which occurred in the beaker.  ..........................................................................................................................  ..........................................................................................................................  (b) Determine the concentration of the following ions in the beaker at the end of  the reaction.  (i) NO3-  (ii) Ag+  (You may assume the reaction had completely ceased upon standing and that  there was negligible volume change in the beaker upon addition of the  copper). | **Marks**  **1**  **3** |

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| **Question 24** (3 marks)  The following information describes the industrial use of radioisotopes to gauge the thickness of thin films, such a thin metal foils. | **Marks** |



Foil being monitored for thickness

The radiation emitted from a radioisotope has its intensity reduced by matter placed between the radioactive source and a detector. The detector measures this reduction and thus can be used to measure the thickness of material between the source and the detector. This is shown in the simplified diagram to the right,

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| 1. Identify an instrument that may be used to detect the radiation produced by   the radioisotope.  ..........................................................................................................................  ..........................................................................................................................   1. The table below shows three examples of radioisotopes (A, B and C) and the   type of radiation that each emits.   |  |  | | --- | --- | | Radioisotope | Type of radiation it emits | | A | alpha only | | B | beta only | | C | gamma only |   On the basis of the information in the table, assess the suitability of each  radioisotope for use as a thickness gauge in the production of foil.  ..........................................................................................................................  ..........................................................................................................................  ..........................................................................................................................  .......................................................................................................................... | **1**  **2** |

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| **Question 25** (4 marks)  Evaluate the use of a recently developed biopolymer.  ..........................................................................................................................  ..........................................................................................................................  ..........................................................................................................................  ..........................................................................................................................  ..........................................................................................................................  ..........................................................................................................................  ..........................................................................................................................  ..........................................................................................................................  **Question 26** (3 marks)  The list below contains acids, bases and salts.   |  |  | | --- | --- | | H2SO4 | CH3COOH | | Na2CO3 | NaOH | | NH4Cl | NH3 | | HCl |  |   (a) Identify the species which would react together to form a basic salt.  ..........................................................................................................................  ..........................................................................................................................  (b) Outline how a buffer solution could be prepared from two or more of the  above compounds.  ..........................................................................................................................  ..........................................................................................................................  ..........................................................................................................................  .......................................................................................................................... | **Marks**  **4**  **1**  **2** |

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| **Question 27** (3 marks)  Describe the trend in the acid-base nature of oxides moving from left to right across the periodic table.  Include examples and relevant chemical equations in your answer.  ..........................................................................................................................  ..........................................................................................................................  ..........................................................................................................................  ..........................................................................................................................  ..........................................................................................................................  **Question 28** (5 marks)  A Chemistry teacher performed a demonstration in which a small mass of copper  metal was added to concentrated nitric acid in a gas jar.  The reaction produced 1.50L of the gas NO2, at 0oC and 100kPa. The other  products were copper (II) nitrate and water.  (a) Write a balanced equation for this reaction.  ..........................................................................................................................  (b) Assuming an excess of nitric acid, calculate the mass of copper needed to  produce this much NO2 gas.  ..........................................................................................................................  ..........................................................................................................................  ..........................................................................................................................  (c) Write a risk assessment for this demonstration.    ..........................................................................................................................  ..........................................................................................................................  .......................................................................................................................... | **Marks**  **3**  **1**  **2**  **2** |

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| **Question 29** (8 marks)  A student set out to determine the concentration of a solution of sodium hydroxide.  Firstly, she placed 25.0 mL of 0.100M ethanoic acid in a conical flask.  She then titrated the NaOH solution from a burette into the flask and used a pH probe to measure the pH as the NaOH solution was added.  Her results are in the table below.   |  |  | | --- | --- | | Volume of NaOH added from the burette (mL) | pH of mixture in conical flask | | 0 | 2.7 | | 5 | 3.1 | | 10 | 3.3 | | 15 | 3.5 | | 20 | 4.1 | | 25 | 10.3 | | 30 | 10.7 |   (a) Graph this data on the grid below. | **Marks**  **3** |

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| Question 29 (continued)  (b) Use the graph to *estimate* the volume of NaOH added to reach the  equivalence point.  ..........................................................................................................................   1. Use your estimate to calculate the concentration of the sodium hydroxide   solution. Show all working.  ..........................................................................................................................  ..........................................................................................................................  ..........................................................................................................................  ..........................................................................................................................   1. Explain how a modification to the student’s procedure could improve the   accuracy of her estimate in (b).  ..........................................................................................................................  ..........................................................................................................................  ..........................................................................................................................  ..........................................................................................................................  **Question 30** (3 marks)  With the aid of labelled electron-dot diagrams, compare the bonding in oxygen and ozone molecules, and explain how the differences you describe affect ONE physical property of the gases. | **Marks**  **1**  **2**  **2**  **3** |

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| **Question 31** (6 marks)  (a) Write a balanced chemical equation to represent the Haber process.  ..........................................................................................................................  ..........................................................................................................................  (b) Explain why reaction conditions need to be carefully monitored in the Haber  process.  ..........................................................................................................................  ..........................................................................................................................  ..........................................................................................................................  ..........................................................................................................................  ..........................................................................................................................  ..........................................................................................................................  ..........................................................................................................................  ..........................................................................................................................  ..........................................................................................................................  ..........................................................................................................................  ..........................................................................................................................  ..........................................................................................................................  ..........................................................................................................................  .......................................................................................................................... | **Marks**  **1**  **5** |

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| **Question 32** (9 marks)  A student collected a sample of waste water as it flowed from a factory.  Analysis of the sample in the school laboratory yielded the following results.   |  |  | | --- | --- | | mass of sample (g) | 147.5 | | mass of a dry filter paper (g) | 0.152 | | mass of dry filter paper + residue (g) | 22.52 | | mass of dry evaporating basin (g) | 48.42 | | mass of evaporating basin + residue (g) | 48.45 | | pH | 6.9 | | DO (ppm) | 5.8 | | BOD5 (ppm) | 0.0 |   (a) Identify the most significant type of pollution present in the sample.  ..........................................................................................................................  (b) Calculate the concentration of dissolved solids in the sample in ppm.  ..........................................................................................................................  ..........................................................................................................................  ..........................................................................................................................  .......................................................................................................................... | **Marks**  **1**  **2** |

**Question 32 continues on page 20.**

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| Question 32 (continued)  Further tests were carried out on the residue in the evaporating basin. The results of these tests are summarised below.   |  |  |  | | --- | --- | --- | | test 1 | addition of HCl | no reaction | | test 2 | addition of H2SO4 | fine white precipitate | | test 3 | addition of AgNO3(aq) | white precipitate | | test 4 | addition of BaCl2(aq) | no reaction | | test 5 | addition of NaOH(aq) | no reaction | | test 6 | flame test | orange- red |   (c) Identify the compound that is dissolved in the water. Justify your answer,  including an appropriate ionic equation.  ..........................................................................................................................  ..........................................................................................................................  ..........................................................................................................................  ..........................................................................................................................  (d) This sample could now be quantitatively analysed using Atomic Absorption  Spectroscopy (AAS).  Describe the chemical principles on which AAS is based, and outline how it  could be used to analyse this sample.  ..........................................................................................................................  ..........................................................................................................................  ..........................................................................................................................  ..........................................................................................................................  ..........................................................................................................................  ..........................................................................................................................  .......................................................................................................................... | **Marks**  **2**  **4** |

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**Section II**

**25 marks**

**Attempt ONE question from Questions 33-37**

**Allow about 45 minutes for this Section.**

Answer the questions in a writing booklet. Extra writing booklets are available.

Show all relevant working in questions involving calculations.

Pages

Question 33 – Industrial Chemistry ........................................................................ 23 - 24

Question 34 – Shipwrecks, Corrosion and Conservation ....................................... 25 - 26

Question 35 – The Biochemistry of Movement ..................................................... 27

Question 36 – The Chemistry of Art ...................................................................... 28 - 29

Question 37 – Forensic Chemistry ......................................................................... 30 - 31

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| **Question 33 - Industrial Chemistry** (25 marks)  (a) The World Health Organisation considers *per capita* soap purchase an  important indicator of the general level of development of a country.   1. Apart from soap, identify the other product of saponification reactions. 2. Outline the structure and properties of cationic detergents, and relate these to their uses. 3. Describe the cleaning action of soaps, including a labelled diagram in your answer.   (b) The formation of dinitrogen pentoxide from nitrogen dioxide is an  equilibrium reaction, as shown below. At 175 oC K = 8.00  4NO2(g) + O2(g) 🡪 2N2O5 H = -340kJ/mol  (i) Write the equilibrium constant expression for the reaction.  (ii) A reaction vessel containing a mixture of NO2, O2 and N2O5 was  sampled at 175oC, and the following concentrations measured.   |  |  | | --- | --- | | species | concentration (M) | | NO2 | 1.55 | | O2 | 0.75 | | N2O5 | 1.25 |   Deduce whether the system is shifting to the left or right to reach  equilibrium?  (iii) Explain how a change in temperature to 250oC will affect the  equilibrium position.  **Question 33 continues on page 24.**  Question 33 (continued)  (c) Two very important basic substances in the chemical industry are sodium  hydroxide and sodium carbonate.  (i) Identify the starting material common to the production of both  sodium carbonate and sodium hydroxide.  (ii) Describe the mercury method for producing sodium hydroxide,  including the chemistry of the process and environmental impacts  associated with it.  (iii) Outline the method you used to safely model a step in the Solvay  Process. Include the reactant(s) you used.  (d) Describe the steps and chemistry involved in the production of sulfuric  acid from its elements. Assess the importance of the reaction conditions  used. | **Marks**  **1**  **2**  **3**  **1**  **3**  **2**  **Marks**  **1**  **3**  **3**  **6** |

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| **Question 34 – Shipwrecks, Corrosion and Conservation** (25 marks)  (a) Our understanding of electricity has changed over time, thanks to the work  of several scientists.   1. In the 1790’s Galvani concluded that animal tissue contained a force that he called ‘animal electricity’.   Outline the experimental work which led to this conclusion.   1. Identify the actual source of the electrical current that Galvani observed in his experiments. 2. Explain how the work of Volta ultimately led to Davy’s discovery of the alkali metals.   (b) Metal objects are often made to look as if they are silver by electroplating  silver onto their surface, using electrolysis of solutions containing silver  ions.   1. Identify the scientist who formulated the Laws of Electrolysis. 2. ‘Increasing electrolyte concentration increases the rate of silver deposition by electrolysis.”   Write a valid and reliable method to test this hypothesis.   1. Electrolysis is also used in the restoration of artefacts found on shipwrecks.   Write two half equations to show the reactions which occur when a silver coin coated with silver sulfide is treated using electrolysis.  **Question 34 continues on page 26.**  Question 34 (continued)  (c) A team of Navy divers discovers a shipwreck sitting on the ocean floor at a  depth of 3000m. A knowledge of chemistry will play an important role in  understanding the extent to which artefacts on the ship have altered, and  will aid in their eventual recovery and restoration.  (i) Identify the relationship between gas pressure and gas solubility.  (ii) Explain why the rate of corrosion of this ship would be different to  that of a ship wrecked on a shallow reef.   1. Account for the fact that wooden objects from the wreck would not be dried out immediately upon recovery and describe the correct sequence in their restoration from the wreck.   (d) Explain the chemistry involved in the rusting of iron, and in the techniques  which reduce or prevent it. | **Marks**  **2**  **1**  **3**  **1**  **3**  **2**  **Marks**  **1**  **3**  **3**  **6** |

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| **Question 35 – The Biochemistry of Movement** (25 marks)  (a) Fats can be made from the reaction between fatty acids and glycerol.    (i) Identify the systematic (IUPAC) name of the molecule commonly  referred to as glycerol.  (ii) Write an equation to represent the reaction of glycerol with stearic  acid (C17H35COOH), and identify the type of reaction which this  represents.  (iii) Explain the implications of a diet low in fats.  (b) As part of your practical work, you investigated factors which affect the  activity of enzymes.  (i) A simple test for starch involves addition of aqueous iodine. If a  sample contains starch the I2(aq) changes colour from pale  yellow/brown to deep blue-black.  Amylase in human saliva catalyses the conversion of starch into  disaccharides.  Using the above information as a guide, design a valid and reliable  investigation to determine the effect of pH on the activity of  amylase in human saliva.  (ii) Explain how changes in pH affect the activity of enzymes such as  amylase.  (c) Movement of bones in vertebrates is brought about by contraction of  muscle cells.  (i) Identify the two types of protein fibres which compose muscle  cells.  (ii) Explain the chemistry involved in muscle cell contraction.  (iii) Compare the appearance of type 1 and type 2 skeletal muscle  cells, and account for the high percentage of type 2 cells in the  legs of sprinters.  (d) Describe the chemistry which occurs during oxidative phosphorylation  and explain the role of NADH and FADH2 in this process. | **Marks**  **1**  **2**  **3**  **3**  **3**  **1**  **3**  **3**  **6** |

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| **Question 36 – The Chemistry of Art** (25 Marks)  (a) Many transition metals can exist in a variety of oxidation states in their  various compounds and the oxidation state can affect the colour of these  compounds.  (i) Transition metal “X” can be found in the following compounds:  **X2O5 K2X2O7 X2O3**  Determine the oxidation state of X in the compound X2O3.  (ii) Identify which of the above compounds is likely to be the  strongest oxidising agent. Justify your answer and account for its  oxidising strength.  (iii) Using copper as an example, explain how the electronic  configuration of a transition metal allows the metal to form  compounds with a variety of oxidation states.  (b) As part of his practical studies of Chemistry of Art, a student recorded the  following results table.   |  |  | | --- | --- | | Metal present | Flame colour | | Potassium | Lilac | | Sodium | Yellow | | Strontium | Scarlet |   (i) Describe a procedure which would have allowed the student to  safely gather the above results.  (ii) Assess the ability of the Bohr model to account for the  difference in flame colours of various metal ions.  **Question 36 continues on page 29.**  Question 36 (continued)  (c) From the earliest of times, humans have used colour to decorate  themselves and their environments.  (i) Identify a mineral that was used by an ancient culture and the  colour the mineral imparted.  (ii) In an attempt to model paint production by early Aboriginals, a  student added a small amount of copper (II) sulfate to water and  applied the resulting blue liquid to a prepared wooden surface.  Draw an electron-dot diagram of the species responsible for the  blue colour of the liquid prepared by the student and describe  fully the bonding within this species.  (iii) Explain why this procedure was not an appropriate method to  model paint making by early Aboriginals, and describe  modifications which could better model the process.  (d) Period 3 of the Periodic Table begins with sodium and ends with argon.  Analyse the relationships between the atomic structures of the Period 3  elements and their first ionisation energies, electronegativity values and  the block of the periodic table to which they are assigned. | **Marks**  **1**  **2**  **3**  **3**  **3**  **Marks**  **1**  **3**  **3**  **6** |

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| **Question 37 – Forensic Chemistry** (25 marks)  (a) The work of a forensic chemist is based on the analysis and classification  of materials found at crime scenes.  (i) Identify the key difference between organic and inorganic  compounds.  (ii) Emission spectra can be used to identify trace elements in  inorganic compounds. Outline the chemical principle upon which  emission spectroscopy is based.  (iii) Outline a sequence of tests which could be used to distinguish  between the compounds below. Include relevant chemical  equations. | **Marks**  **1**  **2**  **3** |



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| (b) The analysis of materials from plants and animals often requires the  identification of different types of carbohydrates.  (i) State the general formula for all carbohydrates.  (ii) “The type of sugar in a sample does not affect its ability to reduce  copper ions”.  Write a valid and safe method to refute this hypothesis.  (iii) Distinguish between the composition of the polysaccharides  (carbohydrates) found in plants and animals.  **Question 37 continued on page 31.**  Question 37 (continued)  (c) Forensic analysis often involves the analysis of small amounts of material  such as protein samples.  (i) Outline the implications for forensic science of using a destructive  test on a sample found at a crime scene.  (ii) Describe the function, structure and composition of proteins, and  illustrate your answer with an equation using structural formulas.  Show the formation of a peptide bond.    (iii) Explain why electrophoresis is a useful technique for identifying  the origins of protein samples.  (d) Describe the structure of DNA and explain why tissue samples found in  modern crime scenes are more useful to investigators than those found in  the early 1900’s. | **1**  **3**  **2**  **Marks**  **1**  **3**  **3**  **6** |

**End of Paper**