

THE PAPUA NEW GUINEA UNIVERSITY OF TECHNOLOGY

FIRST SEMESTER EXAMINATION

CH 212 – APPLIED INORGANIC CHEMISTRY

THURSDAY 18<sup>th</sup> JUNE 2020 12:50 PM

**TIME ALLOWED: 2 HOURS**

**INFORMATION FOR CANDIDATES:**

1. You will have 10 minutes to read the question paper. You **MUST NOT** begin writing in the answer book during this time.
2. **ANSWER ALL QUESTIONS.**
3. All answers **MUST** be written on the answer book provided
4. Calculators are permitted in the examination room. Lecture notes, notebooks plain papers and textbooks are **NOT** allowed.
5. Mobile phones are not allowed. **SWITCH OFF THE MOBILE PHONES.**
6. Show all workings and calculations in the answer book.
7. **DRAW** the **STRUCTURES** clear and visible.
8. **DO NOT** over write.
9. Write your name and number clearly on the front page. **DO IT NOW.**

**MARKING SCHEME:** Total 50 marks

1. (a)  $\text{Sn}^{2+}$  ions in solution are good reducing agents. Why?
- (b) Calculate the spin only magnetic moment [ $\mu(\text{s.o})$ ] for  $\text{Fe}^{3+}$  ion.
- (c) Draw the resonance structures for nitrite ion.
- (d) What is known as *Copauxis* method?
- (e) Is *d-d* transition expected for zinc(II) compounds? Why or why not?
- (f) What are interhalogen compounds? Give ONE example.
- (g) Draw the structures of the following:
  - (I) Diborane
  - (II)  $[\text{Na}(15\text{-crown-5})]^+$

(14 marks)

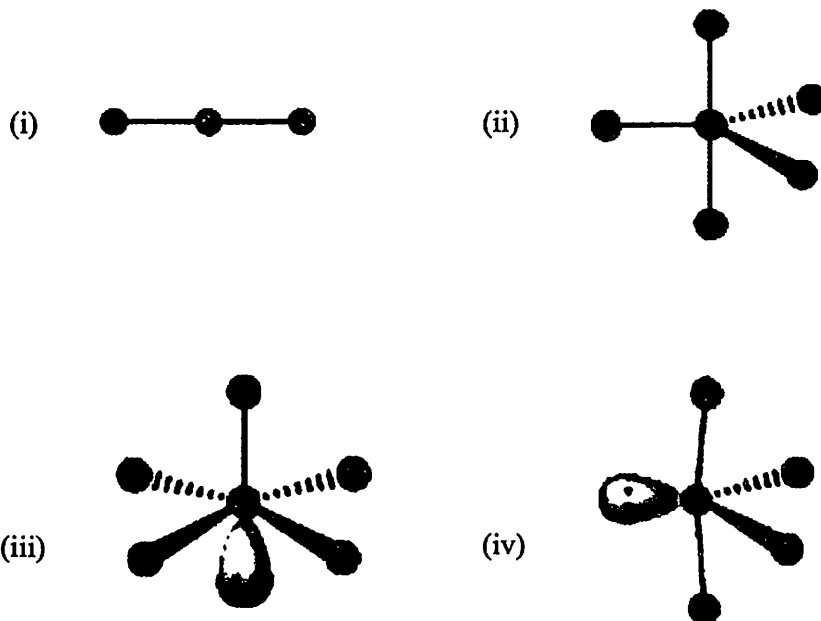
2. (a) Explain Down's process for the extraction of sodium.
- (b) Give any THREE dissimilarities between hydrogen and alkali metals.
- (c) Distinguish between pyro-silicates and sheet-silicates with suitable examples.
- (d) Use the Valence Bond Theory (VBT) and predict the bonding, hybridization and geometry of CHLORITE anion  $[\text{ClO}_2^-]$  with the help of an electron box diagram.
- (e) Zeolites are known natural ion exchangers. Taking Permutit water softener as an example, explain how it helps in water softening process?
- (f) What are the THREE types of ionic carbides? Give ONE example each.
- (g) Complete the following equations (may have more than one products) and balance them, if required:



- (h) Draw a simple diagram of graphene and explain its structure.

(24 marks)

3. (a) Write the geometry, steric number and bond angle/s for the following structures. [DO NOT REDRAW THE DIAGRAMS]



- (b) Explain the KROLL process for the extraction of Titanium metal.
- (c) Draw a neat Molecular Orbital (MO) diagram for oxygen molecule. Using this diagram, determine the bond order of the following:
- (i)  $O_2^+$
- (ii)  $O_2^{2-}$

(12 marks)

DATA SHEET

1. The periodic table of elements

# The Periodic Table

	<b>IA</b>											<b>IIA</b>											<b>IIIA</b>	<b>IVA</b>	<b>VA</b>	<b>VIA</b>	<b>VIIA</b>	<b>VIIIA</b>
<b>1</b>	H 1.01											He 4.00																
<b>2</b>	Li 6.94	Be 9.01											B 10.81	C 12.01	N 14.01	O 16.00	F 19.00	Ne 20.18										
<b>3</b>	Na 22.99	Mg 24.31											Al 26.98	Si 28.09	P 30.97	S 32.07	Cl 35.45	Ar 39.95										
<b>4</b>	K 39.10	Ca 40.08	Sc 44.96	Ti 47.88	V 50.94	Cr 52.00	Mn 54.94	Fe 55.85	Co 58.93	Ni 58.69	Cu 63.55	Zn 65.39	Ga 69.72	Ge 72.64	As 74.92	Se 78.96	Br 79.90	Kr 83.80										
<b>5</b>	Rb 85.47	Sr 87.62	Y 88.91	Zr 91.22	Nb 92.91	Mo 95.94	Tc 98.91	Ru 101.07	Rh 101.07	Pd 106.42	Ag 107.87	Cd 112.41	In 114.82	Sn 118.71	Sb 121.75	Te 127.60	I 126.90	Xe 131.29										
<b>6</b>	Cs 132.91	Ba 137.33	La 138.91	Hf 178.49	Ta 180.95	W 183.85	Re 186.21	Os 190.2	Ir 192.22	Pt 195.08	Au 196.97	Hg 200.59	Tl 204.38	Pb 207.2	Bi 208.98	Po (209)	At (210)	Rn (222)										
<b>7</b>	Fr (223)	Ra (226)	Ac (227)	Uuq (261)	Uup (262)	Uuh (263)	Uus (264)	Uuo (265)	Uue (266)																			

Ce 140.12	Pr 140.91	Nd 144.24	Pm (145)	Sm 150.4	Eu 151.96	Gd 157.25	Tb 158.93	Dy 162.50	Ho 164.93	Er 167.26	Tm 168.93	Yb 173.04	Lu 174.97
Th 232.04	Pa 231.04	U 238.03	Np (237)	Pu (244)	Am (243)	Cm (247)	Bk (247)	Cf (251)	Es (252)	Fm (257)	Md (258)	No (259)	Lr (260)

**Active Metals**  
 Li > K > Ba >  
 Sr > Ca > Na