NameIndex No.

9518/2
CHEMISTRY
Paper 2
D.T.E.
March/April 2011
Time: 2 hours

* Candidate's Signature

Date

THE KENYA NATIONAL EXAMINATIONS COUNCIL

DIPLOMA IN TEACHER EDUCATION

CHEMISTRY

Paper 2

2 hours

INSTRUCTIONS TO CANDIDATES

Write your name and index number in the spaces provided above.
Sign and write the date of the examination in the spaces provided above.
This question paper consists of TWO sections; A and B.
Answer ALL questions in section A in the spaces provided.
Answer any ONE question from section B in the spaces provided.
Electronic calculators may be used
A sample of the periodic table is provided at the end of the paper.

For Official Use Only

SECTION	QUESTIONS	MAXIMUM SCORE	CANDIDATE'S SCORE
A	1	12	
	2	12	
	3	12	
	4	12	
	5	12	
B	6	20	
	7	20	
	8	20	
	TOTAL	80	

This paper consists of 22 printed pages.

Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.

Turn over

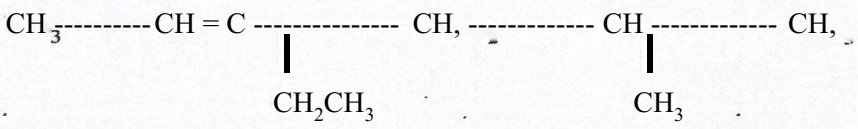
SECTION A (60 marks)

1. (a) Using hybrid orbitals, describe the bonding in the following molecules:-

(i) CH_4 (2 marks)

(ii) $CH_2 = CH_2$ (2 marks)

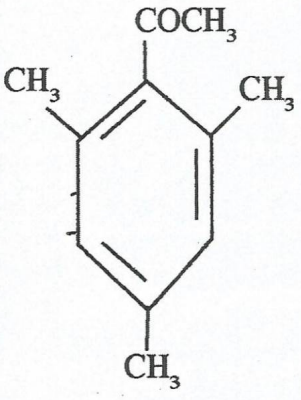
(b) (i) Give the systematic name of each of the following compounds.



(1 mark)

(ii) $CH_3CH,CH(CH_3)CHO$ (1 mark)

(iii)



(1 mark)

(c) Draw the structures of the following compounds:

(i) Phenylethanoic acid (1 mark)

(ii) 2,2,4 - trimethylpentane (1 mark)

(d) Write the mechanism for the reaction between methane and chlorine in UV-light to give di chloromethane. (3 marks)

2. (a) Alkylhalides (halogeno alkanes) undergo nucleophilic substitution reactions.

(i) What is a nucleophile? (1 mark)

(ii) Write the mechanism for the following reaction: (2 marks)

$(CH_3)_3\ CC1 + OH' \longrightarrow (CH_3)_3\ COH + Cl-$

(iii) Write the rate expression for the reaction in (ii) above. (1 mark)

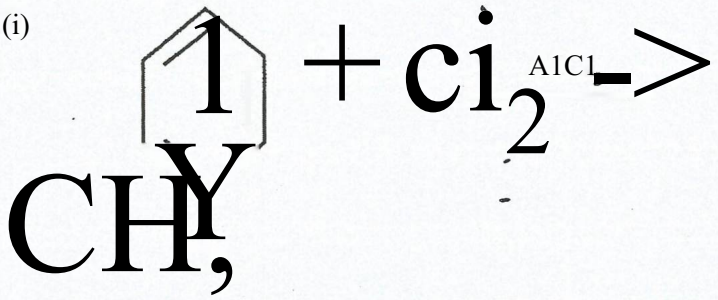
(b) When chloroethene reacts with bromine in carbon tetrachloride, the product is a mixture of two isomers.

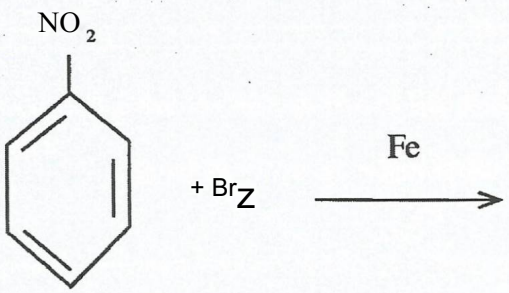
(i) Draw the structures of the isomers. (2 marks)

(ii) State one physical property that can be used to distinguish between the two isomers. (1 mark)

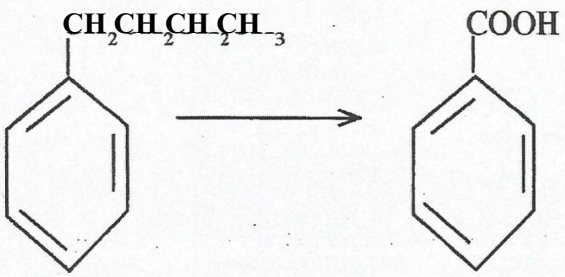
(c) Give the structures of the organic products formed in the following reactions.

(2 marks)

(i) 

(ii) 

(d) (i) Give the reagent and condition that can be used for the conversion of compound A to compound B. (1 mark)



A B

(ii) Describe how a mixture of compounds A and B in d (i) above can be separated.

(2 marks)

3. (a) Explain each of the following observations.

(i) Phenol is more acidic that ethanol. (2 marks)

(ii) A solution of ethylamine in water is basic. (2 marks)

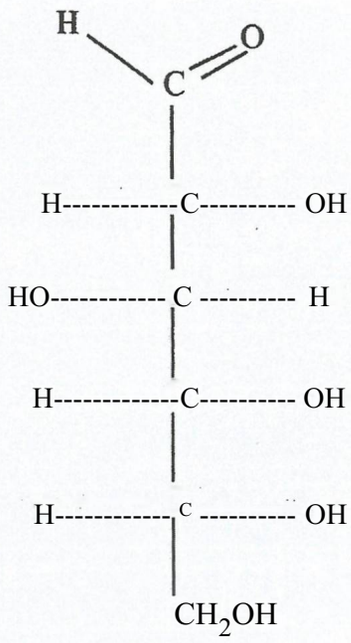
(iii) The boiling points of cis -1,2-dichloroethene and trans-1,2-dichloroethene are different. (2 marks)

(b) Carbonyl compounds react with 2,4 - dinitrophenylhydrazine producing hydrazone derivatives.

(i) Write an equation for the reaction between propanal and 2,4 - dinitrophenyl hydrazine. (1 mark)

(ii) Explain how these reactions are used to give the identity of a carbonyl compound. (2 marks)

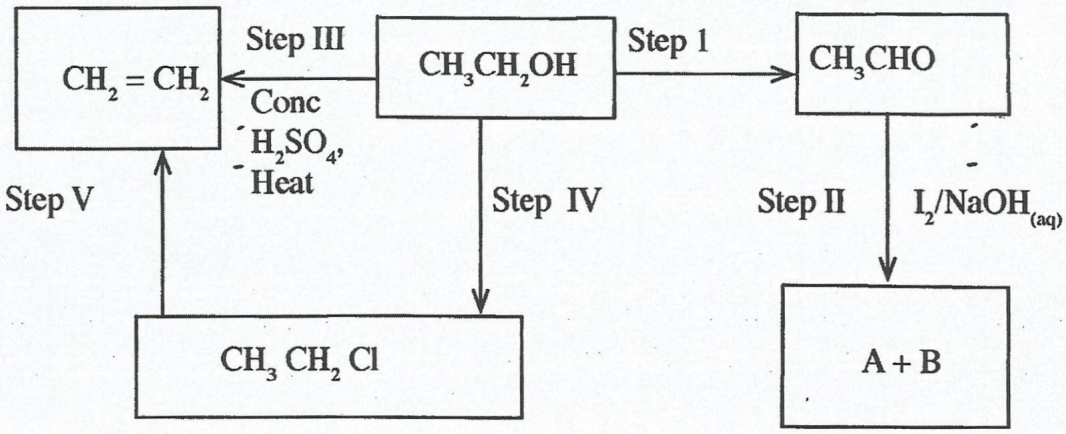
(c) (i) Draw and label the structures of the cyclic forms of D-glucose in aqueous media. (2 marks)



D-glucose

(ii) The tw'o cyclic compounds of D-glucose have different melting points. State another physical property that can be used to distinguish them. (1 mark)

4. (a) Study the reaction scheme below and answer the questions that follow:



(i) Write the formula of compounds A and B. (2 marks)

A: _____

B: _____

(ii) State the reagents and conditions used in steps I, IV and V. (3 marks)

Step I: _____

Step IV: _____

Step V:

(iii) Which other product could be formed in step I? (1 mark)

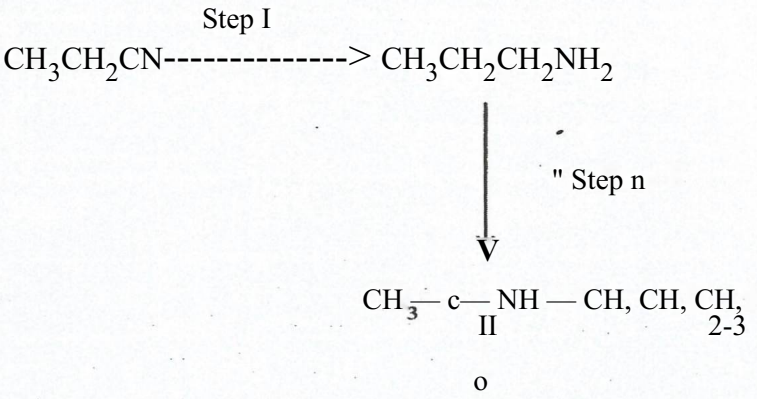
(iv) Write the mechanism for the reaction in step III. (3 marks)

(b) The reaction between ethanal and the Grignard reagent, CH_3MgBr, followed by acid produces propan - 2 - ol.

(i) Describe how the Grignard reagent, CH_3MgBr can be prepared in the laboratory. (2 marks)

(ii) Give the structure of the organic product formed when propanone reacts with CH_3MgBr followed by acid. (1 mark)

5. (a) Propylethanamide can be prepared from propane nitrile as shown below.



(i) Give the reagents and conditions necessary for carrying out. (2 marks)

Step I:

Step II

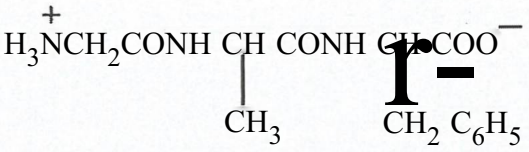
(ii) In an experiment, a student started with 3.24 g of propane nitrile and obtained 3.69 g of propylethanamide after recrystallizing and drying.

I: Calculate the percentage yield. (2 marks)

II Explain how the student could confirm the purity of the product.

(1 mark)

(b) The structure of a tri peptide is given below.



(i) What is meant by the term "tripeptide"? (1 mark)

(ii) Draw the structures of the organic products obtained when the tripeptide is heated with excess hydrochloric acid. (3 marks)

(iii) State **one** technique that can be used to separate the products obtained in (b) (ii) above. (1 mark)

(c) When a sample of phenylamine is reacted with sodium nitrite and hydrochloric acid at 5° C, an intermediate compound is formed which reacts with phenol forming a dye. Write two equations showing the formation of the:-

(i) intermediate compound (1 mark)

(ii) dye (1 mark)

SECTION B (20 marks)

6. (a) An industrialist intends to set up a sulphuric (VI) acid plant in Nairobi.
Explain how the following factors would affect the manufacturing costs:-

(i) labour; (1 mark)

(ii) energy; (1mark)

(iii) environmental issues; (1mark)

(iv) markets. (1mark)

(b) (i) Give **two** methods used to obtain sulphur (IV) oxide for the production of sulphuric acid (VI) acid. (2 marks)

(ii) What are the sources of energy for the sulphuric (VI) acid manufacturing processes? (2 marks)

(iii) State, giving reasons the optimum conditions for the industrial production of sulphuric (VI) acid. (3 marks)

(iv) Explain how sulphuric (VI) acid is used in

I. Fertilizer industry. (1 mark)

II. Battery industry; (1 mark)

III. Detergent industry. (1 mark

(c) Technical grade concentrated sulphuric (VI) acid is sold as 98.3% sulphuric (VI) acid.
Explain how:

(i) Sulphuric (VI) oxide is converted to the 98.3% sulphuric (VI) acid.
(2 marks)

(ii) Dilute sulphuric (VI) acid is obtained from the technical grade one. (1 mark)

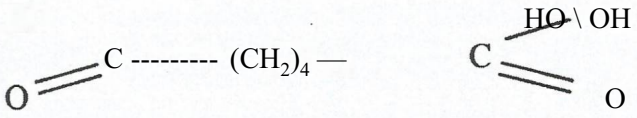
(d) Sulphuric (VI) acid producing plants emit sulphur (IV) oxide into the atmosphere.
State and explain two methods of minimising these emissions. (3 marks)

7. (a) What do the following terms mean?

(i) Condensation polymerisation (1 mark)

(ii) Thermoplastic polymer. (1 mark)

(b) Hexane -1,6 - dioic acid,

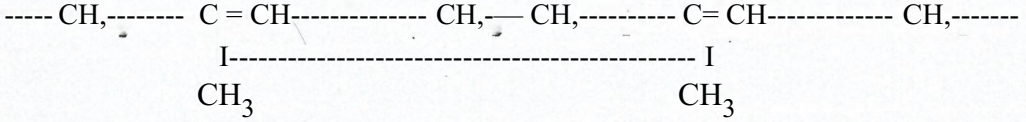


and 1,6-diaminohexane, $H_2N - (CH_2)_6 - NH_2$ react to form a polymer.

(i) Draw the structure of the polymer formed showing two repeat units. (1 mark)

(ii) Give the name of the polymer formed. (1 mark)

(c) Natural rubber is a polymer with the following structure.



(i) Draw the structure of the monomer of natural rubber. (1 mark)

(ii) Give two physical properties of natural rubber. (2 marks)

(iii) Describe the process of vulcanization of natural rubber. (2 marks)

(iv) Give one use of vulcanised rubber. (1 mark)

(d) (i) Describe using a labelled diagram how crude oil is refined. (4 marks)

(ii) Some products from petroleum refining have to undergo a process known as reforming.

I. Using an example, explain the process of reforming. (2 marks)

II State **one** advantage of reforming. (1 mark)

(e) Lead compounds were commonly used as petrol additives.

(i) Give the name of one such lead compound. (1 mark)

(ii) Explain why the lead additives: (1 mark)

I. were used;

II. are being phased out. (1 mark)

8. (a) Soda ash is extracted from trona, $Na_2CO_3.NaHCO_3.2H_2O$, at lake Magadi which is situated about 120 km south west of Nairobi.

(i) State **two** factors that contribute to the formation of trona at lake Magadi.

(2 marks)

(ii) Describe the processes involved in the manufacture of soda ash from trona.

(4 marks)

(b) About 90% of the soda ash produced by the Magadi soda company is exported through Mombasa port.

(i) Give two possible reasons why the factory is sited at lake Magadi and not Mombasa. (2 marks)

(ii) Explain the uses of soda ash in:-

I. Water treatment; (1 mark)

II. Glass industry. (1 mark)

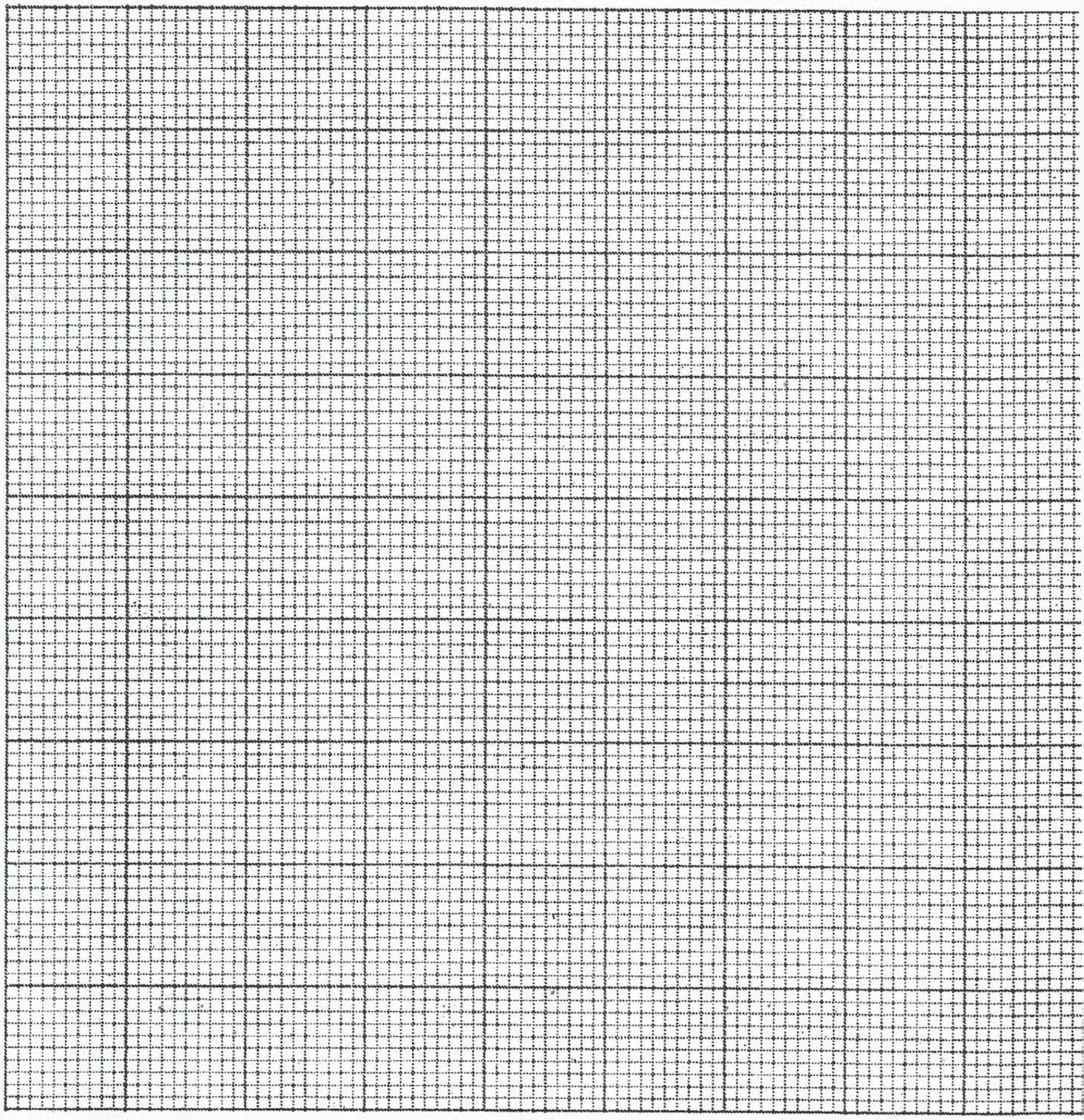
(c) Magadi soda company produces about 300,000 tonnes of soda ash per year.
Calculate the minimum amount of trona used per year. (3 marks)

(d) The liquor in lake Magadi contains sodium chloride and sodium carbonate.

lk

(i) Using the data provided in the table below, plot solubility curves for sodium carbonate and sodium chloride in the grid provided. (3 marks)

Temperature(°C)	Solubility in g/lOOg water	
	Sodium chloride	Sodium carbonate
20	35.5	21.4
40	36.4	48.5
60	37.1	46.5
80	38.1	45.8
100	39.2	45.5



(ii) Use the information from the graph to explain how sodium chloride is obtained from the liquor. (2 marks)

(iii) Describe how sodium chloride is used to produce sodium hydroxide. (2 marks)

Periodic Table of the Elements

1A	2A	3B	4B	5B	6B	7B	8B	1B	2B	3A	4A	5A	6A	7A	8A
1 H 1.00794															2 He 4.002602
3 Li e.w	4 Be 9.012182									5 B 10.811	6 C 120107	7 N 14.0067	8 0 15.9994	9 F 10.9084032'	10 Ne 20.1797
$1 Na 22989768	12 Mg 24.3080									13 Al 28.9815386	14 Si 28.0855	15 p 30.973782	16 S 32085	17 Cl 35.453	18 Ar 39.948
19 K 39.0963	20 Ca 40078	21 Sc 44966912	22 Ti 47.867	23 V 50.9415	24 Cr 51J961	25 Mn 54.938045	26 Fe 56.845	27 Co 58.933195	28 Ni 586934	29 Cu 63.546	30 Zn 66.38	31 Ga 69.723	32 Ge 72.64	33 As 74.92160	34 Se 78.96	35 Br 79.904	36 Kr 83.798
37 Rb 85.4678	38 Sr 87.62	39 Y 8690665	40 Zr 91.224	41 Nb 92.90638	42 Mo 98.96	43 Tc P»8]	44 Ru 101.07	45 Rh 10290660	46 Pd 108.42	47 Ag 107.8882	48 Cd 112.411	49 In 114.818	50 Sn ; 118.710	51 Sb 121.760	52 Te 127.60	53 I 126.90447	54 Xe 131.293
55 Cs 132.9054519	5fl Ba 137.327	57-71 Lanthanides	72 Hf 176.48	73 Ta 180.94788	74 w 183.64	75 Re 168.207	78 Os 190.23	77 Ir 192.217	78 Pt 195.084	79 Au 106.968560	80 Hg 200.59	61 Tl 204.3833,	82 Pb 207.2	83 Bi 206.98040	84 Po ROB]	85 At Riq	86 Rn ' [222]
87 Fr 223	88 Ra [2261 '	89-103 'ActWdaa	104 Rf pen	105 Db peel	106 Sg P71J	107 Bh P7ZJ	108 Hs P7t?	109 Mt P78)	110 Ds [281J	111 Rg P80]	112 Uub p®]	113 Uut p«]	114 Uuq [2891	115 Uup PM]	116 Uuh (293)	117 Uus I»4]	118 Uuo P04]

Lanthanides	57 La 138.90647	58 Ce 140.116	59 Pr 140.90763	60 Nd 144.242	61 Pm [146]	62 Sm 190.08	63 Eu 151.964	64 Gd 157.25	65 Tb 158.92535	66 Dy 162.500	67 Ho 184.93032	68 Er 167.259	69 Tm 168.93421	70 Yb 173.054	71 Lu 174.9668
Actinides	89 Ac P27]	90 Th 232.03806	91 Pa 231.03566	92 U 238.02891	93 Np (237]	94 Pu P<4]	95 Am (2431	96 Cm P<7]	97 Bk P47]	98 Cf P51]	99 Es P52)	100 Fm [257]	101 Md (253]	102 No (256)	103 Lr R62]

22

9518/2