education

Department of Education
FREE STATE PROVINCE

CONTROL TEST

GRADE 11

PHYSICAL SCIENCES

SEPTEMBER 2019

MARKS: 100

TIME: 2 HOURS

This paper consists of nine pages and three information sheets.

INSTRUCTIONS AND INFORMATION

1. Write your name and other information in the appropriate spaces on the ANSWER BOOK.

2. This question paper consists of SEVEN questions. Answer ALL questions in the ANSWER BOOK.

3. Start EACH question on a NEW page in the ANSWER BOOK.

4. Number the answers correctly according to the numbering system used in this question paper.

5. Leave one line between two sub-questions, for example between QUESTION 2.1 and QUESTION 2.2.

6. You may use a non-programmable pocket calculator.

7. You may use appropriate mathematical instruments.

8. You are advised to use the attached DATA SHEETS.

9. Show ALL formulae and substitutions in ALL calculations.

10. Round off your FINAL numerical answers to a minimum of TWO decimal places where applicable.

11. Give brief motivations, discussions, et cetera where required.

12. Write neatly and legibly.

QUESTION 1: MULTIPLE-CHOICE QUESTIONS

Four options are provided as possible answers to the following questions. Each question has only ONE correct answer. Choose the answer and write down only the letter A, B, C or D next to the question number (1.1–1.10) in your ANSWER BOOK.

1.1 The force of one charge on another is 120 N. If the distance between the charges is doubled, the force, in N, will be …

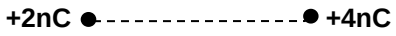
A 60.

B 40.

C 30.

D 15. (2)

1.2 Two point charges of +2 nC and +4 nC are placed as shown in the diagram below. The +2 nC charge experiences an electrostatic force *F*.



What is the magnitude of the electrostatic force experienced by the +4 nC charge?

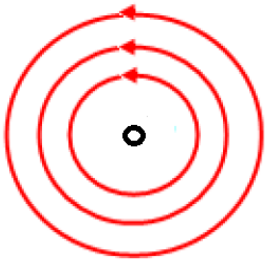
A 8 F

B 4 F

C 2 F

D F (2)

1.3 A current-carrying wire is placed perpendicular to the page. The direction of the magnetic field around the wire is indicated in the diagram. What is the direction of the conventional electric current in the wire?



A Into the page

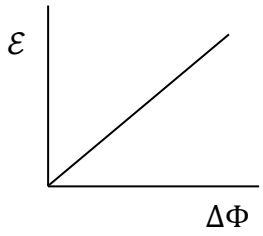
B Out of the page

C Clockwise

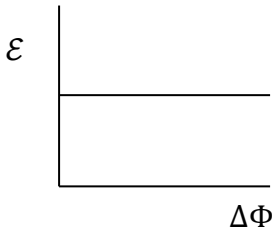
D Counter-clockwise (2)

1.4 Which one of the following graphs represents the relationship between the induced emf ($\mathcal{E}$) and the change in magnetic flux ($\Delta\Phi$)?

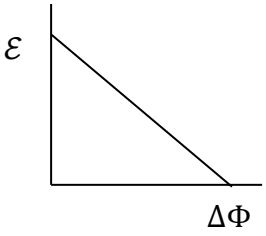
A



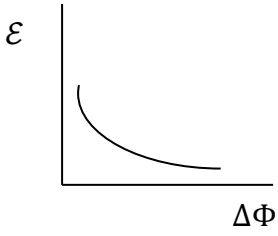
B



C

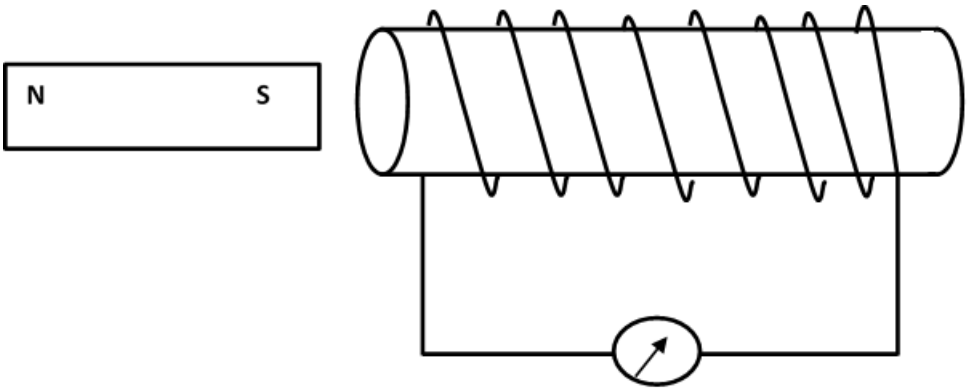


D



(2)

1.5 Learners investigate the effect of a magnet on a solenoid. The magnet is pushed INTO the solenoid and the needle of a galvanometer, which is connected to the solenoid, deflects to the right.



The magnet is now pulled out of the solenoid with a greater speed as before. The galvanometer needle will deflect …

A to the left with a greater deflection.

B to the left with a smaller deflection.

C to the right with a greater deflection.

D to the right with a smaller deflection. (2)

1.6 Two bulbs **A** (500 W) and **B** (200 W) are both rated to function at 250 V. What is the ratio of the resistances (R_A:R_B) for bulbs **A** and **B**?

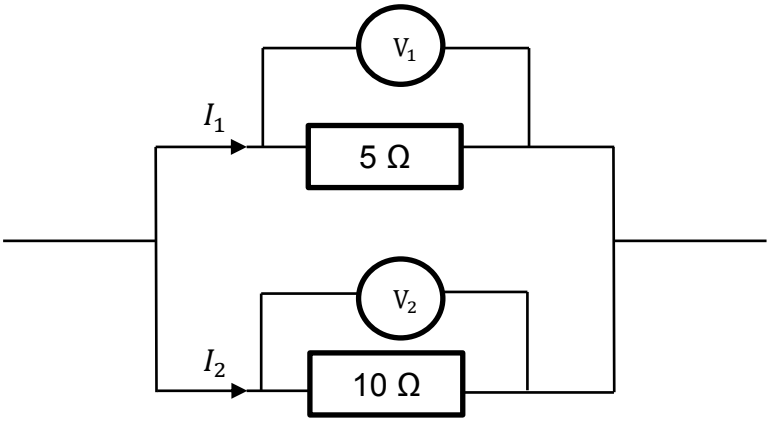
A 25:4

B 4:25

C 5:2

D 2:5 (2)

1.7 A 5 Ω and a 10 Ω resistor are connected in parallel as shown in the diagram. The resistors are connected to a battery with negligible internal resistance in a closed circuit.



What is the reading on V_1 if the reading on V_2 is *x* V?

A 0 V

B x V

C 2x V

D 5x V (2)

1.8 A voltmeter in a circuit shows a reading of 2 V. 2 V has the same meaning as ...

A $\frac{2\text{C}}{1s}$.

B $\frac{2\text{J}}{1s}$.

C $\frac{2\text{C}}{1\text{J}}$.

D $\frac{2\text{J}}{1\text{C}}$. (2)

1.9 Which one of the following gases has the highest volume at STP?

A 20 g O_2

B 10 g NH_3

C 20 g H_2

D 15 g SO_2 (2)

1.10 What is the total number of atoms present in ONE formula unit of $CuSO_4 \cdot 5H_2O$?

A 8

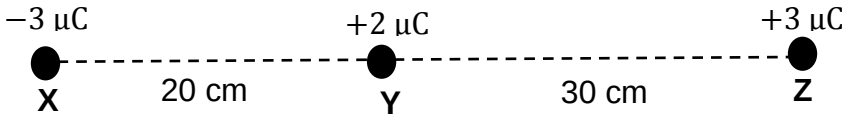
B 13

C 21

D 27 (2)
[20]

QUESTION 2

Three point charges, **X**, **Y** and **Z**, carrying charges of -3 µC, +2 µC en +3 µC respectively, are arranged as shown in the diagram below. The distance between charges **X** and **Y** is 20 cm and between **Y** and **Z** is 30 cm.



2.1 State *Coulomb's law* in words. (2)

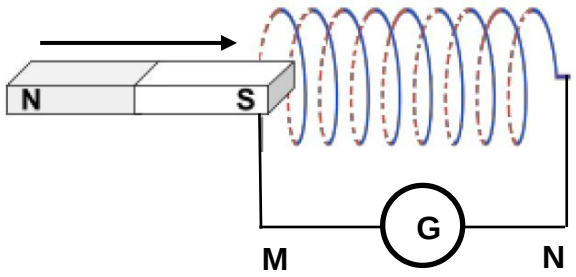
2.2 Calculate the NET ELECTROSTATIC FORCE experienced by **Y** due to **X** and **Z**. (6)

2.3 Show by means of an accurate (not to scale) VECTOR DIAGRAM, why the net electric field at **Y** cannot be zero. (4)

2.4 Calculate the NET ELECTRIC FIELD at **Y** due to **X** and **Z**. (5)
[17]

QUESTION 3

A magnet is pushed into a coil as shown in the diagram below. It is kept stationary for a few seconds before it is pulled out of the coil.



3.1 State *Faraday's law* in words. (2)

3.2 Explain what will be observed on the galvanometer when the magnet is moved into the coil, kept stationary and then pulled out of the coil. (3)

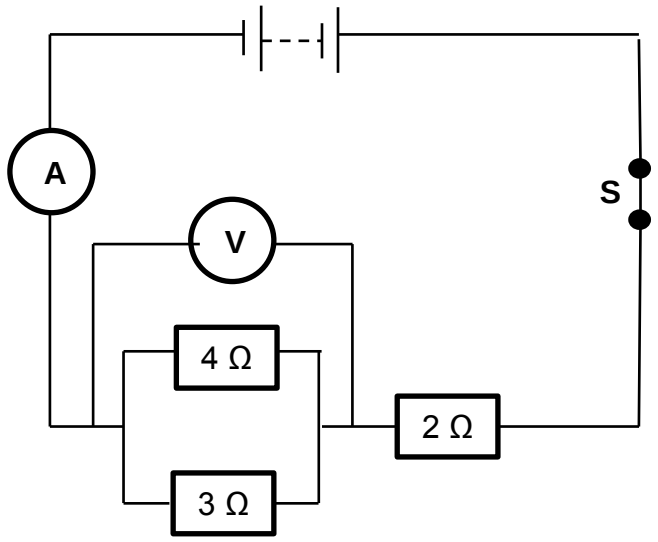
3.3 The south pole enters the coil as shown in the diagram. In which direction is the current in the coil? Write only **M** to **N** or **N** to **M**. (1)

3.4 Name three ways in which the induced current in the coil can be increased. (3)

3.5 A square solenoid of which each side is 4 cm contains 50 turns. The magnetic field parallel to the normal of the area of the solenoid changes from 0 T to 0,03 T in 1,5 s. Calculate the magnitude of the induced emf. (7)
[16]

QUESTION 4

Three resistors, 2 Ω, 3 Ω and 4 Ω, are connected to a 24 V battery of negligible internal resistance as shown in the circuit diagram below. Switch **S** is closed.



4.1 State *Ohm's law* in words. (2)

Calculate the:

4.2 Total resistance in the circuit (4)

4.3 Reading on the ammeter (3)

4.4 Reading on the voltmeter (3)

4.5 Power of the 2 Ω resistor (3)

Switch **S** is now OPENED.

4.6 Will the reading on the ammeter INCREASE, DECREASE or REMAIN THE SAME? (1)

[16]

QUESTION 5

A 220 V washing machine draws a current of 20 A for 2 minutes. The price of electricity is R1,15 per kWh.

5.1 Define *power* in words. (2)

5.2 Calculate the cost to operate the washing machine for two minutes. (6)
[8]

QUESTION 6

After physical activity lactic acid forms in muscle tissue and is responsible for muscle soreness. Lactic acid contains 40 % carbon (C), 6,7 % hydrogen (H) and 53,3 % oxygen (O).

6.1 Determine the empirical formula of lactic acid. (6)

6.2 Determine the molecular formula of lactic acid if the molar mass of lactic acid is 90 $g.mol^{-1}$. (2)
[8]

QUESTION 7

7.1 A learner wants to determine the percentage $CaCO_3$ that is present in 0,5 g sea shells. He adds 0,15 dm^3 of a 0,1 $mol.dm^{-3}$ $HC\ell$ solution to the seashells.

0,1 dm^3 CO_2 gas is produced at STP. The balanced chemical equation for the reaction is:

$$CaCO_3(s) + 2HC\ell\,(\ell) \rightarrow CaC\ell_2\,(aq) + H_2O(\ell) + CO_2(g)$$

Calculate the:

7.1.1 Number of moles of $HC\ell$ added to the seashells. (3)

7.1.2 Number of moles of CO_2 gas that is formed. (3)

7.1.3 Percentage of $CaCO_3$ that is present in the sea shells. (5)

7.2 Butane (C_4H_{10}) is used to produce other carbon and hydrogen containing substances. Determine the percentage composition of the carbon and hydrogen in butane. (4)
[15]

GRAND TOTAL: 100

DATA FOR PHYSICAL SCIENCES GRADE 11 (PHYSICS)
CONTROL TEST - TERM 3

GEGEWENS VIR FISIESE WETENSKAPPE GRAAD 11 (FISIKA)
KONTROLETOETS - KWARTAAL 3

TABLE 1: PHYSICAL CONSTANTS / *TABEL 1: FISIESE KONSTANTES*

NAME / *NAAM*	SYMBOL / *SIMBOOL*	VALUE / *WAARDE*
Coulomb's constant *Coulomb se konstante*	k	$9,0 \times 10^{9}\ N{\cdot}m^{2}{\cdot}C^{-2}$
Charge on electron *Lading op elektron*	e	$-1,6 \times 10^{-19}\ C$
Electron mass *Elektronmassa*	m_e	$9,11 \times 10^{-31}\ kg$

TABLE 2: FORMULAE / *TABEL 2: FORMULES*

ELECTROSTATICS / *ELEKTROSTATIKA*

$F=\frac{kQ_1Q_2}{r^2}$ $(k = 9,0 \times 10^{9}\ N{\cdot}m^{2}{\cdot}C^{-2})$	$E=\frac{F}{q}$
$E=\frac{kQ}{r^2}$ $(k = 9,0 \times 10^{9}\ N{\cdot}m^{2}{\cdot}C^{-2})$	$V=\frac{W}{Q}$

ELECTROMAGNETISM / *ELEKTROMAGNETISME*

$\varepsilon=-N\frac{\Delta\Phi}{\Delta t}$	$\Phi=BA\cos\theta$

CURRENT ELECTRICITY / *STROOMELEKTRISITEIT*

$I=\frac{Q}{\Delta t}$	$R=\frac{V}{I}$
$\frac{1}{R}=\frac{1}{r_1}+\frac{1}{r_2}+\frac{1}{r_3}+\ldots$	$R=r_1+r_2+r_3+\ldots$
$W = Vq$ $W = VI\Delta t$ $W = I^2R\Delta t$ $W = \frac{V^2\Delta t}{R}$	$P=\frac{W}{\Delta t}$ $P = VI$ $P = I^2R$ $P=\frac{V^2}{R}$

DATA FOR PHYSICAL SCIENCES GRADE 11 (CHEMISTRY)
CONTROL TEST - TERM 3

GEGEWENS VIR FISIESE WETENSKAPPE GRAAD 11 (CHEMISTRY)
KONTROLETOETS - KWARTAAL 3

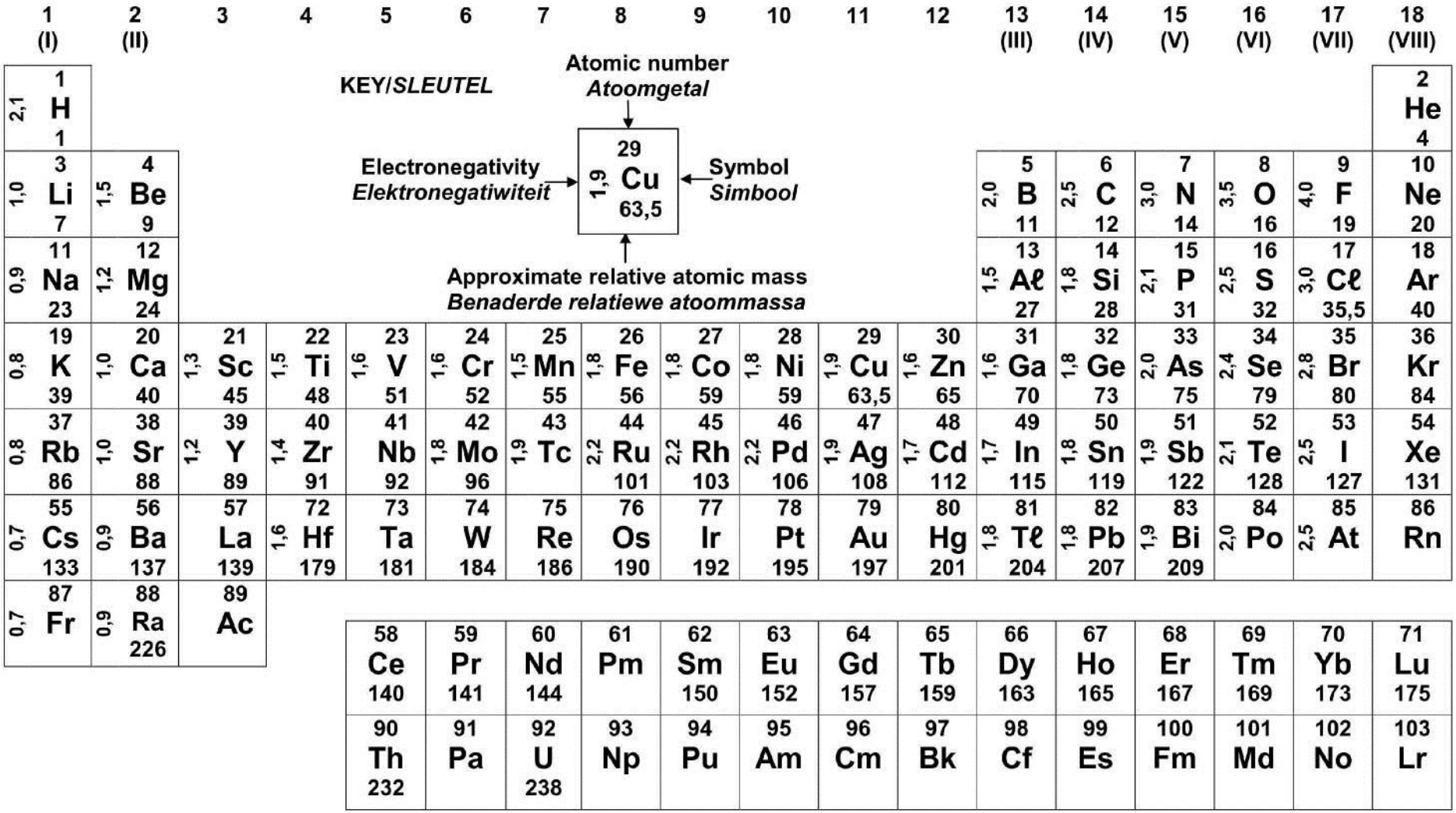
TABLE 1: PHYSICAL CONSTANTS / *TABEL 1: FISIESE KONSTANTES*

NAME / *NAAM*	SYMBOL / *SIMBOOL*	VALUE / *WAARDE*
Avogadro's constant *Avogadrokonstante*	N_A	$6{,}02 \times 10^{23}\ mol^{-1}$
Molar gas volume at STP *Molêre gasvolume by STD*	V_m	$22{,}4\ dm^3 \cdot mol^{-1}$
Standard pressure *Standaarddruk*	p^θ	$1{,}013 \times 10^5\ Pa$
Standard temperature *Standaardtemperatuur*	T^θ	273 K
Charge on electron *Lading op elektron*	e	$-1{,}6 \times 10^{-19}\ C$
Molar gas constant *Molêre gaskonstante*	R	$8{,}31\ J \cdot K^{-1} \cdot mol^{-1}$

TABLE 2: FORMULAE/*TABEL 2: FORMULES*

$\frac{p_1V_1}{T_1} = \frac{p_2V_2}{T_2}$	$pV = nRT$
$n = \frac{m}{M}$	$n = \frac{N}{N_A}$
$n = \frac{V}{V_m}$	$c = \frac{n}{V}$ OR/*OF* $c = \frac{m}{MV}$

THE PERIODIC TABLE OF ELEMENTS
DIE PERIODIEKE TABEL VAN ELEMENTE



1 (I)	2 (II)	3	4	5	6	7	8	9	10	11	12	13 (III)	14 (IV)	15 (V)	16 (VI)	17 (VII)	18 (VIII)
2,1 H 1																	2 He 4
1,0 Li 7	1,5 Be 9											2,0 B 11	2,5 C 12	3,0 N 14	3,5 O 16	4,0 F 19	10 Ne 20
0,9 Na 23	1,2 Mg 24											1,5 Aℓ 27	1,8 Si 28	2,1 P 31	2,5 S 32	3,0 Cℓ 35,5	18 Ar 40
0,8 K 39	1,0 Ca 40	1,3 Sc 45	1,5 Ti 48	1,6 V 51	1,6 Cr 52	1,5 Mn 55	1,8 Fe 56	1,8 Co 59	1,8 Ni 59	1,9 Cu 63,5	1,6 Zn 65	1,6 Ga 70	1,8 Ge 73	2,0 As 75	2,4 Se 79	2,8 Br 80	36 Kr 84
0,8 Rb 86	1,0 Sr 88	1,2 Y 89	1,4 Zr 91	41 Nb 92	1,8 Mo 96	1,9 Tc	2,2 Ru 101	2,2 Rh 103	2,2 Pd 106	1,9 Ag 108	1,7 Cd 112	1,7 In 115	1,8 Sn 119	1,9 Sb 122	2,1 Te 128	2,5 I 127	54 Xe 131
0,7 Cs 133	0,9 Ba 137	57 La 139	1,6 Hf 179	73 Ta 181	74 W 184	75 Re 186	76 Os 190	77 Ir 192	78 Pt 195	79 Au 197	80 Hg 201	1,8 Tℓ 204	1,8 Pb 207	1,9 Bi 209	2,0 Po	2,5 At	86 Rn
0,7 Fr	0,9 Ra 226	89 Ac															

58 Ce 140	59 Pr 141	60 Nd 144	61 Pm	62 Sm 150	63 Eu 152	64 Gd 157	65 Tb 159	66 Dy 163	67 Ho 165	68 Er 167	69 Tm 169	70 Yb 173	71 Lu 175
90 Th 232	91 Pa	92 U 238	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lr