

THE PAPUA NEW GUINEA UNIVERSITY OF TECHNOLOGY

FIRST SEMESTER EXAMINATIONS

CH461 ENVIRONMENTAL CHEMISTRY II

MONDAY 15<sup>TH</sup> JUNE, 2020 – 12:50 P.M.

**TIME ALLOWED: 2 HOURS**

**INFORMATION FOR CANDIDATES:**

1. You have ten minutes to read the paper. You must not begin writing in the answer book during this time.
2. **ANSWER ALL QUESTIONS.**
3. All answers must be written in the answer books provided.
4. Calculators are permitted in the examination room.
5. **NOTES, MOBILE PHONES AND TEXTBOOKS ARE NOT ALLOWED.**
6. Show all workings and calculations in the answer book.
7. **DRAW** any **FIGURES** clearly and visibly.
8. **DO NOT** over write.
9. Write your name and student number clearly in the front page. **DO IT NOW.**

**MARKING SCHEME**

[TOTAL = 60 MARKS]

1. (a) Define environmental chemistry and differentiate between it and environmental science. [2 marks]
- (b) Define water quality monitoring and name the THREE types of monitoring activities. [4 marks]
- (c) Define sampling and discuss its importance in the chemical analysis process. [2 marks]

(Total = 8 marks)

2. (a) Name the FOUR main types of water quality sampling programs. [4 marks]
- (b) List any THREE factors that may affect sampling. [3 marks]
- (c) Define the following:
- (i) analyte
  - (ii) composite sample
  - (iii) grab sample
  - (iv) isokinetic sampling

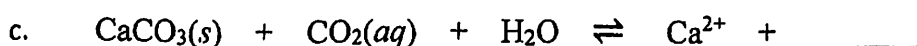
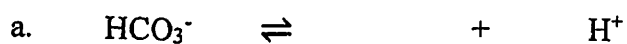
[4 marks]

(Total = 11 marks)

3. (a) When determining total acidity in a water sample, what is the sample titrated against, and to what end-point? [2 marks]
- (b) Name FOUR chemical processes happening in the aquatic environment that affects aquatic chemistry. [4 marks]

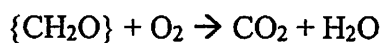
(Total = 6 marks)

4. The acid-base chemistry of natural waters is greatly influenced by certain chemical species. Study the reactions below and fill in the missing blanks.



[6 marks]

5. If organic matter of biological origin is represented by the formula  $\{\text{CH}_2\text{O}\}$  and the consumption of oxygen in water by the degradation of organic matter is expressed by the following biochemical reaction:



Calculate the weight of organic matter required to consume 8.3 mg of  $\text{O}_2$  in a litre of water in equilibrium with the atmosphere at  $25^\circ\text{C}$  using simple stoichiometric calculation (refer to page 3 for relevant data).

[8 marks]

6. When preparing soil samples for chemical analysis:
- (a) What is the maximum temperature for drying the soil and why?
  - (b) What is maximum sieve size for sizing the soil samples and why?
  - (c) What are the appropriate storage containers for storing prepared soil samples?

[6 marks]

7. (a) State TWO reasons for carrying out plant analysis.  
(b) State the TWO types of tests carried out on plant samples.  
(c) What are the TWO acids used for organic digestion of plant samples?

[6 marks]

8. (a) Name TWO main categories of atmospheric pollution.  
(b) Name THREE common atmospheric pollutants.  
(c) What TWO common mineral acids constitute "acid rain"?  
(d) Name one manual and one instrumental air quality monitoring techniques.

[2 marks]

[3 marks]

[2 marks]

[2 marks]

(Total = 9 marks)

# IUPAC Periodic Table of the Elements

Key:		atomic number	
Symbol	name	Symbol	name
standard atomic weight			
1	H hydrogen 1.008	2	He helium 4.0026
3	Li lithium 6.941	4	Be beryllium 9.0122
11	Na sodium 22.990	12	Mg magnesium 24.305
19	K potassium 39.098	20	Ca calcium 40.078(4)
37	Rb rubidium 85.468	38	Sr strontium 87.62
55	Cs caesium 132.91	56	Ba barium 137.33
87	Fr francium	88	Ra radium
21	Sc scandium 44.956	22	Ti titanium 47.867
39	Y yttrium 88.906	40	Zr zirconium 91.224(2)
57	La lanthanum 138.905	72	Hf hafnium 178.49(2)
71	Lu lutetium 174.967	104	Rf rutherfordium
23	V vanadium 50.942	24	Cr chromium 51.996
41	Nb niobium 92.906	42	Mo molybdenum 95.96
73	Ta tantalum 180.95	74	W tungsten 183.84
105	Db dubnium	106	Sg seaborgium
25	Mn manganese 54.938	26	Fe iron 55.845(2)
43	Tc technetium	44	Ru ruthenium 101.07(2)
75	Re rhenium 186.21	76	Os osmium 190.23(2)
107	Bh bohrium	108	Hs hassium
27	Co cobalt 58.933	28	Ni nickel 58.693
45	Rh rhodium 102.91	46	Pd palladium 106.42
77	Ir iridium 192.22	78	Pt platinum 195.08
109	Mt meitnerium	110	Ds darmstadtium
29	Cu copper 63.546(3)	30	Zn zinc 65.38(2)
47	Ag silver 107.87	48	Cd cadmium 112.41
79	Au gold 196.97	80	Hg mercury 200.59
111	Rg roentgenium	112	Cn copernicium
31	Ga gallium 69.723	32	Ge germanium 72.630(8)
49	In indium 114.82	50	Sn tin 118.71
81	Tl thallium 204.38	82	Pb lead 207.2
113	Nh nihonium	114	Fl flerovium
15	N nitrogen 14.007	16	O oxygen 15.999
33	As arsenic 74.922	34	Se selenium 78.971(8)
51	Sb antimony 121.76	52	Te tellurium 127.60(3)
83	Bi bismuth 208.98	84	Po polonium
115	Mc moscovium	116	Lv livermorium
7	N nitrogen 14.007	8	O oxygen 15.999
15	P phosphorus 30.974	16	S sulfur 32.06(2)
33	As arsenic 74.922	34	Se selenium 78.971(8)
51	Sb antimony 121.76	52	Te tellurium 127.60(3)
83	Bi bismuth 208.98	84	Po polonium
115	Mc moscovium	116	Lv livermorium
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57	La lanthanum 138.905	58	Ce cerium 140.12	59	Pr praseodymium 140.908	60	Nd neodymium 144.24	61	Pm promethium 144.913	62	Sm samarium 150.36	63	Eu europium 151.964	64	Gd gadolinium 157.25	65	Tb terbium 158.925	66	Dy dysprosium 162.50	67	Ho holmium 164.930	68	Er erbium 167.26	69	Tm thulium 168.934	70	Yb ytterbium 173.054	71	Lu lutetium 174.967
89	Ac actinium	90	Th thorium 232.0377	91	Pa protactinium 231.03688	92	U uranium 238.02891	93	Np neptunium 237.04817	94	Pu plutonium 244.0642	95	Am americium 243.06138	96	Cm curium 247.070353	97	Bk berkelium 247.070353	98	Cf californium 251.0832	99	Es einsteinium 252.0832	100	Fm fermium 257.10	101	Mn mendelevium 258.10	102	No nobelium 259.10	103	Lr lawrencium 260.10



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For notes and updates to this table, see [www.iupac.org](http://www.iupac.org). This version is dated 28 November 2016.  
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