



MACHAKOS UNIVERSITY

University Examination for 2019/2020 Academic Year

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF PHYSICAL SCIENCE

**FOURTH YEAR FIRST SEMESTER EXAMINATION FOR THE DEGREE OF
BACHELOR OF EDUCATION SCIENCE AND BACHELOR OF EDUCATION
(SPECIAL NEEDS)**

SCH 400: COMPARATIVE STUDY OF TRANSITION ELEMENTS

DATE:

TIME: 2 HOURS

INSTRUCTIONS:

1. Question **ONE** is **COMPULSORY** (Section A) (30mks)
2. Answer **ANY** other **TWO** questions from **Section B** (each 20marks)

SECTION A (COMPULSORY)

QUESTION ONE (30 MARKS)

- a) State four characteristics of stable compounds (4mks)
- b) Explain why VCl_2 is ionic while VCl_3 is less ionic while VCl_3 and VCl_4 are covalent (3mks)
- c) Give three reasons why transition metals form good homogeneous or heterogeneous catalyst. (3mks)
- d) State and explain briefly three reasons why complex containing higher oxidation states are more stable. (3mks)
- e) Explain why zinc is not a transition metal (2mks)
- f) Explain briefly why atoms of transition elements are smaller than those of group I or II in the same period (3mks)
- g) Give three reasons why transition metals easily form alloys with each other (3mks)
- h) State three uses of chromium (3mks)
- i) Explain briefly why most transition metal compounds are colored. (3mks)
- j) Explain why Zinc, cadmium and mercury have low melting and boiling points (3mks)

SECTION B

QUESTION TWO (20 MARKS)

- a) Describe briefly one method of extracting Manganese from its ores (5mks)
- b) Using a flow diagram show the main stages involved in extraction of Nickel from pentlandite (7mks)

- c) State three uses of Nickel (3mks)
- d) Write discharging equations at both positive and negative terminals and the overall equation in a zinc-carbon dry cell battery (5mks)

QUESTION THREE (20 MARKS)

- a) Outline the key steps in commercial production of Zirconium during the Kroll process (6mks)
- b) Briefly describe three stages involved in extractive metallurgy (7mks)
- c) Discuss biological and chemical importance of iron (7mks)

QUESTION FOUR (20 MARKS)

- a) Briefly describe the mechanism involved in polymerization of an alkene over the Ziegler-Natta catalyst $\text{TiCl}_4/\text{AlEt}_3$ (8mks)
- b) Using suitable examples, discuss briefly any four methods of synthesizing organometallic compounds (8mks)
- c) State the effect of lanthanoid contraction on physical and chemical properties of transition metals (4mks)

QUESTION FIVE (20 MARKS)

- a) Briefly discuss d-block elements with reference to the following (9mks)
- i) Magnetic properties
 - ii) Complex compound formation
 - iii) Catalytic properties
- b) Provide a step-wise description of extraction of iron from its main ores (7mks)
- c) State two iron complexes and explain how they are used in qualitative analysis (4mks)

END