

NAME..... SIGNATURE.....

P525/1

Chemistry

Paper 1

2½ Hours



**UGANDA TEACHERS' EDUCATION CONSULT (UTEC)**

**Uganda Advanced Certificate of Education**

**CHEMISTRY**

**PAPER 1**

**2 hours 45 minutes**

**INSTRUCTIONS TO THE CANDIDATES**

Answer **all** questions in Sections **A** and any **six** in Section **B**.

Write the answers in the spaces provided.

Mathematical tables and graph papers are provided.

Non-programmable scientific electronic calculators may be used.

Illustrate your answers with equations where applicable.

Where necessary use **C = 12 , O = 16 , H = 1 , Ca = 40 , Ag = 108 , P = 31**

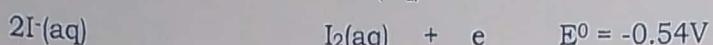
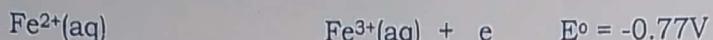
**For Examiner's use only**

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

## SECTION A (46 MARKS)

Attempt **all** questions in this Section

1. Electrode potentials for some half cells are given below;



a) Write;

- i) Cell convention for the cell formed when the two half cells are combined. (1 mark)

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- ii) Equation for the overall cell reaction (1 mark)

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- b) Calculate the free energy of the cell (2½ 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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2. a) State three factors that determine both the polarizing power and polarizability of an ion. (1½ marks)

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b) A clean magnesium ribbon was added to a solution of aluminium nitrate in water.

i) State what was observed (1 mark)

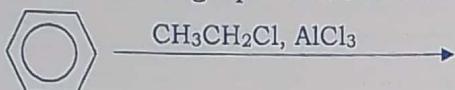
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ii) Write equation for reaction that took place (1½ marks)

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3. Complete the following equations and outline the mechanism for the reaction

a)



(3 marks)

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b)  $\text{CH}_3\text{CHBrCH}_2\text{Br} \xrightarrow{\text{KOH/CH}_3\text{CH}_2\text{OH, Heat}}$  (3 marks)

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4. Explain the following observations

a) A mixture of water and phenylamine boils at a temperature lower than the boiling point of either components. (3 marks)

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- b) Sodium chloride is more soluble in hot water than in concentrated hydrochloric acid whereas lead(II) chloride is more soluble in concentrated hydrochloric acid than in water. (2 marks)
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5. a) Define the term heat of reaction (1 mark)
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b) Given,

$$\Delta H_f^0 \text{CO}_2(\text{g}) = -393.5 \text{ kJmol}^{-1}$$

$$\Delta H_f^0 \text{CO}(\text{g}) = -111.3 \text{ kJmol}^{-1}$$

$$\Delta H_f^0 \text{H}_2\text{O}(\text{l}) = -241.8 \text{ kJmol}^{-1}$$

Calculate the heat of reaction for



6. a) State;

- i) three properties in which beryllium differs from other group (II) elements (1½ marks)
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- ii) three reasons why beryllium differs from other group (II) elements.  
(1½ marks)

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- c) Write the equation of reaction between dilute hydrochloric acid and  
i) Beryllium carbide (1½ marks)

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- ii) Calcium carbide (1½ marks)

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7. Explain the following observations

- a) The heat of hydrogenation of cyclohexene is  $-120 \text{ kJ mol}^{-1}$  whereas that of benzene is  $-200 \text{ kJ mol}^{-1}$  (3 marks)

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- b) Carbon dioxide is a gas whereas silicon (IV) oxide is a solid at room temperature. (2 mark)

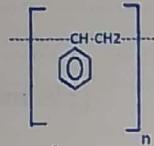
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8. 20cm<sup>3</sup> of a gaseous hydrocarbon Q ( $\text{C}_x\text{H}_y$ ) were exploded with 100cm<sup>3</sup> of oxygen. On cooling to room temperature, the residual gases occupied 90cm<sup>3</sup> and this on treatment with potassium hydroxide solution reduced to 50cm<sup>3</sup>.

- a) Write equation of reaction between Q and oxygen (1 mark)

b) Determine the molecular formula of Q (2½ marks)

c) Using equations only, show how polystyrene can be synthesized from Q



9. a) Write;

i) equation for the hydrolysis of sodium ethanoate in water (1 mark)

ii) the expression for the hydrolysis constant  $K_h$  for sodium ethanoate

(2 marks)

c) The pH of 0.1M solution of sodium ethanoate is 8.87

i) Calculate the hydrolysis constant,  $K_h$  for sodium ethanoate ( $K_w = 1 \times 10^{-14} \text{ mol dm}^{-3}$ ) (2½ marks)

- ii) State the assumptions you have made in (b)(i) above (1 mark)

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### SECTION B (54 MARKS)

Attempt any **six** questions in this Section

10. Haematite is the principal ore from which iron is obtained. The first stage in the manufacture of iron involves preparing the ore for reduction in the blast furnace.

- a) State;

- i) What happens during the first stage of iron extraction. (2 marks)

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- ii) The major impurities of haematite. (1 mark)

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- b) The second stage involves reduction of haematite. Write;

- i) Equation for the reduction of haematite. (1½ marks)

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- ii) Equation that leads to the formation of slag (1½ marks)

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- c) The basic oxygen process is one of the techniques of steel production.

Briefly describe how steel is obtained from pig iron by the basic oxygen process. (3 marks)

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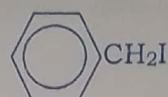
11.

Name a reagent that can be used to distinguish between the following pairs of compounds. In each case state what is observed when the reagent is separately treated with each member of a pair.

a)



and

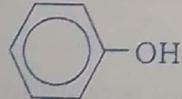


Reagent

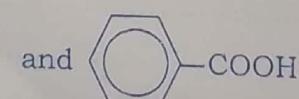
Observation

(3 marks)

b)



and



Reagent

Observation

c)  NHCH<sub>3</sub> and



and



## Reagent

## Observation

12. Describe the general methods of preparing halogens (excluding fluorine) in the laboratory. (4 marks)

c) Write ionic equations of reactions for fluorine and iodine with;

i) Cold dilute sodium hydroxide solution

### Fluorine

(1 mark)

(1 mark)

Chlorine

- ii) Hot concentrated sodium hydroxide solution

(1½ marks)

Fluorine

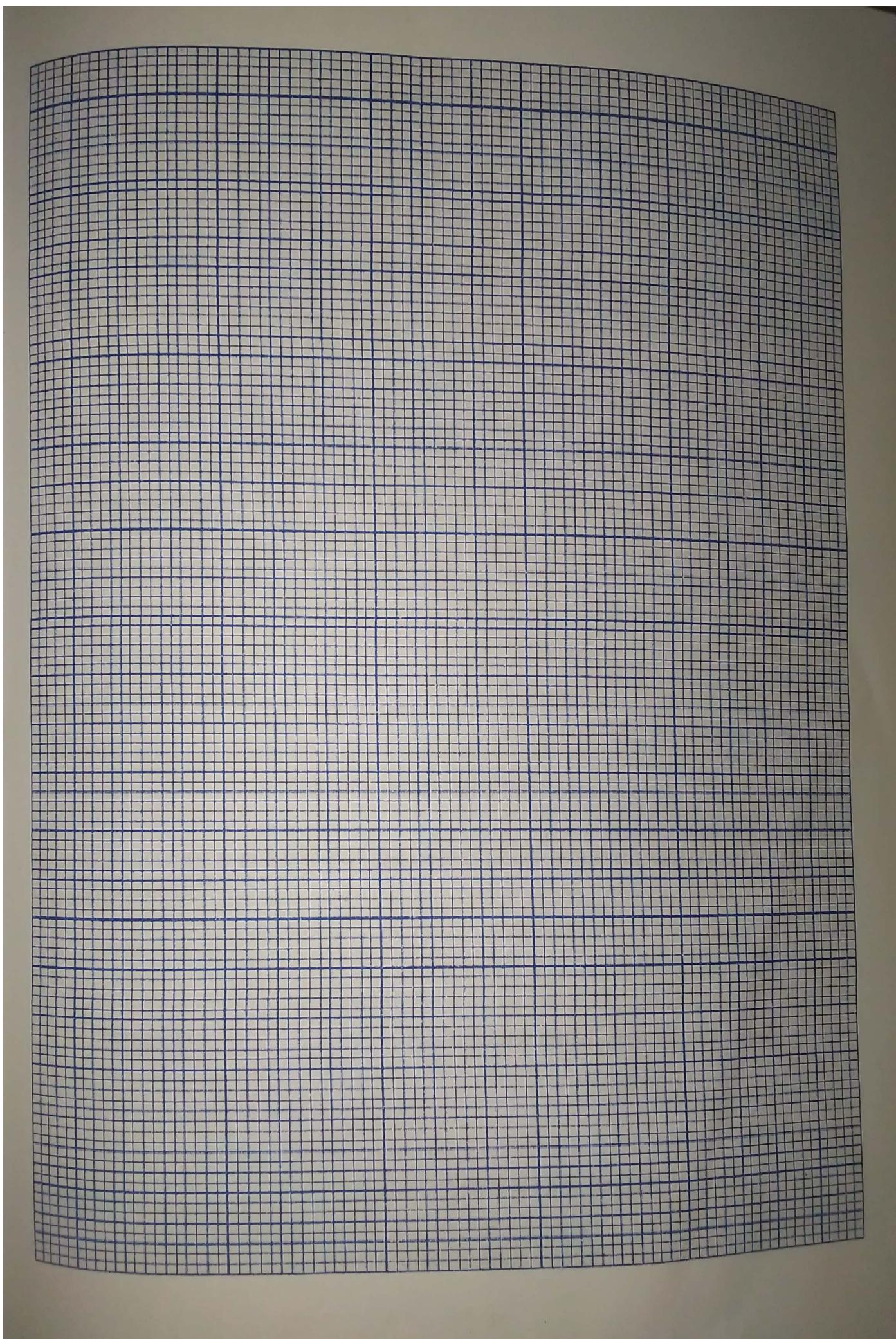
Chlorine

(1½ marks)

13. The table below shows the melting points and compositions of various mixtures of lead and tin.

Percentage of tin	20	35	50	65	80	95
Melting point (°C)	226	190	156	184	242	300

- a) Draw a well labelled phase diagram for lead – tin system. (3½ marks)



- b) Use your graph to;
- i) Determine the melting points of pure lead and pure tin  
(1 mark)
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- ii) Determine the composition and melting point of the eutectic mixture.  
(1 mark)
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- c) Calculate the mass of lead that would crystallise when 200g of the mixture containing 25% tin was cooled from 300°C to 168°C  
(2½ marks)
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- d) Give two similarities between eutectic mixture and a pure compound.  
(1 mark)
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14. a)i) Define the term thermosetting plastic  
(2 marks)
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- ii) Give one example of a thermos setting plastic.  
(1 mark)
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b) Nylon-6,10 can be formed from the monomers hexane-1,6-diamine and decane-1,10-diyl dichloride,  $\text{ClOC}(\text{CH}_2)_8\text{COCl}$

i) Write equation for the formation of nylon-6,10. (2 marks)

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ii) State the type of polymerization involved in the formation of nylon-6,10. (1 mark)

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c) The osmotic pressure of a solution containing  $2\text{g l}^{-1}$  of nylon-6,10 at  $25^\circ\text{C}$  was  $0.188\text{mmHg}$ . Calculate the relative formula mass of nylon-6,10 (2 marks)

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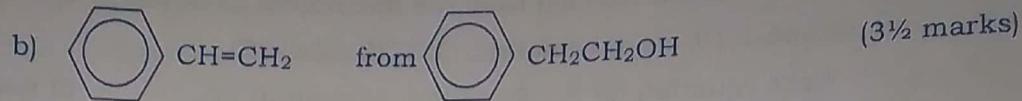
d) State one use of nylon-6,10. (1 mark)

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15. Write mechanisms to show how the following conversions can be effected.

a)  $(\text{CH}_3)_2\text{C}=\text{NOH}$  from propanone (3 marks)

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16. Trilead tetra oxide was treated with dilute nitric acid and when the resultant solution was filtered , a filtrate P and a dark brown residue Q were obtained.

a) i) Name compounds P and Q

P

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Q

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(1 mark)

ii) Write equation of a reaction between trilead tetraoxide and dilute nitric acid (1½ marks)

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b) Q was heated in the presence of sulphur dioxide

- i) State what was observed (1 mark)

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- ii) Write equation of reaction that took place (1½ marks)

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Write ionic equation of reaction between

- i) P and dilute sulphuric acid (1 mark)

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- ii) Q and warm concentrated hydrochloric acid (1½ marks)

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- iii) Q and manganese(II) sulphate in the presence of concentrated nitric acid (1½ marks)

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17. a)i) Sketch a graph to show the pH changes when 0.1M ammonia solution is titrated into hydrochloric acid solution (1½ marks)

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- ii) Explain the shape of your sketch graph in (a)(i) (4½ marks)

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iv) Suggest a suitable indicator for this titration. Give a reason.

(1 mark)

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b) 35cm<sup>3</sup> of 0.2M NH<sub>3</sub>(aq) was added to 45cm<sup>3</sup> of 0.1M HCl. Determine  
the pH of the resultant solution. ( $K_b = 1.8 \times 10^{-5}$ M) (2 marks)

# THE PERIODIC TABLE

1	2													3	4	5	6	7	8
1.0 H 1																		1.0 H 1	4.0 He 2
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 Rn 86		
223 Fr 87	226 Ra 88	227 Ac 89																	
			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		