

OKOT BRIAN INNOCENT

MARKING GUIDE

Candidate's Name ..... *Tr's copy* .....

Signature: *OKB* .....

Random No.	Personal No.

P525/1  
**CHEMISTRY**  
Paper 1  
July/August.  
2024  
2  $\frac{3}{4}$  hours



**TORORO ARCHDIOCESE EXAMINATIONS BOARD**

Uganda Advanced Certificate of Education

**MOCK EXAMINATIONS 2024**

Chemistry

**Paper 1**

2 hours 45 minutes.

**INSTRUCTIONS TO CANDIDATES.**

- Answer **All** questions in section A and only **six** questions in section B
- The periodic Table, with relative atomic masses is supplied.
- All questions must be answered in the spaces provided.
- Mathematical table (3-figure table) and non-programmable scientific electronic calculators may be used.
- Where necessary use the following;
- Molar gas constant  $R = 8.314 \text{ J K}^{-1} \text{ mol}^{-1}$
- Molar volume of gas at s.t.p is  $22.4 \text{ dm}^3$ .

**For Examiner's Use Only.**

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	Total

**Turn Over**

## SECTION A: (46 MARKS)

*Answer all questions in this section.*

1. Write equation of reaction between manganese (II) chloride solution and:

(i) Ammonia solution.

(1 ½ marks)

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(ii) Sodium bismuthate in the presence of concentrated nitric acid. (1 ½ marks)

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(iii) Sodium peroxodisulphate solution.

(1 ½ marks)

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2. (a) What is solvent extraction?

(1 mark)

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(b) A solid Q is a quarter times as soluble in solvent Y as in solvent X. Q has the same relative molecular mass in both solvents. Calculate the mass of Q that would be extracted from a solution of 10 g of Q in 30 cm<sup>3</sup> of Y by extracting it with;

(i) 30 cm<sup>3</sup> of X.

(2 marks)

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(ii) Two successive portions of 15 cm<sup>2</sup>

(4 marks)

(c) Comment on your results in (b) (i) and (ii).

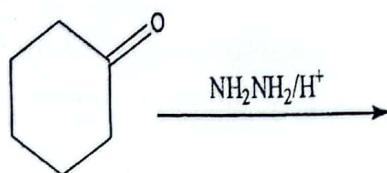
(1 mark)

3. Complete each of the following reactions and in each case outline a mechanism for the reaction.

(a)



(b)



(3 marks)

4. (a) What is meant by the term salt hydrolysis?

(1 mark)

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b) Ammonium chloride undergoes hydrolysis when dissolved in water.

(i) Write an expression for the hydrolysis constant,  $K_h$  for ammonium chloride.

(1 mark)

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(ii) Calculate the PH of a 0.2 M solution of ammonium chloride ( $K_h$  for ammonium chloride =  $5.6 \times 10^{-10}$  mol dm<sup>-3</sup>). (2 marks)

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(iii) Determine the degree of hydrolysis of 0.1 M solution of ammonium chloride.  
(1 mark)

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5. (a) Explain why phosphorus forms  $\text{PCl}_5$  and  $\text{PCl}_3$  but nitrogen only forms  $\text{NCl}_3$  despite of the two being in the same group.

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b) Draw the molecular structures of the following species and name the shapes of the species.  
(4  $\frac{1}{2}$  marks)

Species	Structure	Shape
$\text{CH}_3^+$		
$\text{ClO}_2^-$		
$\text{SO}_3^{2-}$		

6. Write equation for the reaction between.

(a) Acidified potassium manganate (VII) solution and sodium sulphite. (1 ½ marks)

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(b) 2,4 – dinitrophenyl hydrazine and phenylethanone in acidic medium. (1 ½ marks)

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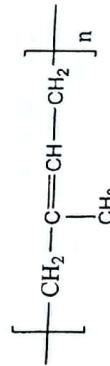
(c) Aqueous copper (II) sulphate and potassium iodide solution. (1 ½ marks)

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7. (a) A synthetic polymer has the structure.



Name;

(i) The monomer used to make the polymer. (1 mark)

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.....

(ii) The process leading to the formation of a polymer. (1 mark)

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.....

b) The osmotic pressure of an aqueous solution of 6.25 % polymer at 23°C is 57.3 Nm<sup>-2</sup>. Calculate the value of n.

Calculate the value of n.

8 (a) State Graham's law  
(1 mark)

b) Two pieces of cotton wool, one soaked in an amine, **R** and the other in concentrated hydrochloric acid, were placed at the opposite ends of 0.5-meter-long glass tube. After sometime, a white ring was observed at 0.26 meters from the end containing the amine. Calculate the molecular mass of the amine **R**. (3 marks)

amine. Calculate the molecular mass of the amine B.

9. State both the oxidation state and coordination number of each of the following complexes.

(a)



(i) Oxidation state:

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(ii) Coordination number:

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(b)



(i) Oxidation state:

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(ii) Coordination:

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## SECTION E. (10 MARKS)

*Answer six questions from this section*

*Any additional question answered will not be marked.*

10. (a) What is meant by the term **buffer solution**? (2 marks)

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- b) Calculate the mass of sodium propanoate that should be added to 1 dm<sup>3</sup> of 0.1 M propanoic acid in order to give a solution whose pH is 4.5. State any assumptions made. (*The dissociation constant for propanoic acid,  $K_a = 1.4 \times 10^{-5}$  mol dm<sup>-3</sup>.*)

(5 marks)

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- c) Few drops of dilute hydrochloric acid were added to the solution in (b).

- (i) State what happened to the pH of the solution. (½ marks)

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- (ii) Give a reason for your answer in (c) (i). (1 ½ marks)

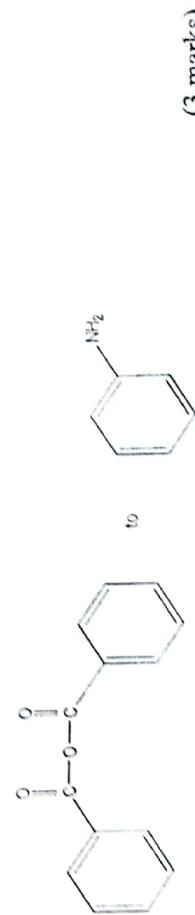
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11. Using equations with suitable conditions, show how the following conversions can be carried out.

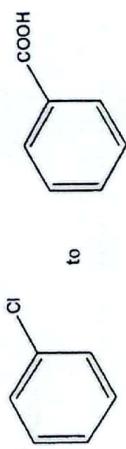
(a)



(b)



(c)



(2 marks)

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12. The elements F<sub>2</sub>, Cl<sub>2</sub>, Br<sub>2</sub> and I<sub>2</sub> belong to group (VII) in the Periodic Table.

- (a) Give a reason why;  
(i) Fluorine is the strongest oxidizing agent in the group.

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Fluorine only exhibits a negative oxidation state of -1 while the rest of the halogens exhibit higher positive oxidation state.

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(b) Compare the reactions of fluorine and chlorine with:

(i) Methane.

(3 marks)

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(ii) Sodium thiosulphate.

(3 ½ marks)

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13. (a) Briefly describe the physical principles involved in the separation of two immiscible liquids.

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- b) Aniline and water are immiscible liquids. The saturated vapour pressures of pure

aniline and pure water at various temperatures are given in the table below.

Temperature/ $^{\circ}\text{C}$	85	90	95	100	105
Vapour pressure of aniline/kPa	3.0	3.9	4.9	6.1	7.3
Vapour pressure of water/kPa	57.9	70.1	84.5	101.3	120

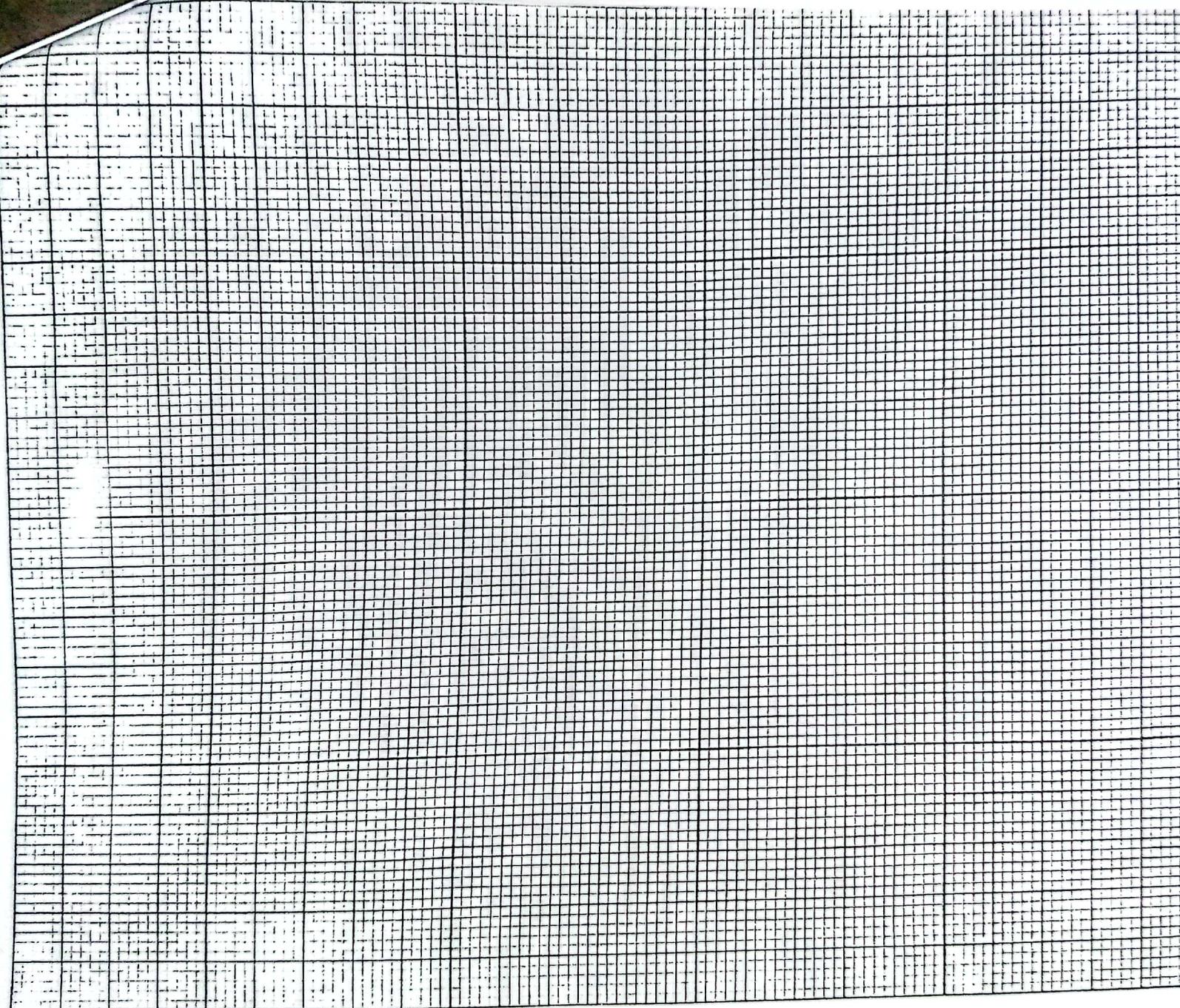
- (i) Plot on the same axes graphs of aniline and pure water and the mixture against temperature.

- (ii) Using the graphs, determine and state the temperature at which the mixture of aniline and water boils. [atmospheric pressure = 101.325 kPa].

(1 mark)

- (iii) Calculate the percentage by mass of aniline if the distillate mixture was steam distilled.

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14. An organic compound Y contains 22.8 % nitrogen, 28 % oxygen, 8.5 % hydrogen and the rest carbon.

(a) Calculate the empirical formula of Y.

(2 ½ marks)

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0.5 g of Y was dissolved in 80 g of water forming a solution that freezes at -0.197°C.

Calculate the molecular formula of Y. (*Cryoscopic constant for water = 1.86°C mol<sup>l</sup> per 1000 g of water*)

(3 ½ marks)

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(b) When Y was refluxed with aqueous ferric ammonium hydroxide, ethanoic acid and ammonia were produced.

- (i) Identify Y. (1 mark)

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- (ii) Write equations to show how Y is obtained from a carbonyl compound. (2 marks)

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15. The standard reduction potentials for some half-cell reactions are given below:



(a) Write the;

- (i) Cell convention for the cell formed when the two half cells are combined.

(1 mark)

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- (ii) Overall cell reaction for the cell in (a) (i). (1 1/2 marks)

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(b) Calculate the emf of the cell. (1  $\frac{1}{2}$  marks)

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(c) State whether the cell reaction is feasible or not. Give a reason for your answer.

(1 mark)

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(1 mark)

(d) Define the term electrolysis.

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(e) During the extraction of aluminium, a current of 0.2A was passed for 2 hours through a solution of aluminium sulphate.

(i) Write an equation of reaction that took place at the cathode. (1  $\frac{1}{2}$  marks)

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(ii) Calculate the mass of aluminium discharged. ( $1F = 96500C$ , molar mass of aluminium = 27 g mol $^{-1}$ ). (1  $\frac{1}{2}$  marks)

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16. (a) 30 cm<sup>3</sup> of a hydrocarbon **Z** were mixed with 150 cm<sup>3</sup> of excess oxygen and the mixture ignited, it burnt completely with a sooty flame. The volume of the residual gases after cooling to room temperature was 120 cm<sup>3</sup>. On treatment with concentrated potassium hydroxide solution, the volume of a gas that finally remained was 30 cm<sup>3</sup>.

- (i) Write the general equation for the reaction between **Z** and oxygen. ....  
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(ii) Calculate the molecular formula of **Z**.  
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- b) When **Z** was treated with ammoniacal silver nitrate solution, a white precipitate was formed.

(i) Identify **Z**.  
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Write equation for the reaction that lead to the formation of a white precipitate.  
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- c) **Z** was reacted with water in the presence of dilute sulphuric acid and mercury (II) sulphate solution at 60°C. Write equation for the reaction and indicate its plausible mechanism.  
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17. (a) Write the name and formula of the metallo-ore of zinc.

(1 mark)

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b) Briefly explain how pure zinc can be obtained from the ore.

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c) 4.0 g of zinc ore was dissolved in excess concentrated ammonia solution. The resultant solution was shaken with carbon tetrachloride and left to stand. 25.0 cm<sup>3</sup> of the organic layer required 12.5 cm<sup>3</sup> of 0.025 M hydrochloric acid for complete neutralization. Calculate the percentage of zinc in the ore. [The partition coefficient of ammonia between carbon tetrachloride and water = 4 marks]

0.04].

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## PERIODIC TABLE

1	2											3	4	5	6	7	8																																				
1.0 H 1																																																					
6.9 Li 3	9.0 Be 4											10.8 B 5	12.0 C 6	14.0 N 7	16.0 O 8	19.0 F 9	20.2 Ne 10																																				
23.0 Na 11	24.3 Mg 12											27.0 Al 13	28.1 Si 14	31.0 P 15	32.1 S 16	35.4 Cl 17	40.0 Ar 18																																				
39.1 K 19	40.1 Ca 20	45.0 Sc 21	47.9 Ti 22	50.9 V 23	52.0 Cr 24	54.9 Mn 25	55.8 Fe 26	58.9 Co 27	58.7 Ni 28	63.5 Cu 29	65.7 Zn 30	69.7 Ga 31	72.6 Ge 32	74.9 As 33	79.0 Se 34	79.9 Br 35	83.8 Kr 36																																				
85.5 Rb 37	87.6 Sr 38	88.9 Y 39	91.2 Zr 40	92.9 Nb 41	95.9 Mo 42	98.9 Tc 43	101 Ru 44	103 Rh 45	106 Pd 46	108 Ag 47	112 Cd 48	115 In 49	119 Sn 50	122 Sb 51	128 Te 52	127 I 53	131 Xe 54																																				
133 Cs 55	137 Ba 56	139 La 57	178 Hf 72	181 Ta 73	184 W 74	186 Re 75	190 Os 76	192 Ir 77	195 Pt 78	197 Au 79	201 Hg 80	204 Tl 81	207 Pb 82	209 Bi 83	209 Po 84	210 At 85	222 Ra 86																																				
223 Fr 87	226 Ra 88	227 Ac 89																																																			
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td>139 La 57</td><td>140 Ce 58</td><td>141 Pr 59</td><td>144 Nd 60</td><td>147 Pm 61</td><td>150 Sm 62</td><td>152 Eu 63</td><td>157 Gd 64</td><td>159 Tb 65</td><td>162 Dy 66</td><td>165 Ho 67</td><td>167 Er 68</td><td>169 Tm 69</td><td>173 Yb 70</td><td>175 Lu 71</td><td></td><td></td><td></td></tr> <tr> <td>227 Ac 89</td><td>232 Th 90</td><td>231 Pa 91</td><td>238 U 92</td><td>237 Np 93</td><td>244 Pu 94</td><td>243 Am 95</td><td>247 Cm 96</td><td>247 Bk 97</td><td>251 Cf 98</td><td>254 Es 99</td><td>257 Fm 100</td><td>256 Md 101</td><td>254 No 102</td><td>260 Lw 103</td><td></td><td></td><td></td></tr> </table>																		139 La 57	140 Ce 58	141 Pr 59	144 Nd 60	147 Pm 61	150 Sm 62	152 Eu 63	157 Gd 64	159 Tb 65	162 Dy 66	165 Ho 67	167 Er 68	169 Tm 69	173 Yb 70	175 Lu 71				227 Ac 89	232 Th 90	231 Pa 91	238 U 92	237 Np 93	244 Pu 94	243 Am 95	247 Cm 96	247 Bk 97	251 Cf 98	254 Es 99	257 Fm 100	256 Md 101	254 No 102	260 Lw 103			
139 La 57	140 Ce 58	141 Pr 59	144 Nd 60	147 Pm 61	150 Sm 62	152 Eu 63	157 Gd 64	159 Tb 65	162 Dy 66	165 Ho 67	167 Er 68	169 Tm 69	173 Yb 70	175 Lu 71																																							
227 Ac 89	232 Th 90	231 Pa 91	238 U 92	237 Np 93	244 Pu 94	243 Am 95	247 Cm 96	247 Bk 97	251 Cf 98	254 Es 99	257 Fm 100	256 Md 101	254 No 102	260 Lw 103																																							