



**NATIONAL OPEN UNIVERSITY OF NIGERIA**  
**UNIVERSITY VILLAGE, PLOT 91 CADASTRAL ZONE, NNAMDI AZIKIWE EXPRESS WAY,**  
**JABI - ABUJA.**  
**FACULTY OF SCIENCES**  
**DEPARTMENT OF PURE AND APPLIED SCIENCE**  
**SECOND SEMESTER EXAMINATION 2020.**

**COURSE CODE: CHM 303**  
**COURSE TITLE: INORGANIC CHEMISTRY III**  
**COURSE UNIT: 3**  
**TIME: 2½ HOURS**  
**INSTRUCTION: Answer question one and any other four questions.**

**QUESTION ONE**

- (a) Explain briefly the relationship between the boiling point and van der Waals forces. (3 marks)
- (b) Describe briefly the occurrence and isolation of helium (5 marks)
- (c) List any FOUR processes that involve the use of large volumes of hydrogen gas. (4 marks)
- (d) Write an equation for the reaction of chlorine gas with water. (2 marks)
- (e) List the ten elements that make up the 4d transition series. (5 marks)
- (f) What is lanthanide contraction? (3 marks)

**QUESTION TWO**

- (a) Describe briefly the reaction of xenon hexafluoride with water. (4 marks)
- (b) What is superconductivity? (2 marks)
- (c) Write the electronic configuration of xenon (2 marks)
- (d) Which noble gas was discovered extra - terrestrially before its discovery on Earth? What were the reasons for late discovery of noble gases? (4 marks)

**QUESTION THREE**

- (a) What is “active hydrogen”? Describe its formation and reactivity. (4 marks)
- (b) (i) What is an alkali metal? (ii) Name the most electropositive alkali metal. (2 marks)

- (c) (i) List the six alkaline earth metals. (ii) With the aid of a balanced chemical equation, describe the consequence of heating of an alkaline earth metal carbonate. (iii) Comment on the solubility of these carbonates (6 marks)

#### QUESTION FOUR

- (a) With the aid of relevant equations, describe how amorphous and crystalline boron can be obtained from borax and boron trioxide respectively. (4 marks)
- (b) Phosphorus pentachloride fumes in air; it reacts appreciably with water. Write equations for the reaction of phosphorus pentachloride in (i) limited water (ii) excess water. (3 marks)
- (c) Mention any TWO oxoacids of phosphorus (2 marks)
- (d) Describe briefly a simple test for halide ions in aqueous solution. (3 marks)

#### QUESTION FIVE

- (a) List SIX methods employed for the refining of crude metals. (3 marks)
- (b) Describe the extraction and purification of copper ore. (9 marks)

#### QUESTION SIX

- (a) Highlight ANY FOUR characteristic properties of transition metals. (4 marks)
- (b) Highlight FOUR differences between the valence bond and molecular orbital theories. (4 marks)
- (c) Between a transition metal and an s-block element, which would you expect to have a higher melting point? Why? (4 marks)