

Chemistry

Duration : 2 hours

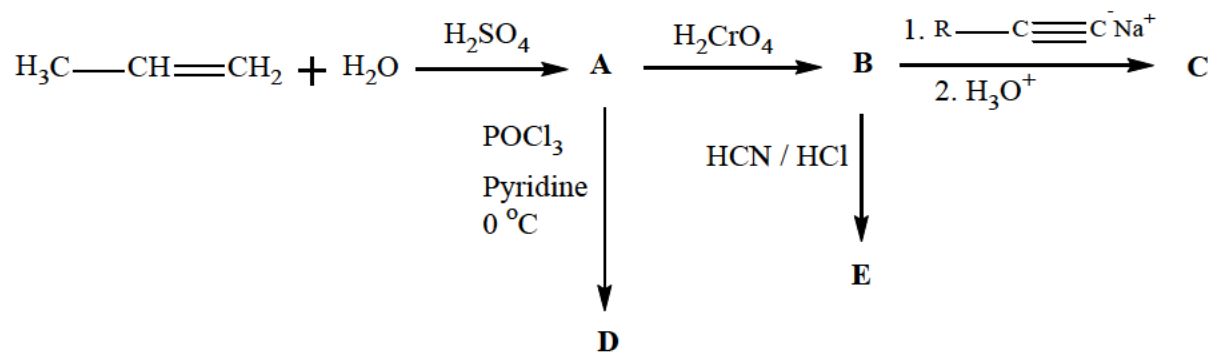
Please read the following instructions carefully.

1. This paper has THREE (3) sections – A, B and C, and comprises FIVE (5) printed pages
2. Attempt all sections. Do not write on the question paper.
3. Answer all questions in Section A, B and C. Indicate your answers on the answer sheet provided. Write the question number clearly.
4. At the end of the examination, complete the information required on the cover page. Place the cover page on top of your answer sheets and tie them together using the string provided.
5. Do not take any paper, including the question paper or unused answer sheets, out of the examination hall.

Section A (33 marks)

Answer all questions.

1. Consider the following reactions



- Write the IUPAC names of the starting material and compound B.
- Provide the structures of the compounds A to E in the above reaction.

(20 marks)

2. Synthesize the following substances from benzene. Give the chemical equations.

- 2-Bromotoluene
- 2-Bromo-1,4-dimethylbenzene

(13 marks)

Section B (33 marks)

1. The rearrangement of methyl isonitrile (CH_3NC) to acetonitrile (CH_3CN) is a first order reaction and has a rate constant of $5.11 \times 10^{-5} \text{ s}^{-1}$ at 472 K. If the initial concentration of CH_3NC is 0.0340 M,

- i) Calculate the molarity of CH_3NC after 2.00 hours
- ii) Determine the time taken in minutes for the concentration of CH_3NC to drop to 0.0300 M.
- iii) Determine the time taken in minutes for 20% of the CH_3NC to react.
- iv) Calculate the half-life of the reaction.

(20 marks)

2. The pH of 0.250 M Hydrofluoric acid (HF) is 2.036. Calculate the values of K_a and $\text{p}K_a$ for hydrofluoric acid.

(13 marks)

SAMPLE

Section C (34 marks)

1. When 2.0 M hydrochloric acid is added to separate samples of aqueous silver nitrate and aqueous lead(II) nitrate, AgCl and PbCl₂ are precipitated.
- When hydrochloric acid is added to aqueous silver nitrate, what will be seen in the container immediately and after one hour in daylight? Briefly explain the observations made.
 - How would you confirm that the original precipitate was AgCl by adding a single reagent to it? Describe what you would see and give an equation with state symbols for the reaction that occurs with the reagent you have chosen.
 - When concentrated hydrochloric acid is added to the precipitate of PbCl₂, the precipitate dissolves. Suggest by means of an ionic equation, an explanation for this observation.

(10 marks)

2. When concentrated hydrochloric acid is added to aqueous copper(II) chloride, the solution eventually becomes yellow. When water is added to this yellow solution, it becomes blue. Suggest by means of ionic equations, an explanation for these observations.

(6 marks)

3. The noble gas, xenon, forms a tetrafluoride XeF₄.
- Suggest a dot-and-cross diagram to show the bonding in XeF₄.
 - Use your diagram to suggest the shape of XeF₄. Briefly explain.
 - When added to water, XeF₄ reacts accordingly to the following equation below. Deduce the values of a, b and c in this equation.



(10 marks)

4. When chlorine gas is passed through a strongly alkaline solution of sodium bromide, a salt is produced, which has the following composition by mass: Na, 15.2%; Br, 53.0%; O, 31.8%.
- Calculate the formula of the salt.
 - Calculate the change in oxidation number of bromine during this reaction.
 - Construct an equation for the reaction.

(8 marks)

END OF PAPER

SAMPLE