NATIONAL OPEN UNIVERSITY OF NIGERIA
14-16 AHMADU BELLO WAY, VICTORIA ISLAND, LAGOS
SCHOOL OF SCIENCE AND TECHNOLOGY
JANUARY/FEBRUARY 2013 EXAMINATION

CHM 303 – INORGANIC CHEMISTRY III
Answer any four questions

Q1
(a) (i) Write the electronic configurations of helium, neon and argon. (3 marks)
(ii) What do you understand by the term 'Lambda point' in the study of helium? (2 marks)
(b) Given below in Column I are the few expected compounds of noble gases. Write down in Column II the shapes of these compounds on the basis of VSEPR theory. (4 marks)

Column I	Column II
(i) XeF_4	(i) .....
(ii) $XeOF_4$	(ii) .....
(iii) XeO_4	(iii) .....
(iv) XeF_6	(iv) .....

(c) State four uses of hydrogen gas. (4 marks)
(d) Write balanced chemical equations to describe the reaction of sodium metal with:
(i) oxygen (ii) water (iii) chlorine (5 marks)

Q2
(a) Explain why there is a steady increase in boiling points from He to Rn (3 marks)

(b) Xenon reacts directly with fluorine on heating the gases in a nickel vessel. With the aid of chemical equations describe the reaction conditions and products of the reaction of xenon with fluorine. (3 marks)

(c) Work out the oxidation states of xenon in XeF_2, XeF_4 and XeF_6. (6 marks)

(d) (i) List and describe the isotopes of hydrogen (3 marks)
(ii) What do you understand by the term 'active hydrogen'? (3 marks)
Q3
(a) How do the following properties vary in the transition elements? (6 marks)
(i) Atomic size
(ii) Ionisation energy
(iii) Electronegativity

(b) Highlight five characteristics of transition metals (5 marks)

(c) (i) Explain briefly why CuSO4 is blue while ZnSO4 is white (3 marks)
(ii) Predict the spin-only magnetic moment for: (4 marks)
Fe^{2+}, Mn^{7+}
Q4
(a) List and give the electronic configurations of the 3d transition elements (10 marks)
(b) What are rare earth elements? Why are they so called? (3 marks)
(c) (i) Identify the most common oxidation state for the lanthanides and the actinides (2 marks)
(ii) How is this oxidation state formed? (3 marks)
Q5
(a) (i) What is the difference between gangue and slag? (4 marks)
(ii) Write balanced chemical equations to show how the flux forms the slag in an iron blast furnace. (4 marks)
(b) (i) Why is it necessary to concentrate the ores before extracting metals from them? (3½ marks)
(ii) Describe the froth flotation process for the concentration of ores. (4 marks)
(c) Why is carbon a preferred reducing agent in commercial metallurgy? (2 marks)

Q6
(a) Discuss the classification of ligands in coordination chemistry (6 marks)
(b) What are β rays? (2 marks)
(c) Discuss briefly the principles of the valence bond theory (5 marks)
(d) Highlight the differences between the valence bond and molecular orbital theories (5 marks)

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