

Name: _____

Index No.: _____ / _____

2411/302
INORGANIC CHEMISTRY
Oct./Nov. 2015
Time: 3 hours



Candidate's Signature: _____

Date: _____

THE KENYA NATIONAL EXAMINATIONS COUNCIL

DIPLOMA IN ANALYTICAL CHEMISTRY

INORGANIC CHEMISTRY

3 hours



INSTRUCTIONS TO CANDIDATES

Write your name and index number in the spaces provided above.

Sign and write the date of the examination in the spaces provided above.

You should have scientific calculator for this examination.

This paper consists of **TWO** sections: A and B.

Answer **ALL** the questions in Section A and **THREE** questions from Section B in the spaces provided.

Each question in section A carries 4 marks while each question in Section B carries 20 marks.

Maximum marks for each part of a question are indicated.

Candidates should answer the questions in English.

For Examiner's Use Only

SECTION A

Question	1	2	3	4	5	6	7	8	9	10	TOTAL SCORE
Candidate's Score											

SECTION B

Question	11	12	13	14	15	TOTAL SCORE
Candidate's Score						

Grand Total

This paper consists of 16 printed pages.

Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no question are missing.

SECTION A (40 marks)

Answer *ALL* the questions in this section in the spaces provided.

1. Draw the hydrogen spectral series. (4 marks)

2. Draw any **four** of the d-orbitals. (4 marks)



3. Explain the significance of the four quantum numbers of an atom. (4 marks)

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4. Explain the ability of carbon to form four bonds. (4 marks)

5. (a) Write the electronic configuration of chromium ion in *spd* notation. (2 marks)

(b) Explain the arrangements in (a) above. (2 marks)

6. Describe the reactions of carbon dioxide and silicon dioxide with sodium hydroxide solution. (4 marks)



7. When chlorine is bubbled through a solution of NaBr slowly the solution turns brown.

(a) Write the equation for the reaction. (2 marks)

(b) Explain the observation. (2 marks)

8. List **four** general properties of the transition metals. (4 marks)

9. (a) Define coordination complex, (2 marks)

(b) Give **two** examples of coordination complexes of iron with cyanide. (2 marks)

10. Explain the principle of semi-conductors, (4 marks)

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SECTION B (60 marks)

Answer any **THREE** questions from this section in the spaces provided after question 15.

11. (a) (i) Sketch a graph of the trends of 1st, and 2nd ionization energies of group IVA. (3 marks)
- (ii) Explain the trends in ionization energies of the group IVA elements. (5 marks)
- (b) Draw the structure of carbon dioxide (CO₂) and explain why it is different from the other oxides of group IVA. (12 marks)
12. (a) Explain the following observations:- Beryllium metal does not react with water. (2 marks)
- (b) (i) Identify the **three** methods of metal extraction and explain their significance. (14 marks)
- (ii) Explain the significance of slug formation in the extraction of iron. (4 marks)
13. Identify the metal ions in sample X and Y based on the test tube reactions carried out in a laboratory:
- (a) Dilute solution of sodium hydroxide when added slowly with shaking till in excess a dark green precipitate was formed which was insoluble in excess. (6 marks)
- (b) Dilute solution of ammonium hydroxide was added to Y and a blue precipitate was formed soluble in excess of ammonium hydroxide solution. (8 marks)
- (c) When the solution obtained in (b) above was heated with glucose a brown precipitate was formed. (4 marks)
- (d) The precipitate formed in (a) above does not dissolved in excess ammonia solution. (2 marks)



14. (a) Write the electronic configurations of the following ions:

- (i) Ti^{2+}
- (ii) Cr^{2+}
- (iii) Ni^{2+}

(5 marks)

(b) Give the formulae of the following complex ions:

- (i) Hexaammine cobalt (III) ions;
- (ii) Hexacyanoferrate (II) ions;
- (iii) Tetraammine copper (II) ion.

(c) Draw the shapes of the following ions:

- (i) $Co(NH_3)_6^{3+}$
- (ii) $[Fe(H_2O)_6]^{2+}$

(4 marks)

(2 marks)

(d) Figure 1 below shows the trend in the melting points of metals in period I of the periodic table.

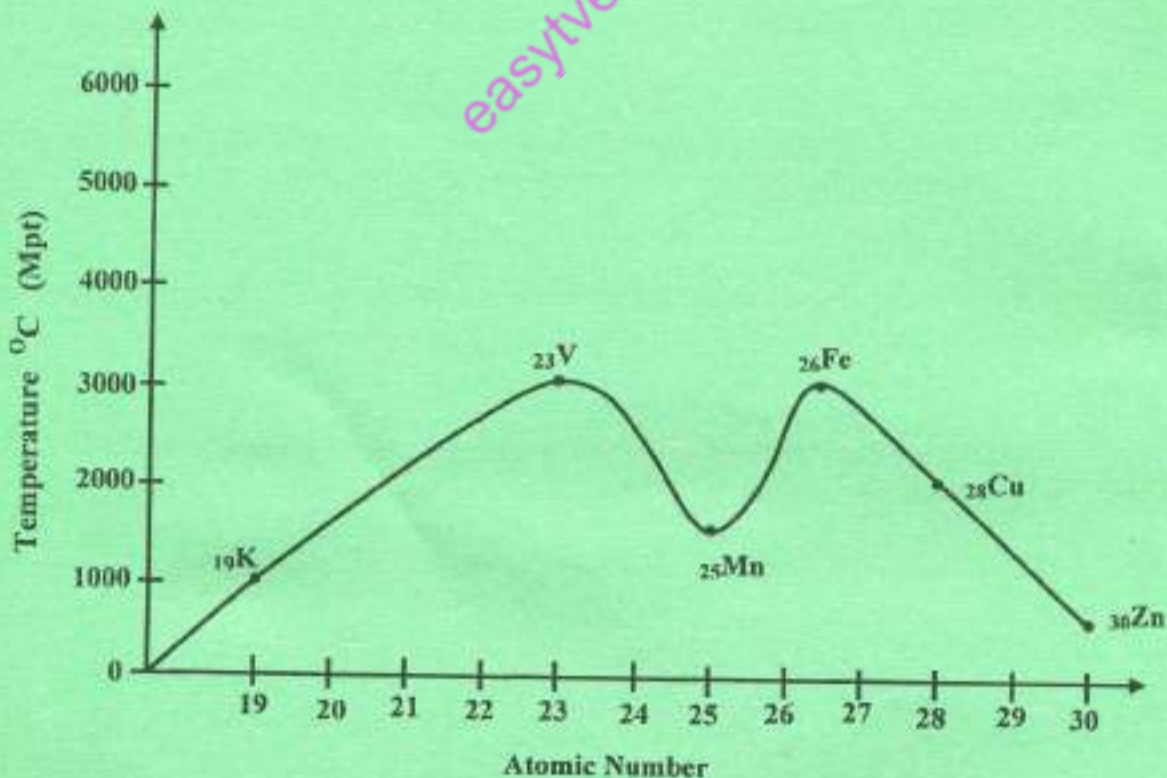


Figure 1

Explain the shape of the graph.

(9 marks)

15. Figure 2 below shows the solubility of hydroxides of group IIA metal ions.

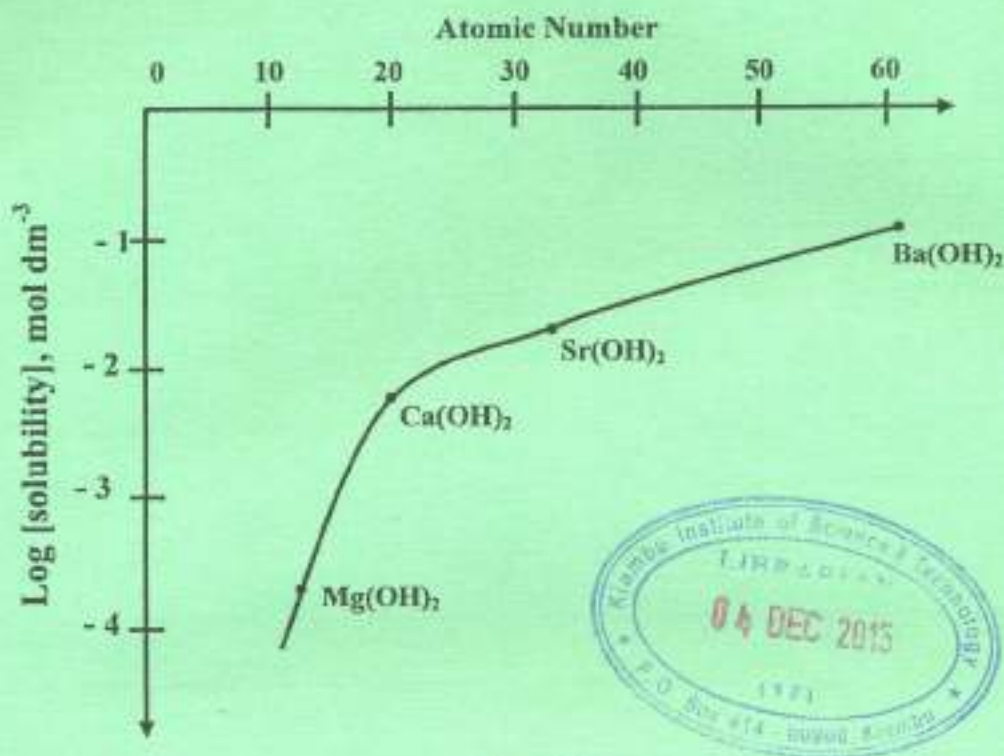


Figure 2

- (a) Comment on the trend of the solubility of the group IIA hydroxides. (4 marks)
- (b) Give the reasons for the observed trend. (3 marks)
- (c) Write equation for the effect of heat on the Ca(OH)_2 . Explain the nature of the reaction. ($\Delta H = +109 \text{ KJ/mol}$) (4 marks)
- (d) It is observed that magnesium oxide (MgO) does not dissolve in water, explain the observation. (5 marks)
- (e) Write balanced chemical equations for the following reactions.
- (i) Addition of excess sodium hydroxide solution to zinc ions. (2 marks)
- (ii) Addition of excess ammonium hydroxide to Pb^{2+} ions. (2 marks)