Chemistry
Section II

25 marks
Attempt ONE question from Questions 30-34
Allow about 45 minutes for this section

Answer the question in a SEPARATE writing booklet.

Show all relevant working in questions involving calculations.

Question 30 – Industrial Chemistry (25 marks) **Marks**

(a) Pressure, volume, concentration and temperature all have an effect on an equilibrium reaction.

(i) Which of these factors will alter the equilibrium constant? **1**

(ii) Compare the effect of an increase in pressure on the following equilibria. **2**

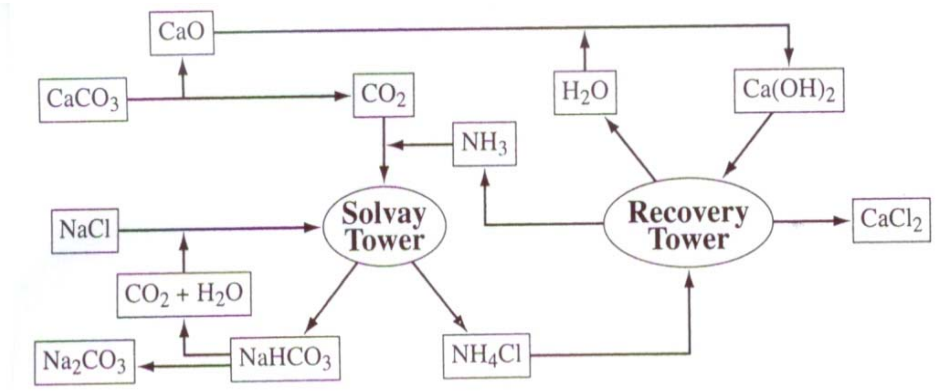
Oxidation of ammonia

$$4\,NH_3(g) + 5O_2(g) \rightleftharpoons 4NO(g) + 6H_2O(g)$$

Production of hydrogen iodide

$$H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$$

(b) The Solvay Process is illustrated below.



(i) Identify the major product of the Solvay Process. **1**

(ii) Choose ONE of the chemical changes that occur in this process and explain the chemistry involved. **3**

(c) Analyse the processes required to manufacture sulfuric acid from Earth materials. **5**

Question 30 continues on page 23

(d) As part of your study of this Option you performed a first-hand investigation to carry out saponification and test the product.

(i) Describe the procedure you used for this investigation. **3**

(ii) Justify your method of data collection. **3**

(e) Assess the impact on the environment of the developments in technology available to manufacture sodium hydroxide. **7**

End of Question 30

Question 31 – Shipwrecks, Corrosion and Conservation (25 marks) **Marks**

(a) Luigi Galvani demonstrated "animal electricity" by making the muscles twitch in a dead frog. Alessandro Volta proposed a different theory about the origins of this electricity.

(i) Identify another scientist who contributed toward our understanding of electrochemistry. **1**

(ii) Compare the theories of Galvani and Volta. **2**

(b) (i) Identify ONE condition at great ocean depths which led to the prediction that shipwrecks would corrode slowly. **1**

(ii) Explain how this condition led to the prediction of a slow rate of corrosion. Support your answer with balanced chemical equations. **3**

(c) With reference to the factors that affect an electrolysis reaction, analyse how an understanding of electrolysis has led to the development of efficient processes that can be applied in the conservation and restoration of marine artefacts. **5**

(d) You were required to perform a first-hand investigation to compare and describe the rate of corrosion of materials in different salt concentrations.

(i) Outline the procedure for your investigation. **2**

(ii) Justify the procedure. **4**

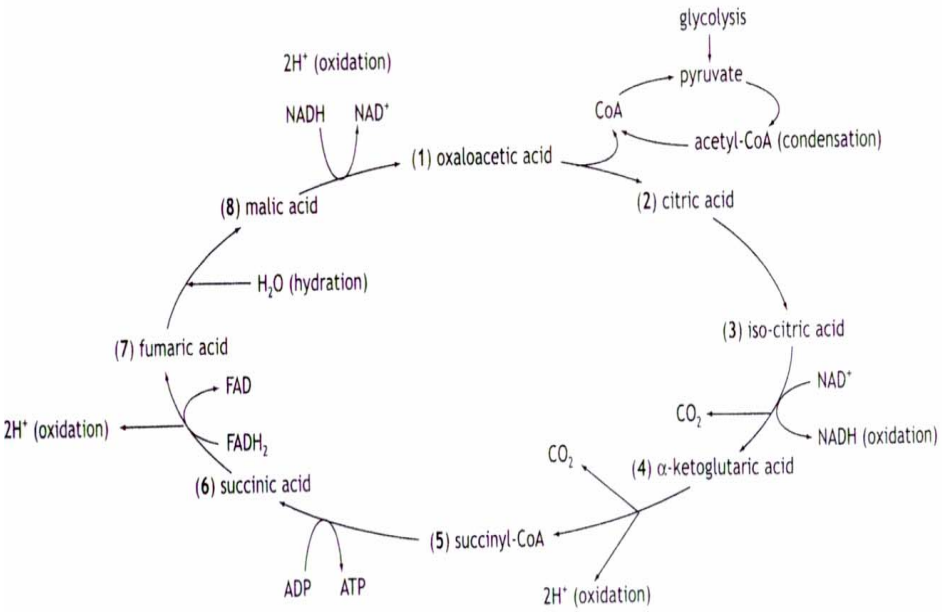
(e) Assess the impact of new materials and the development of corrosion protection systems on the construction of marine going vessels, with a particular emphasis on the 20th Century. **7**

Question 32 – The Biochemistry of Movement (25 marks) **Marks**

(a) (i) Identify the main use of ATP in the body. **1**

(ii) Compare the structure of ATP and ADP. **2**

(b) (i) Identify the name of the process shown below. **1**



(ii) Explain the importance of this process. Use an equation to support your answer. **3**

(c) Analyse the effects of changes in pH and temperature on enzyme activity. **5**

(d) As part of your study of this Option you performed a first-hand investigation to compare the structures of glycogen and glucose.

(i) Draw the structure of glucose. **1**

(ii) Outline the procedure you used for this investigation. **3**

(iii) Justify the choice of materials. **2**

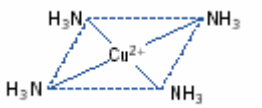
(e) Assess the impact of discoveries in biochemistry on the understanding of the changes that occur in the muscles of a sprinter. **7**

Question 33 – The Chemistry of Art (25 marks) **Marks**

(a) Ammonia (NH_3) is an example of a molecule that acts as a ligand.

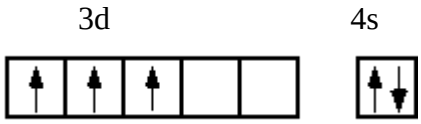
(i) Identify another molecule that can act as a ligand. **1**

(ii) Describe the colour change when the following complex is formed from a Cu^{2+} solution and excess ammonia. **1**



(iii) Write a chemical reaction showing the formation of this complex. **1**

(b) (i) Identify the name of the element with the following electronic configuration. **1**



(ii) Account for TWO different oxidation states of this element. **3**

(c) Analyse the reasons for the position of Manganese in the periodic table in terms of its electron arrangement, ionisation energy and electronegativity. **5**

(d) As part of your study of this Option you performed a first-hand investigation to observe the colour changes of a transition metal in its different oxidation states.

(i) Outline the procedure you used for this investigation. **3**

(ii) Justify the chemicals used. **3**

(e) Assess the impact of technology in analysing the range of pigments used by artists throughout history. **7**

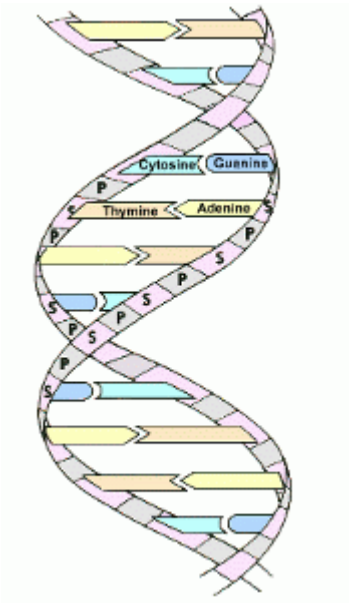
Question 34 – Forensic Chemistry (25 marks) **Marks**

(a) Carbohydrates such as cellulose, starch and glycogen can be used to distinguish between plant and animal materials

(i) Identify the general formula for a carbohydrate. **1**

(ii) Compare the use of carbohydrates by plants and animals. **2**

(b) A section of a DNA molecule is shown below.



(i) Identify the three main components of DNA. **1**

(ii) Explain how DNA is analysed to identify relationships between people. **3**

(c) With reference to a first hand investigation you have carried out, analyse the factors that allow a chemist to use emission spectroscopy to identify an element. **5**

Question 34 continues on page 28

(d) As part of your study of this Option you performed a first-hand investigation to separate a mixture of organic materials.

(i) Outline the procedure you used for this investigation. **3**

(ii) Justify your choice of solvent(s). **3**

(e) Assess the impact of developments in a range of technologies on the ability of chemists to resolve forensic investigations. **7**

End of paper