



MERU UNIVERSITY OF SCIENCE AND TECHNOLOGY

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University Examinations 2024/2025

SECONDN YEAR FIRST SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF EDUCATION SCIENCE AND BACHELOR OF SCIENCES

SCH 3200: COMPARATIVE STUDIES OF S AND P-BLOCK ELEMENTS

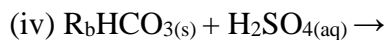
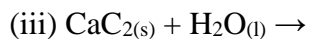
DATE: JANUARY 2025

TIME: 2 HOURS

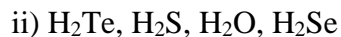
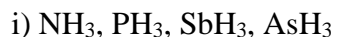
INSTRUCTIONS: Answer question *one* and any other *two* questions

QUESTION ONE (30 MARKS)

- a) Briefly discuss the following concepts as applied to the chemistry of s and p block elements:
- i) Diagonal effect (2 Marks)
 - (ii) Inert Pair effect (2 Marks)
 - (iii) Effective Nuclear Charge (2 Marks)
- b) Describe three types of bonding in hydrogen compounds. (4 Marks)
- c) Explain the causes of anomalous chemistry of second-period elements in the s and p blocks. (3 Marks)
- d) Predict the products of each reaction and balance each chemical equation. (4 marks)
- (i) $\text{Sr}_{(s)} + \text{O}_{2(g)} \rightarrow$
 - (ii) Thermal decomposition of $\text{CaCO}_{3(s)}$



e) Arrange the following compounds in the order of increasing melting points.



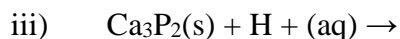
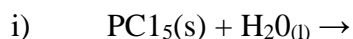
f) Explain why the B - F bond lengths in BF_3 (130 pm) and BF_4^- (143 pm) differ. (4 Marks).

g) Using appropriate equations discuss the major steps in Contact Process for the manufacture of sulphuric acid. Include balanced equations for the reactions. (4 Marks).

H) Determine the effective atomic number of the 4s electron in copper ($Z=29$). Show your working. (2 Marks).

QUESTION TWO (20 MARKS)

a) Predict the products of each reaction and write a balanced chemical equation for each reaction.



B) Briefly discuss the role of s block elements in the following biological processes:



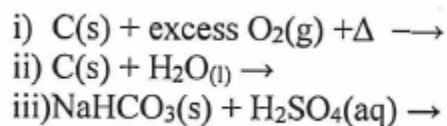
C) Using appropriate reactions discuss the major steps in extraction and isolating Lithium from Spodumene, a Lithium Silicate Ore ($\text{LiAlSi}_2\text{O}_6$). (8 Marks)

QUESTION THREE (20 MARKS)

a) For each reaction, explain why the given product forms.



b) Predict the products of the reactions and balance the chemical equation for each reaction:
(3 Marks)



c) Describe the key steps in commercial extraction of silicon. (8 Marks)

d) Briefly describe the possible sources of noble gases for industrial applications. (3 Marks)

QUESTION FOUR (20 MARKS)

A) Write a balanced chemical equation showing how you would prepare each compound from its elements and other common compounds.



(6 Marks)

B) Distinguish yellow or white, red and black phosphorus. (3 Marks)

C) Using appropriate chemical structures distinguish the oxoacids of phosphorus and give oxidation states for each compound. (8 Marks)

D) Identify three industrial applications phosphorus. (3 Marks)