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KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS
2017/2018 ACADEMIC YEAR

SECOND YEAR SECOND SEMESTER
SUPPLEMENTARY EXAMINATIONS

FOR THE DEGREE OF B.ED (SCIENCE)

COURSE CODE: SCH211

COURSE TITLE: INORGANIC CHEMISTRY

DURATION: 2 HOURS

DATE: 21ST SEPTEMBER 2017 **TIME:** 8 – 10 AM

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 (30 MARKS)

1a) Define the following terms (5 marks)

- i. Electronegativity
- ii. Lewis acid
- iii. Lewis base
- iv. Isoelectronic
- v. Chemical bond

b) State if the molecules are polar or non polar (3 marks)

- i. SF_6 (½ mark)
- ii. SO_2 (½ mark)
- iii. BrCl (½ mark)
- iv. AsH_3 (½ mark)
- v. CF_2Cl_2 (½ mark)
- vi. H_2O (½ mark)

c) Draw the following complexes (5 marks)

- i. Hexaamminecobalt(III) chloride (1 mark)
- ii. Diamminesilver(I) ion (1 mark)
- iii. Tetraamminedichloroplatinum(IV) ion (1 mark)
- iv. Hexachloroplatinate(IV) ion (1 mark)
- v. Tetraaquadichlorochromium(III) chloride (1 mark)

d) Name the following complexes (5 marks)

- i. $[\text{Zn}(\text{NH}_3)_2\text{Cl}_2]$ (1 mark)
- ii. $\text{K}_3[\text{Fe}(\text{CN})_6]$ (1 mark)
- iii. $[\text{Cu}(\text{NH}_3)_4]^{2+}$ (1 mark)
- iv. $[\text{Cr}(\text{en})_3]^{3+}$ (1 mark)
- v. $[\text{Co}(\text{CO})_3]^{3-}$ (1 mark)

e) What is the molecular geometry of PO_2F^{2-} (1 mark)

(i) Predict the approximate size of the O-P-O angle (3 marks)

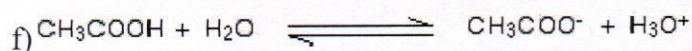
(ii) Does PO_2F^{2-} have a dipole moment (Explain your answer using electronegativities and bond polarities) (½ mark). (2 marks)

f) Differentiate between Amphiprotic and amphoteric substances and in each case give two examples. (4 marks)

g) Explain the difference between a molecular dipole moment and the dipole moment of a polar bond. (2 marks)

QUESTION TWO (20 MARKS)

- 2 a) Give two uses of complexes (2 marks)
- b) Define the following terms and in each case give an example (5 marks)
- Homoleptic complexes
 - Heteroleptic complexes
 - Ambidentate ligand
- c) Discuss the types of structural isomerism that occur in coordinate compounds (6 marks)
- d) Differentiate between a coordinate and a covalent bond (1 mark)
- e) Arrange the atoms in each of the series in order of decreasing electronegativity. (3 marks)
- Al, H, Na, O, P (1 mark)
 - C, F, H, N, O (1 mark)
 - Ba, H, N, O, As (1 mark)



Write an expression for calculating the K_a and the $\text{p}K_a$ of the above reaction (2 marks)

QUESTION THREE (20 MARKS)

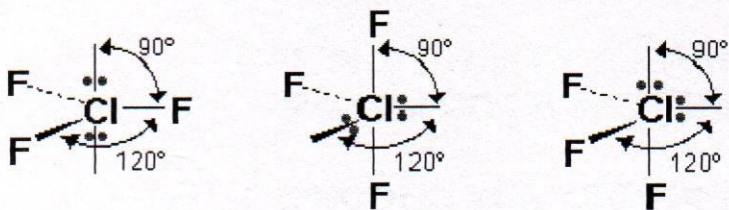
- 3 a) Define acid and base according to Arrhenius theory (2 marks)
- b) Arrhenius acids and bases react with each other in neutralization reactions. Give the net ionic equation for such reactions. (1 mark)
- c) Explain the limitation of Arrhenius theory and how it is solved using Bronsted-Lowry theory (8 marks)
- d) Indicate the acids and bases in the reaction below (2 marks)
- $$\text{HA} + \text{H}_2\text{O} \rightleftharpoons \text{H}_3\text{O}^+ + \text{A}^-$$
- e) In a NaOH solution the concentration of hydroxide ions is 7.2×10^{-3} M. Calculate the pH of the solution. (3 marks)
- f) The concentration of hydrogen ions in wine was 4.1×10^{-4} M after the cap was removed. If half was consumed, the other half after standing open for a month had a concentration of 2.3×10^{-3} M. Calculate the pH of the wine at the two occasions. Explain the results. (4 marks)

QUESTION FOUR (20 MARKS)

4a) Draw the structures of the following ions or molecules and give their shapes. (3 marks)

- i. Sulphate ion – tetrahedral (½ mark)
- ii. Sulphur dioxide – bent/v shaped (½ mark)
- iii. Phosphorus pentafluoride – trigonal bipyramidal (½ mark)

b) Which of the below structures is the most probable for ClF_3 ? Discuss (3 marks)



A

B

C

c) Indicate the partial charges for all atoms in the following molecules. (4½ marks)

- i) XeOF_2
- ii) ClOF_4^-
- iii) NOF_2

d) Determine the oxidation states for all atoms in the following compounds by formally cleaving bonds according to the electronegativity differences. (4½ marks)

- i) CFCl_3
- ii) SOCl_2
- iii) FNO (central atom: nitrogen)

e) For each of the following pairs of acids, circle the stronger acid (3 marks)

- i) $[\text{V}(\text{H}_2\text{O})_6]^{3+}$ or $[\text{Nb}(\text{H}_2\text{O})_6]^{3+}$
- ii) $[\text{Cu}(\text{H}_2\text{O})_6]^{2+}$ or $[\text{Cu}(\text{H}_2\text{O})_6]^{3+}$
- iii) H_2SO_4 or H_2CO_3

f) Write the equilibrium for the one of the above aqua-acids in water (2 marks)

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