LIMPOPO
PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF
EDUCATION

NATIONAL SENIOR CERTIFICATE

GRADE 12

PHYSICAL SCIENCES

TERM 1 CONTROLLED TEST

MARCH 2026

MARKS: 100

TIME: 2 hours

This question paper consists of 10 pages and 3 data sheets.

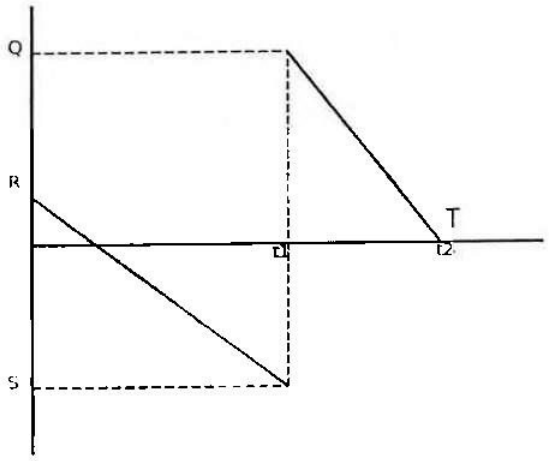
QUESTION 1: MULTIPLE-CHOICE QUESTIONS

Four options are provided as possible answers to the following questions. Each question has only ONE correct answer. Choose the answer and write only the letter (A – D) next to the question number (1.1 – 1.6) in the ANSWER BOOK. E.g. 1.7 A

1.1 If the net force acting on an object doubles while its mass remains constant, the acceleration will:

A Remain the same
B Double
C Be halved
D Become zero (2)

1.2 The velocity-time graph for the motion of the ball from the instant it is projected from a cliff until it reaches point **T** is shown below



The quantity $t_2 - t_1$ represents:

A The time taken for the ball to reach maximum height
B The duration of motion after the bounce until the ball reaches point T
C The total time of flight
D The time taken for the velocity to become zero for the first time (2)

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1.3 A 2 kg ball is moving horizontally at 2 $m \cdot s^{-1}$ when it strikes a wall and rebounds at the same speed in the opposite direction. Which ONE of the following represents the magnitude of the change in momentum of the ball?

A 0 $kg.m \cdot s^{-1}$
B 4 $kg.m \cdot s^{-1}$
C 8 $kg.m \cdot s^{-1}$
D 16 $kg.m \cdot s^{-1}$ (2)

1.4 What is the IUPAC name of $CH_3CH_2COOCH_3$?

A Ethyl propanoate
B Methyl propanoate
C Methyl propanone
D Butan-2-one (2)

1.5 Consider two organic compounds of alkane group that have the same molecular formula but different boiling points. What is the cause of the difference in their boiling point?

A Hydrogen bonding absence
B Branching
C Chain length
D Functional group (2)

1.6 When but-1-ene reacts with hydrogen bromide (HBr), two structural isomers are produced. Which of the following accurately describes the IUPAC name of the primary product and the type of reaction occurring?

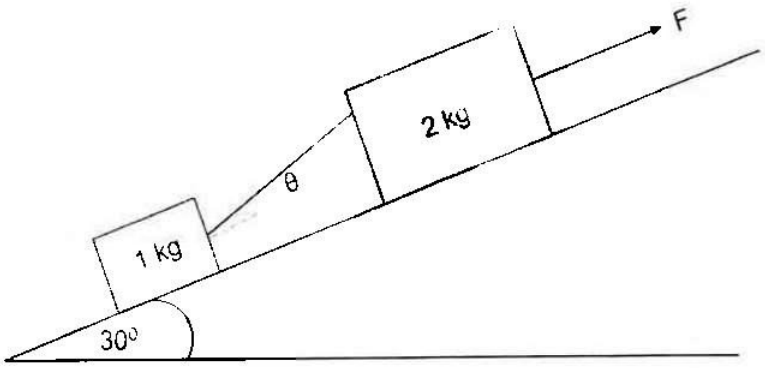
A 1-bromobutane, Substitution
B 2-bromobutane, Addition
C 1-bromobutane, Addition
D 2-bromobutane, Substitution (2)

[12]

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QUESTION 2: (Start on a new page.)

A 1kg block and a 2 kg block are placed on a frictionless plane inclined at 30° to the horizontal. The two blocks are connected by a light, inextensible string that makes an angle θ with the surface of the incline. A constant force, F, is applied to the 2 kg block, pulling the system up the plane.



2.1 State *Newton's Second Law of Motion* in words (2)

2.2 Draw a labelled free-body diagram for the 2 kg block whilst in motion. (4)

2.3 Calculate the magnitude of the Normal force acting on the 2 kg block if the vertical component of tension (perpendicular to the plane) is **12,94 N** (4)

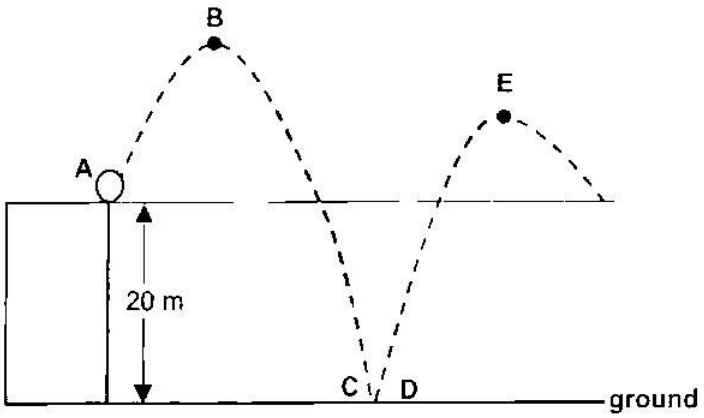
2.4 How will an increase in the angle **θ** affect the magnitude of the Normal force exerted on the 1 kg block? Choose between INCREASE, DECREASE, or REMAIN THE SAME. Give a reason for your answer. (3)

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QUESTION 3 (Start on a new page)

A ball is projected vertically upwards from the edge of the cliff at 12 $m.s^{-1}$. The ball strikes the ground and bounces vertically upwards, reaching a maximum height at point E. The height of the cliff is 20 m as shown in the diagram below.



3.1 Explain what is meant by a *projectile*. (2)

3.2 Calculate the:

3.2.1 Time taken by the ball to reach maximum height (at point B). (3)

3.2.2 Time taken for the ball to reach the ground from the moment it was projected (4)

3.3 Give an equation for a position versus time graph from the moment the ball was projected until in reaches the ground in the form $y = ax^2 + bx + c$ Take the ground as zero position.0 (3)

3.4 Sketch the velocity-time graphs of the entire motion for ball from the moment the ball was projected until it reaches the maximum height at point **E**. Clearly indicate the following on the graphs:

- The initial velocity of the ball
- The time at which the ball reaches the maximum height at **B** (3)

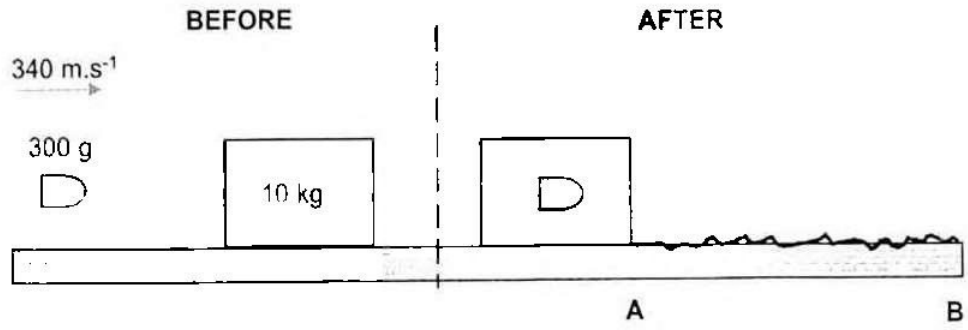
3.5 Use Newton's Laws and the necessary formulae to explain why free falling objects of different weights have the same acceleration. (3)

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QUESTION 4: (Start on a new page.)

A bullet with a mass of **300 g** is fired horizontally with a velocity of **340 m.s^{-1}** to the right toward a stationary wooden block of mass **10 kg**. The bullet embeds itself in the block. The combined bullet–block system then moves together across a rough horizontal surface from point **A** to point **B** in a **third quarter** of a second as shown in the diagram below. The bullet–block system comes to a standstill when it reaches point **B**



4.1 **Describe** the term *linear momentum.* (2)

4.2 **Calculate** the final velocity of the bullet-block system after collision. (4)

4.3 **Calculate** the average net force exerted by the rough surface on the bullet-block system during given time interval. (4)

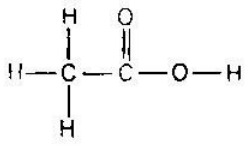
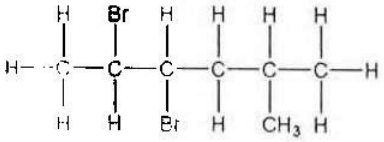
4.4 Sketch a labeled vector diagrams (not to scale) to illustrate the relationship among the initial momentum (p_i), final momentum (p_f) and change in momentum (Δp) for the bullet. (3)

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QUESTION 5: (Start on a new page.)

A to **F** in the table below represent six organic compounds.

A		**B**	5-ethylhept-2-ene
C	$C_5H_{12}O$	**D**	
E	2,2-dimethylpropanol	**F**	$CH_3(CH_2)_2CH_3$

5.1 Define the term *molecular formula*. (2)

5.2 Write down the:

5.2.1 Letter that represents an UNSATURATED hydrocarbon (1)

5.2.2 The type of alcohol to which compound **E** belongs. Choose from PRIMARY, SECONDARY or TERTIARY (1)

5.2.3 IUPAC name of compound **D** (3)

5.3 For compound **A**, write down the

5.3.1 Homologous series to which compound **A** belongs (1)

5.3.2 NAME or FORMULA of the inorganic product formed when an alcohol and compound **A** are heated in the presence of concentrated sulphuric acid to form an ester. (1)

5.4 Write the STRUCTURAL formula of compound **B** (2)

5.5 Write condensed structural formula of **2,2-dimethyl propane.** (2)

5.6 A chemical analysis of a compound, $C_nH_{2n}O_2$, shows that it contains 16% oxygen by mass. Calculate the percentage of carbon in the compound.0 (5)

5.7 Using MOLECULAR FORMULAE, write down a balanced equation for the reaction of compound **F** with excess oxygen. (3)

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QUESTION 6: (Start on a new page.)

The table below shows four organic compounds represented by the letters A to D and their boiling points.

Compound	Molecular Formula	Homologous series	Boiling Point (°C)
A	C_4H_8	Alkene	–6 °C
B	C_4H_8O	Aldehyde	75 °C
C	C_4H_8O	Ketone	80°C
D	$C_4H_8O_2$	Carboxylic acid	164 °C

6.1 Define homologous series. (2)

6.2 Write down the IUPAC name of a structural isomer of compound A that will react with H_2O in the presence of an acid catalyst to produce butan-2-ol as the only organic product? (1)

6.3 Consider compound **B** and **C** in the table above.

6.3.1 Write down the independent variable for this investigation. (1)

6.3.2 Write down a possible investigative question that compares the physical properties of the two compounds. (2)

6.4 Consider the investigation as per table above.

6.4.1 Describe the trend in the boiling points from compound **B** to **D**. (1)

6.4.2 Fully explain the answer to QUESTION 6.4.1 considering compound C and D (2)

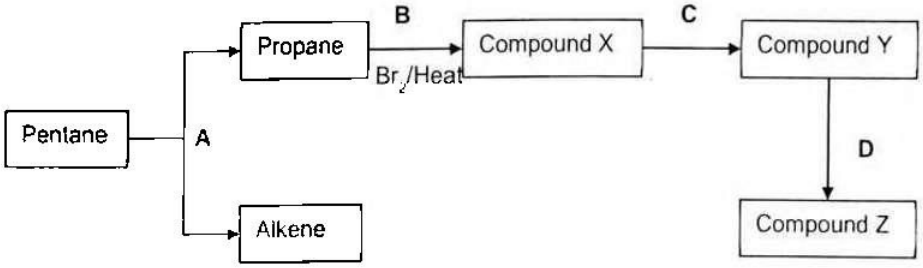
6.5 Write down the structural formula of the functional group of **B** (1)

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QUESTION 7: (Start on a new page.)

The flow diagram below shows the preparation of an alkene and alcohol using pentane as a starting reagent. **A**, **B**, **C** and **D** represent different organic reactions.



7.1 Name the homologous series to which **pentane** belongs. (1)

7.2 Reaction **A** involves the cracking of pentane.

7.2.1 Define the term *cracking*. (2)

7.2.2 Give **one** reaction condition required for thermal cracking. (1)

7.3 Consider Reaction **B**: Propane reacts with Br_2 in the presence of heat to form a major product, Compound **X**.

7.3.1 Name the type of reaction that occurs. (1)

7.3.2 Write down the IUPAC name of the **major** product (Compound **X**). (2)

7.4 In reaction **C**, Compound **X** is heated with **concentrated** sodium hydroxide in ethanol to form Compound **Y**. (2)

7.4.1 Identify the type of reaction taking place. (1)

7.4.2 Write the STRUCTURAL formula of compound **Y**. (2)

7.5 In reaction **D**, compound **Y** is reacted with excess water in the presence of an acid catalyst to form compound **Z**.

7.5.1 Write down the IUPAC name of compound **Z**. (1)

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TOTAL: [100]

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DATA FOR PHYSICAL SCIENCES GRADE 12
PAPER 1 (PHYSICS)

TABLE 1: PHYSICAL CONSTANTS / TABEL 1: FISIESE KONSTANTES

NAME / NAAM	SYMBOL / SIMBOOL	VALUE / WAARDE
Acceleration due to gravity *Swaartekragversnelling*	g	9,8 $m \cdot s^{-2}$
Universal gravitational constant *Universele gravitasiekonstante*	G	$6,67 \times 10^{-11}$ $N \cdot m^2 \cdot kg^{-2}$
Speed of light in a vacuum *Spoed van lig in 'n vakuum*	c	$3,0 \times 10^8$ $m \cdot s^{-1}$
Planck's constant *Planck se konstante*	h	$6,63 \times 10^{-34}$ $J \cdot s$
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
Mass of Earth *Massa van Aarde*	M	$5,98 \times 10^{24}$ kg
Radius of Earth *Radius van Aarde*	R_E	$6,38 \times 10^6$ m

TABLE 2: FORMULAE / TABEL 2: FORMULES

MOTION / BEWEGING

$v_f = v_i + a\Delta t$	$\Delta x = v_i\Delta t + \frac{1}{2}a\Delta t^2$ or/of $\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$
$v_f^2 = v_i^2 + 2a\Delta x$ or/of $v_f^2 = v_i^2 + 2a\Delta y$	$\Delta x = \left(\frac{v_i + v_f}{2}\right)\Delta t$ or/of $\Delta y = \left(\frac{v_i + v_f}{2}\right)\Delta t$

FORCE / KRAG

$F_{net} = ma$	$p = mv$
$f_s^{max} = \mu_s N$	$f_k = \mu_k N$
$F_{net}\Delta t = \Delta p$ $\Delta p = mv_f - mv_i$	$w = mg$
$F = G\frac{m_1 m_2}{d^2}$ or/of $F = G\frac{m_1 m_2}{r^2}$	$g = G\frac{M}{d^2}$ or/of $g = G\frac{M}{r^2}$

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DATA FOR PHYSICAL SCIENCES
GRADE 12 PAPER 2 (CHEMISTRY)

GEGEWENS VIR FISIESE WETENSKAPPE
GRAAD 12 VRAESTEL 2 (CHEMIE)

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

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

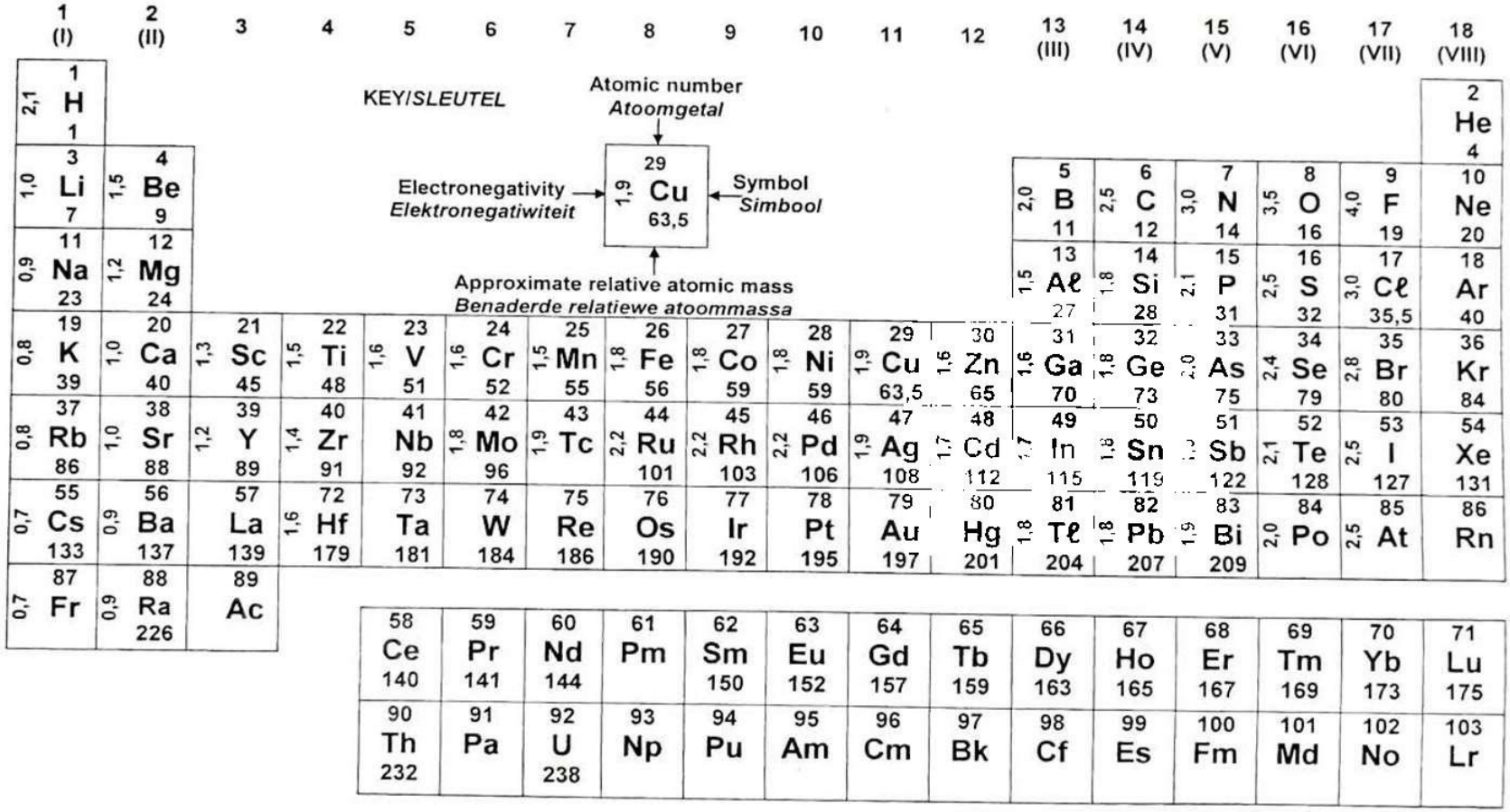
TABLE 2: FORMULAE / *TABEL 2: FORMULES*

$n = \frac{m}{M}$	$n = \frac{N}{N_A}$
$c = \frac{n}{V}$ OR $c = \frac{m}{MV}$	$n = \frac{V}{V_m}$
$\frac{c_a V_a}{c_b V_b} = \frac{n_a}{n_b}$	pH = -log[H_3O^+]
$K_w = [H_3O^+][OH^-] = 1 \times 10^{-14}$ at 298 K	

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TABLE 3: THE PERIODIC TABLE OF ELEMENTS



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