

**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**

**APRIL/MAY, 2019 EXAMINATIONS**

**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**

1 (a) With the aid of molecular orbital energy level diagram describe the three-centered four-electron bond nature in XeF2. 4 Marks

1b) Boron practically prefers to form borate than forming a B3+ ion, explain? 21/2 Marks

1 (c) If the number of unpaired electrons in [V(H2O)6]2+ and [Cu(H2O)6]2+ are x and y respectively, what will be the value of 2x + y. 3 Marks

1 (d) Write down the chemical equations for the reactions of lanthanum (Ln) with:

 (i) water and (ii) oxygen 4 Marks

1 (e) List three methods of beneficiation of ore. Hence, which of the methods will

be most appropriate for beneficiation of haematite (Fe2O3). 21/2 Marks

1 (f) In the crystal field theory, itemize any two consideration that should be given to the electronic configuration of the metal ion in the complexes. 3Marks

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1(g) With equation only, explain alpha decay of Uranium-238 i.e. (23892U). 3 Marks

**QUESTION TWO**

2. (a) What are clathrates? Hence, explain how the clathrate of the composition

G.3 Quinol can be formed. 3 Marks

2. (b) The decrease in atomic radius from sodium to chlorine is greater than that

from scandium to copper, explain. 3 Marks

2. (c) The simple equation for the preparation of boron is B2O3 + Mg → 2B + 3MgO. What is the change in oxidation state of B and what is the role of Mg. 3 Marks

2. (d) Write the electronic configuration of the transition metal ions and mention the number of unpaired electrons in each case: (i) Mn4+ (ii) Cr2+ . 3 Marks

**QUESTION THREE**

3a) The noble gases are chemically unreactive but chemical reactivity of the noble gases increase as we go down the group from helium to radon. Explain. 4 Marks

3b). Outline any four general properties of transition elements. 4 Marks

3c) Complete the following chemical equations:

1. 2K(s) + O2(g )
2. 2Na(s) + 2H2O(1)
3. ? NaHCO3(aq) + NaOH(aq)

 4 Marks

**QUESTION FOUR**

4(a) Discuss the effect of increase in pH in the following half-cell reaction:

 $FeO\_{4}^{2-}+8H^{+}+4e^{-}\rightarrow Fe^{2+}+4H\_{2}O$ 3 Marks

4(b) Study the equation below carefully and provide condition A and B



 2 Marks

4(c) The most stable oxidation state for Mn, Co, Ni is +2. Explain briefly why FeCl3 is more stable than FeCl2.  4 Marks

4(d) Explain briefly the preparation of borazine and boron nitride 3 Marks

**QUESTION FIVE**

 5(a) Explain why group IIIB elements, unlike group I and II are essentially covalent or contain an appreciable amount of covalent character. 4 Marks

5(b) What kind of oxides are formed when oxygen reacts with;

i. Group I and II metals

ii. Sulphur and Phosphorus 2 Marks

5(c) How do elements of group IVA make more than four covalent bonds (carbon excluded).

 21/2 Marks

5(d) Vanadium can exist has V2+ and V3+. Which of the two conditions: V(s)/V3+(aq) and V2+(aq)/V3+(aq) has the electrode potential closer to positive and why ? 31/2 Marks

**QUESTION SIX**

6a. Using Valence Shell Electron Pair Repulsion Theory (VSEPR), justify the shape of XeF2 compounds.

 6 marks

6b. Comment on colour of transition metal compounds. 6 marks