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# KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS  
2016/2017 ACADEMIC YEAR

THIRD YEAR SECOND SEMESTER  
SUPPLEMENTARY/SPECIAL EXAMINATIONS

FOR THE DEGREE OF B.ED (SCIENCE)

**COURSE CODE:** SCH 311

**COURSE TITLE:** COMPARATIVE STUDY OF S AND P BLOCK  
ELEMENTS

**DURATION:** 2 HOURS

**DATE:** 21<sup>ST</sup> SEPTEMBER 2017 **TIME:** 11:30AM – 1:30PM

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**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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1.(a) Define the term transition element.(1mk)

(b) Describe the following physical properties of d block elements:

(i) Ionization energy across the period.(2mks)

(ii) Melting point compared to s block elements.(2mks)

(c) Write the electron configuration of the d block element in each of the following atoms/ions.(2mks)

(i)  $V^{2+}$

(ii)  $Cu^+$

(iii)  $FeO_4^{2-}$

(iv)  $Ni(en)^{2+}$

(d) Manganese shows oxidation states of +2,+4,+6,+7 while zinc only exhibits an oxidation state of +2.Explain.(2mks)

(e) Among the following oxoanions, state the strongest and weakest oxidizing agent. Give a reason for your answer.(2mks)

$VO_4^{3-}$ ,  $CrO_4^{2-}$ ,  $MnO_4^{2-}$  and  $FeO_4^{2-}$ .

(f) By use of appropriate illustrations, explain the following terms as used d block elements chemistry.

(i) Homogenous catalysts.(1mk)

(ii) Interstitial compound.(1mk)

(iii) Polydentate ligand.(1mk)

(g) Explain the following observations.

(i) Most copper (ii) compounds have a blue to green colour whereas those of Titanium(iv) are colourless.(2mks)

(ii) When  $CrO_4^{2-}$  react with an acid to form  $Cr_2O_4^{2-}$  ions the colour shifts from bright yellow to orange.(2mks)

(iii) Compounds of  $V^{2+}$  are paramagnetic while those of  $V^{5+}$  diamagnetic.(2mks)

(iv)  $[Mn(H_2O)_6]^{2+}$  is a high spin complex .(3mks)

(h) Name the following coordination complexes.(2mks)

(i)  $[Co(NH_3)_5(H_2O)(NO_3)_3]$



(ii)  $[\text{Cr}(\text{NH}_3)_4\text{Cl}_2]\text{Cl}$ .

(i) Determine the formula of the following compounds. (4mks)

(i) Tri(ethylenediamide)chromium(III)chloride.

(ii) Potassium tetranitritodiammine cobalt nitrate (III).

(j)(i) With the help of appropriate equations, describe preparation of potassium permanganate. (8mks)

(ii) Name the important use of potassium dichromate. (1mk)

2.(a)(i) Describe the essential reactions in the extraction of iron metal in the Blast furnace. (6mks)

(ii) Comment on the purity of the iron from the above process. (2mks)

(iii) What is steel? State its composition. (2mks)

(b)(i) Explain why Titanium metal cannot be extracted from its ore ( $\text{TiO}_2$ ) using the same process used for extraction of  $\text{ZrO}_2$ . (2mks)

(ii) Give two uses of titanium metal. (2mks)

(c) The complex  $[\text{Co}(\text{NH}_3)_4\text{Cl}_2]^+$  can be made by replacing two ammonia ligands from the complex  $[\text{Co}(\text{NH}_3)_6]^{3+}$ . Draw the possible geometrical isomers of  $[\text{Co}(\text{NH}_3)_4\text{Cl}_2]^+$  and give in each case the systematic IUPAC name of the complex. (6mks)

3.(a) Rhodium is one of the 2<sup>nd</sup> row d block elements that form simple cationic complexes. For example, it forms a stable hexaqua complex  $[\text{Rh}(\text{H}_2\text{O})_6]^{3+}$  where the analogous Cobalt(III) ions are unstable. Suggest possible reasons for the observations. (4mks)

(b) Give an example of biologically imported Cobalt complex and draw its structures. (6mks)

(c) You are provided with a solution containing both Ni(II) and Co(II) ions. Describe the procedure that you may use to separate the two and get pure samples of each metal (element). (10mks)

4.(a) Briefly describe how you can achieve separation of Niobium and Titanium if you are supplied with an ore containing the two elements. (6mks)

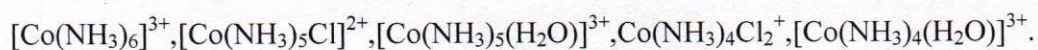
(b) When a few drops of potassium permanganate are added to an aqueous solution of ferrous sulphate, the solution turns brown, on the other hand if the tests are repeated using sodium molybdate, instead of potassium permanganate, no similar colour change is observed. Explain this observation. (5mks)

(c) Below is a list of some octahedral complexes.

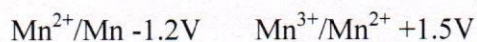


(i) Select the one that can form cis/trans isomer. (3mks)

(ii) Draw the structure of their geometric isomer. (3mks)



(d) For  $\text{M}^{3+}/\text{M}$  and  $\text{M}^{3+}/\text{M}^{2+}$  systems the  $E^0$  values for some metals are as follows:



Use the data to comment upon;

(i) The stability of  $\text{Fe}^{3+}$  in acid solution as compared to  $\text{Cr}^{3+}$ . (1mk)

(ii) The ease with which Iron can be oxidized as compared to the same process for Manganese metal. (1Mk)

(iii)  $\text{Cr}^{2+}$  is strongly reducing while Manganese (iii) is strongly oxidizing. (1mk)

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