

THE PAPUA NEW GUINEA UNIVERSITY OF TECHNOLOGY

SECOND SEMESTER EXAMINATION

CH 225 – ANALYTICAL CHEMISTRY

THURSDAY 29th OCTOBER 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) Define the following terms with suitable examples:
(i) Monoprotic and polyprotic acids.
(ii) Monobasic and poly basic base.
(iii) Solubility product. [6 marks]
- (b) Explain the role and types of filtering equipment used in gravimetric analysis. [2 marks]
- (c) Explain the importance of a desiccator in chemical analysis and mention its types. [2 marks]
- (Total = 10 marks)
2. (a) Describe the types of percent concentration in solutions. [2 marks]
- (b) How do you detect the systematic errors? [2 marks]
- (c) Define the following terms with ONE example each.
(i) Mean and median.
(ii) Absolute error and relative error.
(iii) Precision and accuracy. [6 marks]
- (Total = 10 marks)
3. (a) A 750 mL solution of 2.0 M H_2SO_4 was prepared from the commercial reagent (specific gravity 1.84) using 66.5% H_2SO_4 . Calculate the volume of the acid required to prepare the solution. [2 marks]
- (b) 11 g of glucose ($\text{C}_6\text{H}_{12}\text{O}_6$) was taken to prepare a 100 mL solution. Then, 20mL of this solution was taken and diluted to 500 mL. How many grams of glucose are present in 100 mL of the FINAL solution? [4 marks]
- (c) What is the volume of 0.2 M AgNO_3 solution containing 8.5 g of solid AgNO_3 ? Express the volume in mL. [2 marks]
- (d) How many grams of $\text{K}_2\text{Cr}_2\text{O}_7$ are required to prepare 750 mL solution with a concentration of 0.25M. [2 marks]
- (Total = 10 marks)

4. (a) How do you find the end point in Volhard precipitation titrations. [3 marks]
- (b) Describe the applications of titrimetric analysis in pharmaceutical industry. Give their advantages and limitations. [4 marks]
- (c) How are reactions classified in titrimetric analysis? [3 marks]
- (Total = 10 marks)

5. (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 suitable chemical equilibrium.
- (ii) Calculate the weight (g) of citric acid in 2000 mL of the sample provided. [4 marks]
- (b) Explain complexometric reactions and titrations with ONE example each. [4 marks]
- (c) How many significant figures are there in the following numbers?
- (i) 10.000
- (ii) 0.000002
- (iii) 0.0402
- (iv) 0.04020

[2 marks]

(Total = 10 marks)

Periodic Table of the Elements

1 IA 11A	2 IIA 2A	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 32.065	17 Cl Chlorine 35.453	18 Ar Argon 39.948	35 Br Bromine 79.904	36 Kr Krypton 84.80
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 55.833	27 Co Cobalt 58.933	28 Ni Nickel 58.693
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
55 Cs Cesium 132.905	56 Ba Barium 137.327	57-71 Lanthanide Series	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
87 Fr Francium 223.020	88 Ra Radium 226.025	89-103 Actinide Series	104 Rf Rutherfordium [261]	105 Db Dubnium [262]	106 Sg Seaborgium [266]	107 Bh Bohrium [264]	108 Hs Hassium [265]	109 Mt Meitnerium [268]	110 Ds Darmstadtium [269]
			109 Tl Thallium 204.383	110 Pb Lead 207.2	111 Au Gold 196.967	112 Hg Mercury 200.59	113 Tl Thallium 204.383	114 Pb Lead 207.2	115 Bi Bismuth 208.980
			116 Po Polonium [209]	117 At Astatine [210]	118 Rn Radon [222]	119 Fr Francium [223]	120 Ra Radium [226]	121 Ac Actinium [227]	122 Th Thorium [232]
			123 La Lanthanum 138.905	124 Ce Cerium 140.115	125 Pr Praseodymium 140.908	126 Nd Neodymium 144.24	127 Pm Promethium [144.913]	128 Sm Samarium 150.36	129 Eu Europium 151.965
			131 Ga Gallium 69.723	132 Ge Germanium 72.61	133 As Arsenic 74.922	134 Se Selenium 78.96	135 Br Bromine 79.904	136 Kr Krypton 83.80	137 Rb Rubidium 85.468
			138 Ba Barium 137.327	139 La Lanthanum 138.905	140 Ce Cerium 140.115	141 Pr Praseodymium 140.908	142 Nd Neodymium 144.24	143 Pm Promethium [144.913]	144 Sm Samarium 150.36
			146 Sn Tin 118.71	147 Sb Antimony 121.760	148 Te Tellurium 127.6	149 I Iodine 126.905	150 Xe Xenon 131.29	151 Ba Barium 137.327	152 La Lanthanum 138.905
			154 Eu Europium 151.965	155 Gd Gadolinium 157.25	156 Tb Terbium 158.925	157 Dy Dysprosium 162.50	158 Ho Holmium 164.930	159 Er Erbium 167.26	160 Tm Thulium 168.934
			162 Sm Samarium 150.36	163 Eu Europium 151.965	164 Gd Gadolinium 157.25	165 Tb Terbium 158.925	166 Dy Dysprosium 162.50	167 Ho Holmium 164.930	168 Er Erbium 167.26
			168 Er Erbium 167.26	169 Tm Thulium 168.934	170 Yb Ytterbium 173.04	171 Lu Lutetium 174.967	172 Hf Hafnium 178.49	173 Ta Tantalum 180.948	174 W Tungsten 183.85
			176 Os Osmium 190.23	177 Ir Iridium 192.22	178 Pt Platinum 195.08	179 Au Gold 196.967	180 Hg Mercury 200.59	181 Tl Thallium 204.383	182 Pb Lead 207.2
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