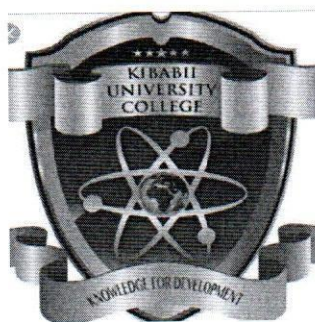


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**KIBABII UNIVERSITY**

**UNIVERSITY EXAMINATIONS**

**2020/2021 ACADEMIC YEAR**

**SECOND YEAR FIRST SEMESTER EXAMINATION**

**FOR THE DEGREE**

**OF**

**BACHELOR OF CHEMISTRY**

**COURSE CODE: SCH 211\***

**COURSE TITLE: INORGANIC CHEMISTRY**

**DATE: 17/06/2021**

**TIME: 2-4 PM**

**INSTRUCTION: ANSWER QUESTION ONE AND ANY OTHER TWO QUESTIONS**

This paper contains 5 printed pages

**(MAIN EXAMINATION)**

**QUESTION 1 (30 marks)**

a) State and explain the expected trend in the values of the lattice energy for group 2 oxides  
**(4marks)**

b) Explain why NaCl has a melting point of 801°C while CaCl<sub>2</sub> has 772°C **(4 marks)**

c) State the difference between a coordinate and a covalent bond **(3 marks)**

d) Explain why AlCl<sub>3</sub> dissolves in water to form an acidic solution unlike MgCl<sub>2</sub> **(2 marks)**

e) The table below gives the Pauling electronegativity values of some elements

Element	Rb	As	F	Cl	Br
Electronegativity	0.8	2.0	4.0	3.0	2.8

i) What is electronegativity **(2 marks)**

ii) Use the electronegativity values in the table to predict the type of bonds (ie ionic, polar covalent or nonpolar covalent) in the following molecules. Explain **(4 marks)**

I) RbF

II) AsBr<sub>3</sub>

f) Briefly explain the bonding in the oxide of selenium **(2 marks)**

h) Explain why the melting point of LiF is 845°C while that of LiI is 449°C **(3 marks)**

i) Explain why I<sub>2</sub> is a solid while Cl<sub>2</sub> is a gas **(2 marks)**

j) Study the ionization energies of Beryllium and Magnesium;

Z	Element	1 <sup>st</sup> I.E	2 <sup>nd</sup> I.E	3 <sup>rd</sup> I.E	4 <sup>th</sup> I.E
4	Be	899	1757	14850	20992
12	Mg	738.1	1450	7730	10500

Account for the very large difference between 2<sup>nd</sup> and 3<sup>rd</sup> ionization energies in beryllium as compared to Magnesium **(4 marks)**

### QUESTION 2 (20 marks)

- a) Explain why Aluminium ion is hydrated by six molecules of water while boron only picks 4 molecules of water (3 marks)
- b) What is inert pair effect (1 mark)
- c) Describe the laboratory preparation of chlorine gas (2 marks)
- d) Briefly explain the effect of fluorochlorocarbons in the atmosphere (2 marks)
- e) Briefly explain why the atomic radius of aluminium and gallium are equal (3 marks)
- f) Explain the oxidation state in  $\text{GaCl}_2$  (3 marks)
- h) Compare the bonding in boron chloride and boron dichloride (7 marks)

### QUESTION 3 (20 marks)

- a) Use an example to describe hydroboration (3 marks)
- b) Determine the name for the following polyhedral boranes ions; (6 marks)
- I).  $(\text{B}_6\text{H}_6)^{2-}$   
II)  $(\text{B}_8\text{H}_{12})^{2-}$
- c) Identify the closoborane that generates the polyhedral carborane,  $\text{B}_7\text{C}_2\text{H}_9$  (2 marks)
- d) Whereas boron can form a maximum of tetrahedral coordinated complexes like  $[\text{BF}_4]^-$ , Indium can coordinated up to 6 ligands in an octahedral shape like in  $[\text{InCl}_6]^-$ . Explain (4 marks)
- e) Whereas Magnesium burns with a bright white flame calcium glows with a brick red colour in a non-luminous flame of a Bunsen burner. Briefly discuss this occurrence (3 marks)
- f) Explain an advantage of VSEPR over the Lewis theory in description of Boron chloride molecule (2 marks)



#### Question 4 (20 marks)

a) Explain the following property changes

- i) Sulphur melts at 113°C while tellurium melts at 450°C. Explain (4 marks)
- ii) Group 2 elements form more complexes than group one (4 marks)
- iii) Beryllium nitride is a volatile compound while solid beryllium chloride has a melting point 399°C (4 marks)

b) Explain the structure of graphite and show why it conducts electricity (4 marks)

c) Compare the reactivity of magnesium and calcium to fluorine (4 marks)

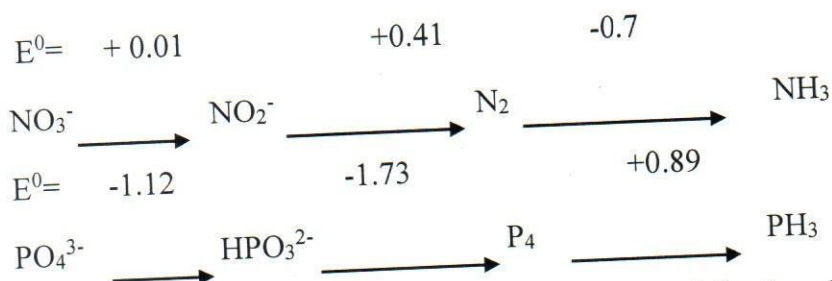
#### Question 5 (20 marks)

a) Discuss the trend in colour of halogens (3 marks)

b) i) What is an oxyacid (1 mark)

ii) Explain why the acid strength of HOCl is less than of HOClO<sub>3</sub> (4 marks)

c) Study the redox chemistry of nitrogen and phosphorus below and answer the questions that follow.



i) Explain why nitric (v) acid is an oxidizing agent while phosphoric acid is not (3 marks)

ii) Draw the structure of NH<sub>3</sub> using VBT (1 mark)

d) Explain why;

- i) Water boils at 100°C while hydrogen sulphide boils at -60°C at sea level (2 marks)
- ii) Group 14 has variable oxidation states (2 marks)

e) Why is carbon diamond not used as electrodes unlike carbon graphite which is its allotrope

4 marks)

PERIODIC TABLE

hydrogen 1 H 1.008 gas	helium 2 He 4.0026 gas																											
lithium 3 Li 6.941 logam	beryllium 4 Be 9.0122 logam											boron 5 B 10.811 padatan	karbon 6 C 12.011 padatan	nitrogen 7 N 14.007 gas	oksigen 8 O 15.999 gas	fluorin 9 F 18.998 gas	neon 10 Ne 20.180 gas											
natrium 11 Na 22.990 logam	magnesium 12 Mg 24.305 logam											aluminium 13 Al 26.982 logam	silikon 14 Si 28.086 padatan	fosfor 15 P 30.974 padatan	sulfur 16 S 32.065 padatan	klorin 17 Cl 35.453 gas	argon 18 Ar 39.948 gas											
kalium 19 K 39.098 logam	kalsium 20 Ca 40.078 logam											skandium 21 Sc 44.956 logam	titanium 22 Ti 47.867 logam	vanadium 23 V 50.942 logam	chromium 24 Cr 51.996 logam	mangan 25 Mn 54.938 logam	besi 26 Fe 55.845 logam	nikel 27 Co 58.933 logam	tembaga 28 Cu 63.546 logam	zinc 29 Zn 65.39 logam	galium 30 Ga 69.723 logam	germanium 31 Ge 72.631 padatan	arsenik 32 As 74.922 padatan	selebarium 33 Sb 121.76 padatan	telurium 34 Te 127.60 padatan	iodin 53 I 126.905 padatan	xenon 54 Xe 131.29 gas	
rubidium 37 Rb 85.468 logam	strontium 38 Sr 87.62 logam											yttrium 39 Y 88.906 logam	zirkonium 40 Zr 91.224 logam	niobium 41 Nb 92.906 logam	molibdenum 42 Mo 95.94 logam	technetium 43 Tc [98] logam	ruhidium 44 Ru 101.07 logam	rodium 45 Rh 101.07 logam	paladium 46 Pd 106.36 logam	perak 47 Ag 107.87 logam	mercuri 80 Hg 200.59 logam	timah 81 Tl 204.38 logam	timbal 82 Pb 207.2 logam	bismut 83 Bi 208.98 logam	polonium 84 Po [209] logam	astat 85 At [210] logam	radon 86 Rn [222] gas	
caesium 55 Cs 132.91 logam	barium 56 Ba 137.33 logam											lantanum 57 La 138.91 logam	lutetium 71 Lu 174.97 logam	hafnium 72 Hf 178.49 logam	tantalum 73 Ta 180.95 logam	wolfram 74 W 183.84 logam	reinerium 75 Re 186.21 logam	osmium 76 Os 190.23 logam	iridium 77 Ir 192.22 logam	platina 78 Pt 195.08 logam	emas 79 Au 196.97 logam	merkuri 80 Hg 200.59 logam	timah 81 Tl 204.38 logam	timbal 82 Pb 207.2 logam	bismut 83 Bi 208.98 logam	polonium 84 Po [209] logam	astat 85 At [210] logam	radon 86 Rn [222] gas
francium 87 Fr [223] logam	radium 88 Ra [226] logam											aktinid series 89-102 * * logam																

\* Lanthanide series

\*\* Actinide series