

i) Cold dilute KOH

ii) Hot concentrated KOH

4 marks

- d) Complete the table below by writing the formulae and names of the compounds of sulphur with the corresponding oxidation states.

Oxidation state	Formulae of compound	Name of sulphur compound
+2		
+4		
+6		

3 marks

- e) Give an equation to show how sulphur or its compounds undergoes

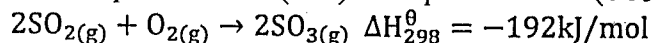
i) Oxidation

ii) Reduction

iii) Disproportionation

3 marks

- f) The key reaction in the contact process for the manufacture of sulphuric acid is the oxidation of sulphur dioxide (SO₂) to sulphur trioxide (SO₃)



- i) State and explain how the yield of SO₃ is increased in practice.

ii) How is SO₃ converted to sulphuric acid?

3 marks

4. (a)(i) Complete the table by giving the formulae of the simple hydrides of the elements of period 2 lithium to neon

Element	Li	Be	B	C	N	O	F	Ne
Formula of hydride								

- ii) Write the equations to show the reaction of the hydrides of Li and F with water. Explain the differences in their reactions with water in terms of their structure and bonding.

Equations:

Explanation

- iii) Suggest a reason why the hydride of carbon does not react with water.

7 marks

- b) What is the difference between a d-block element and a transition element? Give an example of each.

2 marks

- c) State and explain the variation in atomic radius across the first transition series from scandium to zinc.

2 marks

- d) (i) Why are transition metal compounds coloured?

- ii) Copper is a transition metal. Explain why some of its compounds are white.

4 marks

- e) (i) Complete the table below by giving the oxides of manganese in the corresponding oxidation states.

Oxidation states	+2	+4	+6	+7
Formula of oxide of manganese				

- ii) Explain why manganese exhibits the +7 oxidation state.

3 marks

- f) Give a balanced equation for the reaction in which a transition metal acts as a homogeneous catalyst.

2 marks

SET 8 : SECTION B (CGCEB 2016)**Inorganic (Mineral) Chemistry**

3. (a)(i) Write the outer electron configuration of the halogens -----
 (ii) State and explain how the following properties will vary down the group 17 (Group VII) of the periodic table.
 (A) Volatility -----

 (B) Electropositivity -----

 5 marks
- (b) A solution of chlorine in water is used as a disinfectant. The following chemical equation indicates the reaction between water and chlorine
 $\text{Cl}_{2(g)} + \text{H}_2\text{O}_{(l)} \rightarrow \text{Cl}^-_{(aq)} + \text{ClO}^-_{(aq)} + 2\text{H}^+_{(aq)}$
 (i) Give a balanced equation for the reaction that occurs when a concentrated solution of NaOH is added to this medium -----

 (ii) What name is given to this type of reaction? -----

 2 marks
- (c) (i) Write balanced equations for the preparation of HF and HI from CaF_2 and NaI respectively. -----

 (ii) Explain any similarity or difference in the methods of preparation of HF and HI -----

 3 marks
- (d) Nitric acid is manufactured by the catalytic oxidation of ammonia.
 (i) Name the source of ammonia used in this process -----

 (ii) Write a balanced equation for the oxidation of ammonia to nitrogen monoxide -----

 (iii) Suggest the temperature at which the reaction in d(ii) occurred as well as the name of the catalyst that was used. -----

 (iv) Write an equation for the conversion of NO_2 to HNO_3 -----

 5 marks
- (e) Sulphuric acid is prepared from sulphur dioxide through the reaction
 $2\text{SO}_2(g) + \text{O}_2(g) \rightleftharpoons 2\text{SO}_3(g)$
 (i) Why is the pressure of one atmosphere maintained taking into consideration that increasing the pressure will favour the production of more $\text{SO}_3(g)$? -----

 (ii) Which catalyst is used in the process? -----

 2 marks

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(f) A large amount of sulphur dioxide was released into the air during the Lake Nyos disaster.

(i) Write an equation to show how $\text{SO}_2(\text{g})$ reacts with water -----

(ii) What is observed when $\text{SO}_2(\text{g})$ is bubbled through solutions of Fe^{3+} and MnO_4^- ions?

(A) Fe^{3+} ion -----

(B) MnO_4^- ion -----

3 marks

4. Define

(a) (i) d-block element -----

(ii) Transition metal -----

(b) (i) Write down the "electron-in-box" configuration of the Fe^{2+} and Fe^{3+} ions (atomic number=26)

Fe^{2+} ion -----

Fe^{3+} ion -----

(ii) Which ion is more stable and why? -----

4 marks

(c) **State and explain** the variation in the following properties across the first transition series (scandium to zinc)

(i) First ionisation energy -----

(ii) Atomic radius -----

4 marks

(d) The elements of period 2 of the Periodic Table include Lithium to Neon.

(i) Complete the table below by giving the formula of the stable oxide of the element.

Element	Li	Be	B	C	N	O	F	Ne
Formula of oxide								

(ii) Identify the element whose oxide is

(A) Most basic -----

(B) Most acidic -----

(C) Amphoteric -----

3 marks

(iii) Sketch the graph of the first ionisation energy versus atomic number for the elements across the period -----

3 marks

(iv) Write equations for the reaction of the oxide of Be and the oxide of B with water.

(A) Oxide of Be -----

(B) Oxide of B -----

-----2 marks

SET 7 : SECTION B (CGCEB 2015)

Inorganic (Mineral) Chemistry

3 (a) The elements of period 2 of the Periodic Table (Li to Ne) show periodic trends in their properties.

(i) What is meant by the term "periodic trend"?

(ii) How do the following properties vary across the period (Li to Ne)? Explain in each case.

A: Atomic radius.

Explanation.

B: First ionization energy.

Explanation.

(5 marks)

(b) For the elements of period 2, give the formula of a hydride which is,

i) Basic and covalent. -----

(ii) Neutral. -----

(iii) Acidic. -----

(3 marks)

(c) (i) With reference to the Group 14 (Group IV) elements (C to Pb), explain the following:

A: Catenation. -----

B: Inert pair effect. -----

(ii) Give the formula of the chloride of Group 14 (Group IV) element which is,

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A: Ionic and insoluble in water. -----

B: Covalent and is hydrolysed in water. -----

(d) Explain the following observations:

(i) CCl_4 is stable to heat while PbCl_4 readily decomposes when heated. -----

(ii) Carbon dioxide is a gas whereas silicon dioxide is a solid. -----

(3 marks)

(e) Give one similarity and one difference between the elements or compounds of carbon and tin.

A: Similarity. -----

B: Difference. -----

(2 marks)

(f) Using equations only, show how:

(i) Ammonia can be prepared in the laboratory -----

(ii) A fertilizer can be prepared from a nitrogen compound with oxidation states, -3 and +5. -----

(2 marks)

(g) Give a balanced equation for a reaction in which nitrogen is oxidized and reduced. -----

(1 mark)

(Total: 20 marks)

4. (a) (i) List all the metals of the first series of transition metals in order of increasing atomic numbers. -----

(ii) How does the atomic radius of the elements vary across the series? Explain.

A: Atomic radius.

B: Explanation. -----

(b) (i) Give any two properties that are typical of transition elements other than complex formation. -----

(ii) Using iron as an example, give an illustration of each of the properties stated in 4b(i).

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Property	Example

(4 marks)

- (c) The Group I elements (Li to Cs) and Group II elements (Be to Ba) are s-block elements.
 (i) State and explain how the first ionization energies of the elements vary from Group I to Group II and down the groups.

A: From Group I to II

Explanation. -----

B: Down the Groups.

Explanation. -----

(4 marks)

- (d) Briefly explain how the following s-block compounds can be prepared.

(i) MgO(s) . -----

(ii) NaCl(s) . -----

(4 marks)

- (e) What would be observed when,

(i) Aqueous silver nitrate is added to potassium bromide solution, followed by aqueous ammonia? -----

(ii) Concentrated sulphuric acid is added to potassium bromide solution, followed by aqueous ammonia? -----

(iii) Chlorine water is added to an aqueous solution of potassium iodide? -----

Write a balanced equation for the reaction taking place in 4e (iii) above and account for any differences in your observations in 4e (ii) and 4e (iii) above.

Equation: -----

Differences. -----

(5 marks)

(Total=20 marks)

SET 10 : SECTION B (CGCEB 2018)**Inorganic (Mineral) Chemistry**

3.(a) This question concerns the d-block elements of the Periodic Table. The elements Cobalt, Nickel, Iron and Zinc are of the d-block.

(i) Which of the elements above is(are) not (a) transition metal(s)? Explain. -----

(ii) Distinguish between a d-block element and a transition metal. -----

(iii) How is a complex ion formed by a transition metal? -----

(iv) What do you understand by the coordination number of a complex ion? -----

(v) Give the name of a complex cation formed by cobalt and draw its shape.-----

9 mks)

(b) This question is on the Group VII elements of the Periodic Table (Fluorine, Chlorine, Bromine and Iodine).

(i) Give the general outermost shell configuration of these elements. -----

(ii) Give the chemical formula in each case of one compound of chlorine in which the oxidation state is:

Oxidation state	Compound
+1	
+7	

(iii) The halogens undergo disproportionation reactions. Using an equation, give an example of a reaction in which chlorine undergoes disproportionation. -----

(iv) Arrange the oxo-acids of chlorine (HClO , HClO_2 , HClO_3 , HClO_4) in order of decreasing acid strength starting with the strongest. Explain your reasoning. -----

6 mks

(c) Sulphur exhibits several oxidation states in its compounds.

(i) Complete the table below by giving either the formula, name or oxidation state of the compound or ion.

Oxidation state	Name	Formula
-2		H ₂ S
	Thiosulphate	
		H ₂ SO ₄
	Persulphate	S ₂ O ₈ ²⁻

(ii) Write balanced equations to show how SO₃ is converted to H₂SO₄ in the contact process. -

(5 mks)

4.(a) (i) Explain why the melting and boiling points of Groups I and II metals are lower than those of transition metals. -----

(ii) Indicate the colours associated with the following elements in a flame test.

Element	Flame colour
Sodium	
Calcium	
Potassium	
Strontium	

(iii) Give one reaction in each case to illustrate how the chemistry of:

A: lithium differs from that of other elements of group I. (1 line)

B: Beryllium differs from that of other elements of group II. -----

6 mks)

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(b) The elements of the first short period of the Periodic Table are, Li, Be, B, C, N, O, F, and Ne.

(i) Give the formula of one stable oxide of each element of the period.

Element	Li	Be	B	C	N	O	F	Ne
Stable oxide								

(ii) Give balanced equations to show how the oxides of lithium and carbon react with water. -

(iii) Give the formulae of the chlorides of the elements Li, Be, B, C, N, O and classify them according to their bond types.

Element	Li	Be	B	C	N	O
Formula of chloride						
Bond type						

(8 mks)

(c) This question concerns the Group IV elements (carbon-lead)

(i) Give equations to show how the tetrachlorides of Si and Pb react with water. -----

(ii) Complete the table below by giving the formulae of the dioxides of the elements and their acid-base character.

Element	Silicon	Lead
Formula of dioxide		
Acid-base character		

(4 mks)

(d) Outline the steps in the conversion of ammonia to nitric acid, specifying the reaction conditions. -----

(2 mks).