



**NATIONAL OPEN UNIVERSITY OF NIGERIA**  
**PLOT 91, CADASTRAL ZONE, NNAMDI AZIKIWE EXPRESSWAY, JABI – ABUJA**  
**FACULTY OF SCIENCES**  
**DEPARTMENT OF CHEMISTRY**  
**2025\_2 EXAMINATIONS**

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**COURSE CODE: CHM 303**

**COURSE TITLE: INORGANIC CHEMISTRY III**

**COURSE UNIT: 3**

**INSTRUCTION: Answer question one (1) and any other three questions**

**Time: 3 hours**

1. (a). (i). Explain why hydrogen can be placed in Group 1 or 17 of the Periodic Table. – **3 Marks**  
(ii). Using balanced equations, write **TWO (2)** reactions of hydrogen. – **4 Marks**  
(b). Differentiate between nuclear fission and nuclear fusion. – **3 Marks**  
(c). (i) Using suitable examples, differentiate between a ligand and a complex – **3 Marks**  
(ii) Mention **ONE (1)** coordination compound in nature and state its importance – **2 Marks**  
(d). (i) Highlight any **THREE (3)** general properties of transition elements. – **3 Marks**  
(ii). Identify any **TWO (2)** models that can be used to describe the electronic structure of d-metal complexes– **2**

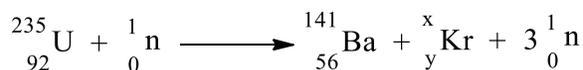
**MARKS**

- (e). (i). Describe the liquation method of purification of metals. – **3 Marks**  
(ii). Name any **TWO (2)** metals that can be separated by Liquation. – **2 Marks**.

2. (a). (i) State **THREE (3)** compounds of boron. – **3 Marks**  
(ii). Predict the product from the hydroboration of  $(\text{CH}_3)_2\text{C}=\text{CH}_2$  – **2 Marks**  
(b). (i) Using suitable equation, what is the product of the complete combustion of phosphorus – **3 Marks**  
(ii) State **TWO (2)** uses of compounds of phosphorus. – **2 Marks**  
(c). (i) Why is Pyrex glass suitable for making heat-resistance laboratory glassware? – **2 Marks**  
(ii). Classify the following carbides:  $\text{Na}_2\text{C}_2$ ,  $\text{SiC}$ , and  $\text{Fe}_3\text{C}$  – **3 Marks**

3. (a) (i) Why does oxygen more readily stabilize high oxidation states of most elements than fluorine – **2 Marks**  
(ii). Discuss any **TWO (2)** uses of compounds of Sulphur – **3 Marks**.  
(b). (i) Mention **TWO (2)** oxohalides of fluorine. – **2 Marks**  
(iii) Arrange the following in order of increasing stability:  $\text{BrO}_4^-$ ,  $\text{ClO}_4^-$ ,  $\text{IO}_4^-$  – **3 Marks**  
(c). (i). Briefly discuss any **ONE (1)** reaction of the noble gases – **2 Marks**  
(ii). Give **ONE (1)** example each of compounds of Xe in the +2, +4 and +6 oxidation states. – **3 Marks**

4. (a). (i). Mention **FOUR (4)** devices used for detection of radiation. – **2 Marks**  
(ii). Balance the equation below and classify it as either nuclear fission or nuclear fusion.



– **4 Marks**

- (b). If  $1.20 \times 10^5$  atoms of a radioactive nuclide decayed such that only  $1.50 \times 10^4$  remained after 81 days. The half-life of the radioactive nuclide is? – **4 Marks**  
(c). The atomic mass of  ${}^{19}_9\text{F}$  is  $18.9984 \mu$ , if the individual masses of the proton, neutron and electron are  $1.007277 \mu$ ,  $1.008655 \mu$  and  $0.0005486 \mu$  respectively, calculate its binding energy: (i) Per mole and (ii). Per atom – **5 Marks**

5. (a) Highlight **FIVE (5)** successes of the crystal field theory. – **5 Marks**  
(b). Differentiate between the Valence Bond and Molecular Orbital Theories – **5 Marks**  
(c). Briefly describe the froth floatation process in metallurgy. – **5 Marks**
6. (a) Using suitable examples, what geometries/structure(s) are complexes with coordination number 4 likely to have? – **5 Marks**  
(b). Name the following complexes: (i).  $[\text{Rh}(\text{CO})_2\text{I}_2]^-$  and (ii).  $[\text{CoCl}_2(\text{en})_2]^+$  – **5 Marks**  
(c). Write the formulas of the following complexes: (i). diaquadichloridoplatinum(II) and (ii) diamminetetra(thiocyanato- $\kappa\text{S}$ )chromate(III) – **5 Marks**