THE PAPUA NEW GUINEA UNIVERSITY OF TECHNOLOGY

SECOND SEMESTER EXAMINATION

CH224 –ANALYTICAL CHEMISTRY

WEDNESDAY 27th OCTOBER 2021 – 8:20 AM

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)   The following titration was done by a student using 0.098 M NaOH solution.

Vol. of citric acid (mL)	Initial reading (NaOH, mL)	Final reading (NaOH, mL)
25	0.5	74.6
25	1.0	75.1

      i.   Calculate the citric acid concentration in moles/L with a suitable chemical equilibrium.
      ii.   Calculate the weight (g) of citric acid in 1500 mL of the sample provided.

[4 marks]

(b)   What are the desirable properties for the following?
      i.   Primary standard.
      ii.   Secondary standard.

[4 marks]

(c)   What weight (in grams) of H_2SO_4 would be needed to make 750.0 mL of 2.00 M solution?

[2 marks]

(Total = 10 marks)

2. (a)   What would be the volume of 0.2 M $AgNO_3$ solution that contains 8.5 g of solid $AgNO_3$? Express the volume in mL.

[2 marks]

(b)   Sea water contains roughly 28.0 g of NaCl per liter. What is the molarity of sodium chloride in sea water?

[2 marks]

(c)   Commercial bleach solution contains 5.25% (by mass) of NaClO in water. It has a density of 1.08 g/mL. Calculate the molarity of this solution. (Hints: assume you have 1.00 L of solution; molar mass of NaClO = 74.4 g/mol)

[2 marks]

(d)   Determine the molarity of the following:
      i.   4.67 moles of Li_2SO_3 dissolved in 2.04 liters of solution.
      ii.   0.897grams of $(NH_4)_2CO_3$ in 250 mL solution.
      iii.   0.0348 grams of $PbCl_2$ in 45.0 mL of solution.
      iv.   0.629 moles of Al_2O_3 in 1.500 liters of solution

[4 marks]

(Total = 10 marks)

3. (a) Describe the applications of titrimetric analysis in pharmaceutical industry? Give their advantages and disadvantages.

[4 marks]

(b) How do you find the end point in Volhard precipitation titrations?

[3 marks]

(c) How are reactions classified in titrimetric analysis?

[3 marks]

(Total = 10 marks)

4. (a) How many significant figures are there in the following numbers?

(i) 10.000
(ii) 0.000002
(iii) 0.0402
(iv) 0.04020

[2 marks]

(b) (i) What are the types of analytical balances?
(ii) What are the precautions to take while using analytical balance?

[4 marks]

(c) What equipment is involved for drying precipitates in gravimetric analysis?

[2 marks]

(d) Explain the role and types of filtering equipment used in gravimetric analysis.

[2 marks]

(Total = 10 marks)

5. (a) Define the following terms with TWO examples:
(i) Random error
(ii) Systematic error

[6 marks]

(b) Explain the sources of systematic errors in detail.

[4 marks]

(Total = 10 marks)

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Periodic Table of the Elements

1 IA 1A	2 IIA 2A	3 IIIB 3B	4 IVB 4B	5 VB 5B	6 VIB 6B	7 VIIB 7B	8 VIII 8	9 VIII 8	10 VIII 8	11 IB 1B	12 IIB 2B	13 IIIA 3A	14 IVA 4A	15 VA 5A	16 VIA 6A	17 VIIA 7A	18 VIIIA 8A
1 **H** Hydrogen 1.008																	2 **He** Helium 4.003
3 **Li** Lithium 6.941	4 **Be** Beryllium 9.012											5 **B** Boron 10.811	6 **C** Carbon 12.011	7 **N** Nitrogen 14.007	8 **O** Oxygen 15.999	9 **F** Fluorine 18.998	10 **Ne** Neon 20.180
11 **Na** Sodium 22.990	12 **Mg** Magnesium 24.305											13 **Al** Aluminum 26.982	14 **Si** Silicon 28.086	15 **P** Phosphorus 30.974	16 **S** Sulfur 32.066	17 **Cl** Chlorine 35.453	18 **Ar** Argon 39.948
19 **K** Potassium 39.098	20 **Ca** Calcium 40.078	21 **Sc** Scandium 44.956	22 **Ti** Titanium 47.88	23 **V** Vanadium 50.942	24 **Cr** Chromium 51.996	25 **Mn** Manganese 54.938	26 **Fe** Iron 55.933	27 **Co** Cobalt 58.933	28 **Ni** Nickel 58.693	29 **Cu** Copper 63.546	30 **Zn** Zinc 65.39	31 **Ga** Gallium 69.732	32 **Ge** Germanium 72.61	33 **As** Arsenic 74.922	34 **Se** Selenium 78.09	35 **Br** Bromine 79.904	36 **Kr** Krypton 84.80
37 **Rb** Rubidium 84.468	38 **Sr** Strontium 87.62	39 **Y** Yttrium 88.906	40 **Zr** Zirconium 91.224	41 **Nb** Niobium 92.906	42 **Mo** Molybdenum 95.94	43 **Tc** Technetium 98.907	44 **Ru** Ruthenium 101.07	45 **Rh** Rhodium 102.906	46 **Pd** Palladium 106.42	47 **Ag** Silver 107.868	48 **Cd** Cadmium 112.411	49 **In** Indium 114.818	50 **Sn** Tin 118.71	51 **Sb** Antimony 121.760	52 **Te** Tellurium 127.6	53 **I** Iodine 126.904	54 **Xe** Xenon 131.29
55 **Cs** Cesium 132.905	56 **Ba** Barium 137.327	57-71	72 **Hf** Hafnium 178.49	73 **Ta** Tantalum 180.948	74 **W** Tungsten 183.85	75 **Re** Rhenium 186.207	76 **Os** Osmium 190.23	77 **Ir** Iridium 192.22	78 **Pt** Platinum 195.08	79 **Au** Gold 196.967	80 **Hg** Mercury 200.59	81 **Tl** Thallium 204.383	82 **Pb** Lead 207.2	83 **Bi** Bismuth 208.980	84 **Po** Polonium [208.982]	85 **At** Astatine 209.987	86 **Rn** Radon 222.018
87 **Fr** Francium 223.020	88 **Ra** Radium 226.025	89-103	104 **Rf** Rutherfordium [261]	105 **Db** Dubnium [262]	106 **Sg** Seaborgium [266]	107 **Bh** Bohrium [264]	108 **Hs** Hassium [269]	109 **Mt** Meitnerium [268]	110 **Ds** Darmstadtium [269]	111 **Rg** Roentgenium [272]	112 **Cn** Copernicium [277]	113 **Uut** Ununtrium unknown	114 **Fl** Flerovium [289]	115 **Uup** Ununpentium unknown	116 **Lv** Livermorium [298]	117 **Uus** Ununseptium unknown	118 **Uuo** Ununoctium unknown

Lanthanide Series

57 **La** Lanthanum 138.906	58 **Ce** Cerium 140.115	59 **Pr** Praseodymium 140.908	60 **Nd** Neodymium 144.24	61 **Pm** Promethium 144.913	62 **Sm** Samarium 150.36	63 **Eu** Europium 151.966	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 173.04	71 **Lu** Lutetium 174.967

Actinide Series

89 **Ac** Actinium 227.028	90 **Th** Thorium 232.038	91 **Pa** Protactinium 231.036	92 **U** Uranium 238.029	93 **Np** Neptunium 237.048	94 **Pu** Plutonium 244.064	95 **Am** Americium 243.061	96 **Cm** Curium 247.070	97 **Bk** Berkelium 247.070	98 **Cf** Californium 251.080	99 **Es** Einsteinium [254]	100 **Fm** Fermium 257.095	101 **Md** Mendelevium 258.1	102 **No** Nobelium 259.101	103 **Lr** Lawrencium [262]