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University Examinations 2023/2024

FOURTH YEAR SECOND SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE IN CHEMISTRY

SCH 3455: F-BLOCK CHEMISTRY AND BIOINORGANIC CHEMISTRY

DATE: APRIL 2024

TIME: 2 HOURS

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

QUESTION ONE (30 MARKS)

- a) Explain why lanthanoids and actinoids unlike first series of d-block elements does not obey spin only formular, $\mu_{eff} = \sqrt{n(n+2)}B.M$ (3 marks)
- b) Determine magnetic moment of Ce^{3+} in CeF_3 . (3 marks)
- c) Why is the bonding in lanthanoids so ionic? (2 marks)
- d) Give four general characteristics of Actinoids. (4 marks)
- e) Account for each of the following observations
- i) Ce^{4+} is an oxidizing agent while Eu^{2+} is reducing agent. (4 marks)
 - ii) Actinoids readily form complexes compared to lanthanoids (2 marks)
 - iii) The chemistry of the actinoid exhibit a greater range of oxidation state than lanthanides. (2 marks)
 - iv) The organometallic compounds of the lanthanoids are dominated by good donor ligands, with complexes of acceptor ligands being rare. (3 marks)
- f) Why are heavy metals poisonous? (3 marks)

- g) Mercury is a heavy metal belonging to the transition element series of the periodic table. It is unique in that it exists or is found in nature in three forms (elemental, inorganic, and organic), with each having its own profile of toxicity. Explain the toxicity mechanism of mercury in elemental and inorganic form (4 marks)

QUESTION TWO (20 MARKS)

- a) Explain any four industrial applications of lanthanoids (8 marks)
- b) Compare and contrast the chemistry of lanthanoids with that of actinoids with reference to:
- Electronic configuration. (2 marks)
 - Oxidation state. (3 marks)
 - Chemical reactivity. (3 marks)
 - Complex formation (2 marks)
 - Radioactivity (2 marks)

QUESTION THREE (20 MARKS)

- a) Name the three principal ores of lanthanides (3 marks)
- b) Explain how lanthanides can be extracted from any one of the ores named in (a) above (4 marks)
- c) Discuss any four effects of lanthanoid contraction (8 marks)
- d) What are the factors that make actinides to be exerting negative impact on the environment? (3 marks)
- h) For the reaction of actinium (III) hydroxide with hydrofluoric acid,
- write and balance the equation (1 mark)
 - explain what makes the O.S. of Actinium different from the other Actinides. (1 mark)

QUESTION FOUR (20 MARKS)

- a) Explain the main functions of ligand in biological system. (4 marks)
- b) What are the indicators of biologically important elements (5 marks)
- c) What are the properties that dominate the transport behavior of transition metals in biological systems (3 marks)

- d) Copper and iron proteins participate in many of the same biological reactions show what iron and copper have in common in this regard (8 marks)