



KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS
2017/2018 ACADEMIC YEAR

THIRD YEAR SECOND SEMESTER
SPECIAL/SUPPLEMENTARY EXAMINATIONS

FOR THE DEGREE OF B.ED (SCIENCE)

COURSE CODE: SCH 311

COURSE TITLE: COMPARATIVE STUDY OF TRANSITION ELEMENTS

DURATION: 2 HOURS

DATE: ~~MONDAY 25TH APRIL~~ 2018 **TIME:** 8 – 10AM

INSTRUCTIONS TO CANDIDATES

- Answer **QUESTION ONE** (Compulsory) and any other two (2) Questions.
- Indicate **answered questions** on the front cover.
- Start every question on a new page and make sure question's number is written on each page.

This paper consists of 3 printed pages. Please Turn Over



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QUESTION ONE

- 1) (a) Write the outer shell electron configuration of Chromium and copper giving an explanation for your answer.....(4)
- (b) Give four properties of Chromium or its compounds in which it shows transition element behaviour.....(4)
- (c) (i) Account for the relative stabilities of the +2 and +3 oxidation states of iron.....(2)
(ii) Give any two differences between zinc and other transition elements.....(2)
- (d) Explain the origin of colour in transition element compounds....(4)
- (e) Give the oxidation state of Chromium in.....(3)
- (i) FeCrO_4
- (ii) CrO_2Cl_2
- (iii) $[\text{Cr}(\text{H}_2\text{O})_4\text{Cl}_2] \cdot \text{Cl} \cdot \text{H}_2\text{O}$
- (f) When silver nitrate is added to an aqueous solution of hydrated chromium(iii) chloride, only one third of the chloride is precipitated as silver chloride
- (i) Explain this observation.....(2)
- (ii) Give the formula of the hydrated chromium chloride.....(1)
- (iii) Two other isomers of this compound exist. Give their molecular formulae and indicate how their aqueous solutions would behave with silver nitrate.....(4)
- (g) (i) Transition elements have unusually higher melting points than the preceding s-block elements. Explain.....(1)
- (ii) State three applications of formation of chelated complexes.....(3)
- 2 (a) If supplied with a sample of chromate, FeCr_2O_4 and another ore of the mineral pentlandite $(\text{NiFe})_9\text{S}_8$ and all reagents that would be required. Describe very briefly how these minerals would be processed and make samples of the following complexes.
- (i) The hexamine complex $[\text{Cr}(\text{NH}_3)_6]^{3+}$
- (ii) Tetracarbonyl Nickel (0) $\text{Ni}(\text{CO})_4$
- (iii) Potassium tetraoxoferrate(vi), K_2FeO_4 . (20mks)
- 3)(a) State and explain the general trend down the group for each of the following properties of transition elements(10)
- (i) Density
- (ii) Ionization energy
- (iii) The oxidizing ability of the group oxidation
- (b) Compare and contrast the chemistry of Cr, Mo and W with respect to their ... (10)
- (i) halides

(ii) oxides

(iii) oxyhalides

4(a) When a few drops of potassium permanganate are added to an aqueous solution of ferrous sulphate, the solution turns brown. On the other hand, when the experiment is repeated using sodium molybdate instead of potassium permanganate, no similar colour change is observed. Explain this observation(4)

(b) Given the mineral ilmenite, outline briefly how it could be used to make

(i) A sample of pigment grade rutile(6)

(ii) A sample of ferrocene (C_5H_5)₂Fe(4)

(c) Name the qualities that make titanium oxide (TiO_2) the base of most white paints used nowadays and explain why naturally occurring mineral rutile TiO_2

cannot be used as mined but must be processed first(6)

5.(a) Explain why the third ionization potential of $_{26}Fe$ is lower than that of $_{25}Mn$ (2)

(b) Explain briefly, the reasons for the following observations supporting your discussion where possible by means of balanced chemical or ionic equation or structures.

(ii) When the mineral pyrolusite, MnO_2 is mixed with sodium carbonate, the mixture melted in presence of air, the melt is colored green. When the cold melt is dissolved in water, the solution formed made just acidic, a brown precipitate forms the solution that results is purple colored. (7mks)

When Molybdenum (ii) bromide is dissolved in water and Lead nitrate added, only a third of the halogens are precipitated. (4mks)

(i) Explain why $Cr^{3+}(aq)$ is violet in color while Y^{3+} is colorless (3mks)

(ii) Explain the origin of magnetism of transition metal compounds and distinguish between paramagnetism citing relevant examples. (4mks)