THE PAPUA NEW GUINEA UNIVERSITY OF TECHNOLOGY

SECOND SEMESTER EXAMINATION

CH224 -ANALYTICAL CHEMISTRY

MONDAY 24th OCTOBER 2022 – 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** overwrite

9. Write your name and number clearly on the front page. **DO IT NOW**

MARKING SCHEME: Total 50 marks

1. (a)   Calculate the volume of 18.0 M H_2SO_4 needed to contain
           2.45 g of H_2SO_4. Express the volume in mL.

                                                              [2 marks]

    (b)   How many grams of $KMnO_4$ are required to prepare 1.5 L
           of a solution of 1.5 M $KMnO_4$?

                                                              [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. (Hint: assume you have 1.00 L of
           solution)

                                                              [2 marks]

    (d)   What mass of pure sulfuric acid must be made up to 250 cm^3
           of aqueous solution so that the resulting solution has the same
           concentration as that of potassium hydroxide solution containing
           2.00 g in 100 cm^3?

                                                              [4 marks]

                            (Total = 10 marks)

2. (a)   What is the role of titrimetric analysis in pharmaceutical
           industry? Give their advantages and limitations.

                                                              [4 marks]

    (b)   How do you distinguish between mass and weight? Give ONE
           example each.

                                                              [3 marks]

    (c)   Describe the percent concentration and their types with suitable
           examples.

                                                              [3 marks]

                            (Total = 10 marks)

3. (a)   Distinguish the terms Ligand and Chelates: write their types with
           suitable examples.

                                                              [2 marks]

    (b)   (i) Describe the properties of EDTA.
           (ii) What are the precautions while using analytical balance?

                                                              [4 marks]

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

                                                              [2 marks]

(d)   Explain how absolute error and relative error differ
        from each other.   [2 marks]

                                        (Total = 10 marks)

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

            (i) 57   (ii) 82.9
            (iii) 10.000   (iv) 0.000002
            (v) 0.0402   (vi) 0.04020
                                                            [3 marks]

5. (a)   Define the following terms with TWO examples each:
            (i)   Random error.
            (ii)   Systematic error.
                                                            [4 marks]

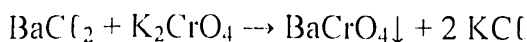   (b)   Distinguish the terms density and specific gravity with
            one example each.
                                                            [3 marks]
                                        (Total = 10 marks)

6. (a)   Consider the reaction:
            $BaCl_2 + K_2CrO_4 \rightarrow BaCrO_4\downarrow + 2 KCl$
                    (i) How many grams of barium chromate can be obtained
                        from 75.0 mL of 0.150 M $BaCl_2$ solution?

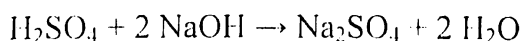   (ii) What volume of 0.500 M K_2CrO_4 solution is required
                        to react with the 75.0 mL of 0.150 M $BaCl_2$ solution?
                                                            [4 marks]

    (b)   How much water must be added to 625 mL of solution
            containing 27.2 g H_2SO_4 to make the final solution of 0.325 M?

                                                            [2 marks]
    (c)   Follow the reaction:
            $H_2SO_4 + 2 NaOH \rightarrow Na_2SO_4 + 2 H_2O$
                    (i) 15.2 mL of 0.425 M NaOH solution is required to
                        neutralize 25.0 mL of H_2SO_4. Determine the
                        concentration of the sulphuric acid solution.

                    (ii) What volume of 0.425 M NaOH is required to neutralize
                        12.5 mL of 0.275 M?
                                                            [4 marks]

                                        (Total = 10 marks)

                    -------------END----------

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	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																	2 He
3 Li	4 Be											5 B	6 C	7 N	8 O	9 F	10 Ne
11 Na	12 Mg											13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr
37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe
55 Cs	56 Ba	57-71	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn
87 Fr	88 Ra	89-103	104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt	110 Ds	111 Rg	112 Cn	113 Uut	114 Fl	115 Uup	116 Lv	117 Uus	118 Uuo

Lanthanide Series

57 La	58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb	71 Lu
Lanthanum 138.9	Cerium 140.115	Praseodymium 140.909	Neodymium 144.24	Promethium 144.913	Samarium 150.36	Europium 151.965	Gadolinium 157.25	Terbium 158.925	Dysprosium 162.50	Holmium 164.9	Erbium 167.25	Thulium 168.934	Ytterbium 173.04	Lutetium 174.967

Actinide Series

89 Ac	90 Th	91 Pa	92 U	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lr
Actinium 227.028	Thorium 232.038	Protactinium 231.036	Uranium 238.029	Neptunium 237.48	Plutonium 244.064	Americium 243.061	Curium 247.070	Berkelium 247.070	Californium 251.080	Einsteinium [254]	Fermium 257.95	Mendelevium 258.1	Nobelium 259.101	Lawrencium [262]