PROVINCE OF THE EASTERN CAPE EDUCATION

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GRADE 12

PHYSICAL SCIENCES

20 MARCH 2025

MARKS: 100
TIME: 2 HOURS

INSTRUCTIONS AND INFORMATION.

1. This question paper consists of 7 questions. Answer ALL the questions in the ANSWER BOOK.
2. Number the answers correctly according to the numbering system used in this question paper.
3. Leave ONE line between two sub-questions, e.g. between QUESTION 2.1 and QUESTION 2.2.
4. You may use a non-programmable calculator.
5. You may use appropriate mathematical instruments.
6. Show ALL formulae and substitutions in ALL calculations.
7. Round off your FINAL numerical answers to a minimum of TWO decimal places.
8. Give brief motivations, discussions etc. where required.
9. You are advised to use the attached DATA SHEETS.
10. Write neatly and legibly.

This Question Paper consists of 12 pages

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 – 1.7) in your ANSWER BOOK.

1.1 Several forces are acting on a moving object.
Which ONE of the following statements is CORRECT when the object moves with constant velocity?

A The forces acting on the object are not in equilibrium.
B The object has a non-zero net force acting on it.
C The object has a non-zero acceleration.
D The forces acting on the object are in equilibrium. (2)

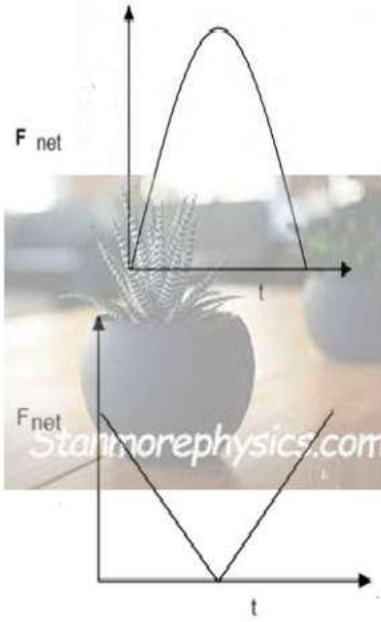
1.2 Which ONE of the following quantities is the tendency of an object to resist a change to its state of motion?

A Acceleration B Inertia

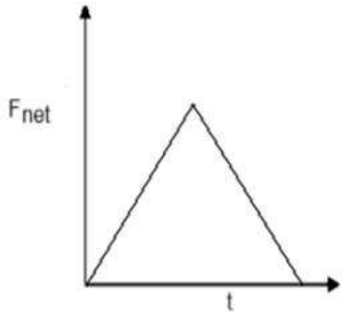
C Impulse D Momentum (2)

1.3 A ball is thrown vertically upwards. Which ONE of the following graphs BEST represents the net force (F_{net}) exerted on the ball against time (t) while the ball is in the air? Ignore the effects of air resistance.

A

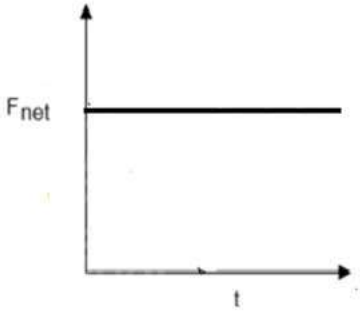


B



C

D



(2)

1.4 A ball moving horizontally has a constant momentum p and kinetic energy K. The ball collides with a wall and bounces back horizontally.
Immediately after collision, the ball has a kinetic energy 1/9 K.
The mass of the ball remains constant.
Which ONE of the following is the momentum of the ball immediately after collision?

A 1/4 p B 1/3 p

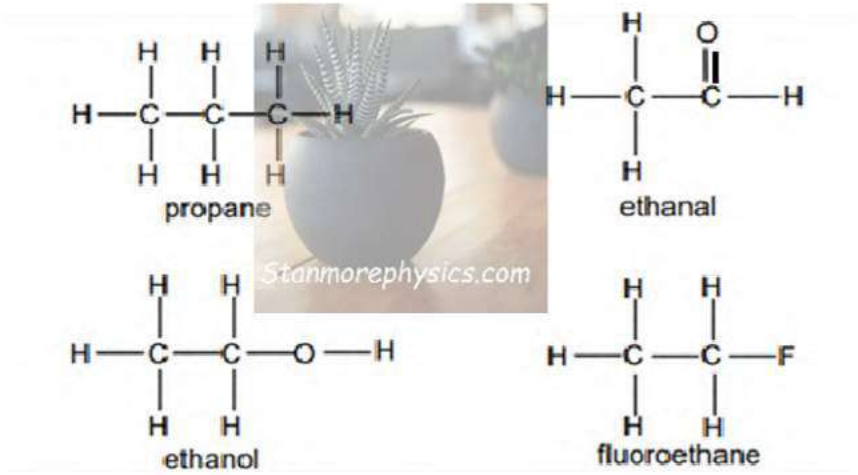
C 1/2 p D p (2)

1.5 The compound $C_5H_{10}O_2$ can be…

I. an alcohol
II. a carboxylic acid
III. an ester

A	Only I	B	I and III	
C	I and II	D	II and III	(2)

1.6 Consider the structural formula and IUPAC name of each compound shown below.



Which ONE of these compounds has the highest vapour pressure at room temperature?

A	Propane	B	Ethanal	
C	Ethanol	D	Fluoroethane	(2)

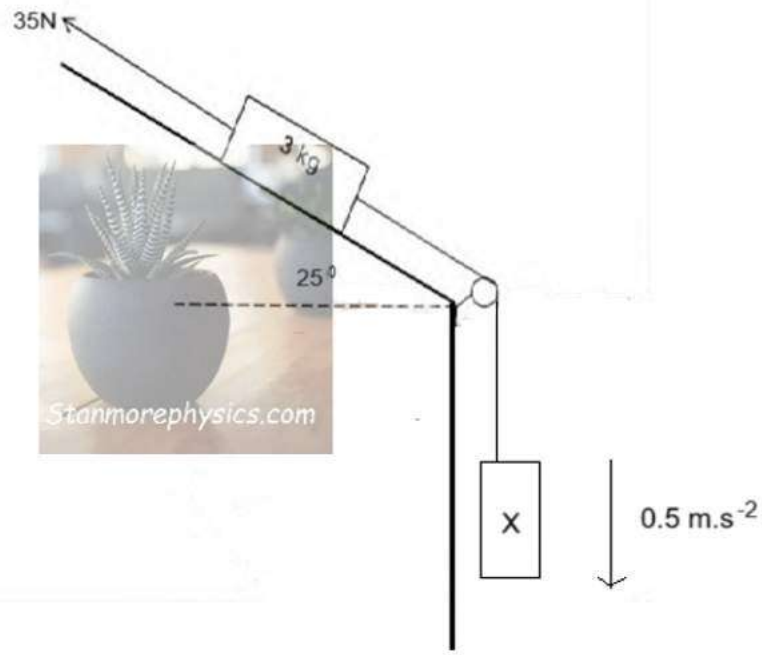
1.7 The addition of hydrogen to an alkene is called….

A	hydrolysis	B	hydration	
C	hydrogenation	D	dehydrogenation	(2)

[14]

2.1 A block of mass 3kg connected with a light inextensible string that is hanging over a frictionless pulley, to another block of mass X as shown in the diagram below.

The 3kg block, placed on an inclined plane at an angle of 25º to the horizontal, is pulled by a constant force of 35N along the incline, while, the block of mass X accelerates at 0.5 $m.s^{-2}$ downward.



The coefficient of kinetic friction between the 3kg block and the surface is 0.2. Ignore the effects of air friction.

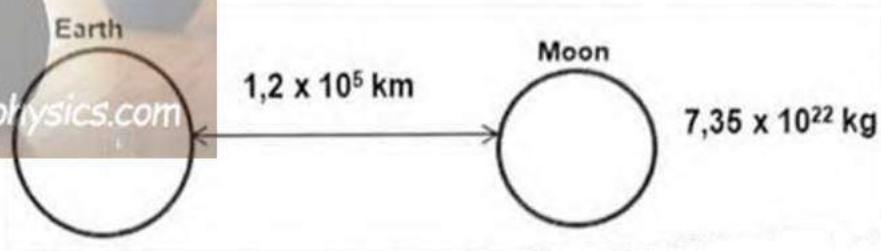
2.1.1 Define the term kinetic friction in words. (2)

2.1.2 Calculate the friction experienced by the 3kg block. (3)

2.1.3 Draw a labelled free body diagram indicating all the forces acting on the 3kg block as it moves. (5)

2.1.4 Calculate X, the mass of the hanging block. (4)

2.2 The Moon which has the mass of 7,35 x 10^{22} kg is 1,2 x 10^{5} km away from Earth as shown in the diagram below.



The gravitational force between the Moon and Earth is 1,91 x 10^{20} N.

2.2.1 State Newton's Law of Universal Gravitation in words. (2)

2.2.2 Calculate the radius of the Moon. (4)
[20]

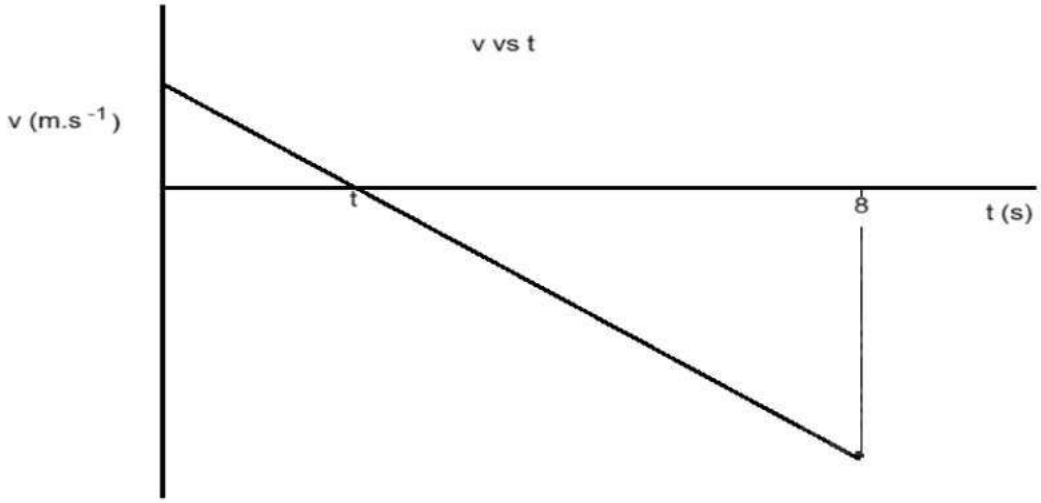
QUESTION 3

A helicopter picks up a package through a cord from the ground as shown below. The package is then pulled up at CONSTANT VELOCITY of 8m.s^{-1}.

3.1 Will the package be considered a projectile while being pulled up?
Write down YES or NO. (1)

3.2 Give a reason for your answer to 3.1. (1)

When the package reaches a certain height ***h,*** the cord breaks, and the package undergoes *free fall*. The motion of the package after the cord breaks until it hits the ground is represented through the velocity-time graph below.



3.3 Calculate:

3.3.1 time t. (3)

3.3.2 the magnitude of the velocity with which the package hits the ground. (3)

3.4 Draw a displacement – time graph for the motion of the package from the moment the cord breaks until it reaches the ground.
TAKE THE GROUND AS THE REFERENCE POINT.

Indicate the following on your graph:

- Time **t**
- Height **h** from which the cord breaks. (4)

[12]

QUESTION 4

A cannon has a mass of 2150 kg and it fires cannonballs during a routine training exercise. Each cannonball travels at a speed of 70m.s-1 to the right when it leaves the cannon.
(Take the initial velocity of the cannonball before being fired, as zero.)

The cannon fires 100 cannon balls per minute. The mass of each cannon ball is 50g.

4.1 Define in words the term impulse (2)

4.2 Calculate the magnitude of:

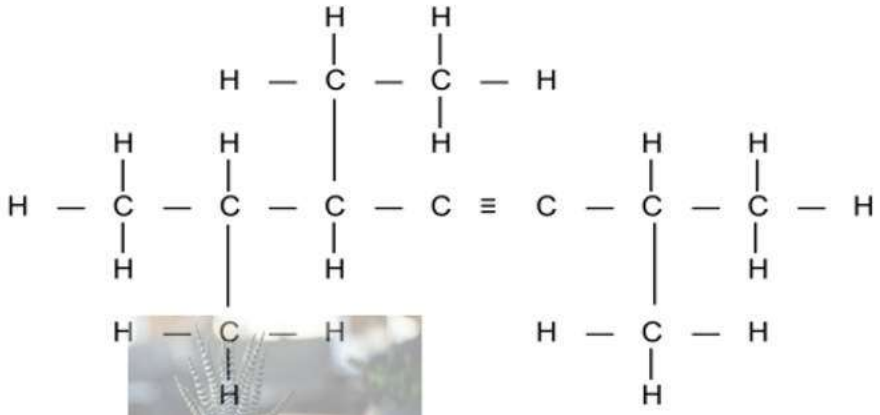
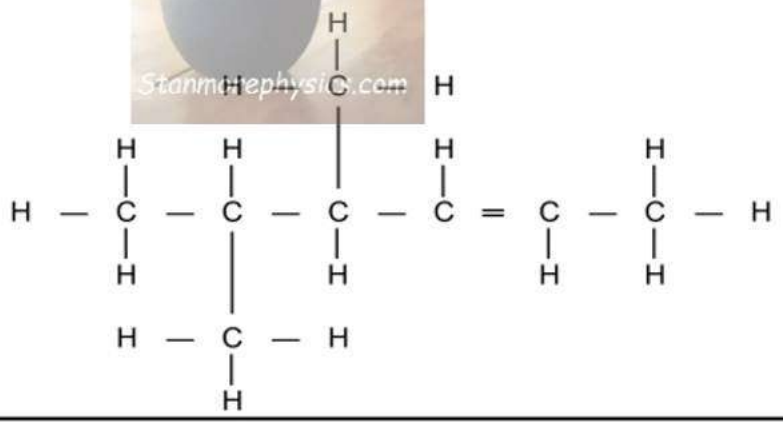
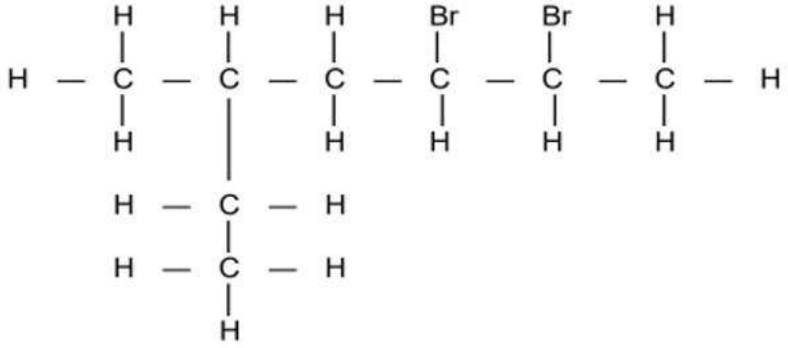
4.2.1 The momentum of each canon ball when it leaves the gun. (3)

4.2.2 The net average force that each cannonball exerts on the cannon. (5)

[10]

QUESTION 5

The letters A to F in the table below represent six organic compounds

A	
B	C_3H_8O
C	C_4H_8O
D	$CH_3CH(CH_3)COCH_2CH_3$
E	
F	

5.1 Write down the LETTER that represents a compound with a formyl group. (1)

5.2 Write down the IUPAC name of the compound:

5.2.1 A (3)

5.2.2 F (2)

5.3 Define the term homologous series. (2)

5.4 Write down the general formula of compound E. (2)

5.5 Write down the STRUCTURAL FORMULAE of the **ISOMERS** of compound C. (4)

5.6 What visible change will be observed when bromine water is added to compound E. (1)

5.7 C_3H_8O (Compound C) reacts with a carboxylic acid X in the presence of a catalyst to produce an organic compound Z that has **six Carbons**.

Write down the:

5.7.1 Type of reaction taking place. (1)

5.7.2 Name or formula of the catalyst used. (1)

5.7.3 Structural formula of compound Z. (2)
[19]

QUESTION 6

Learners use three primary alcohols A, B and C *with the same molecular formula* to investigate ONE of the factors which influences boiling points of organic compounds.

The table below shows the results obtained.

ALCOHOL	BOILING POINT (°C)
A	108
B	149
C	129

6.1 Write down a term that can be used to describe the three alcohols based on the underlined words. (1)

6.2 Define the term boiling point. (2)

6.3 Name the independent variable for this investigation. (1)

6.4 Can the above investigation be described as a fair test? Give a reason for your answer. (2)

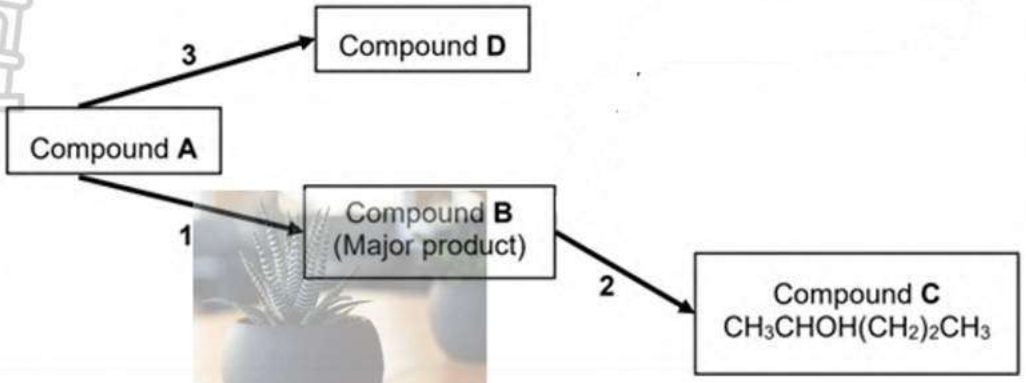
6.5 Which alcohol B or C will have a higher vapour pressure? Fully explain your answer. (4)

6.6 How will the vapour pressure of compound C at 129°C compare to that of compound B at 149°C? (Write only LESS THAN, GREATER THAN or EQUAL TO) (1)

6.7 The molecular mass of B is 88 $g.mol^{-1}$, write down the structural formula of Compound A. (2)
[13]

QUESTION 7

In the flow diagram below 1, 2 and 3 represent organic reactions; A, B, C and D represent organic compounds.



7.1 Compound B has the general formula $C_nH_{2n+1}X$.

7.1.1 Name the homologous series to which Compound B belongs. (1)

7.1.2 Name the type of addition reaction represented by reaction 1. (1)

7.1.3 Using structural formulae write down a balanced equation for reaction 2. (4)

7.2 Inorganic reagent H_2 is used in reaction 3.

7.2.1 Write down one reaction condition needed for reaction 3. (1)

7.2.2 Using molecular formula write down a balanced equation for the complete combustion of compound D. (3)

7.2.3 Draw a sketch graph of potential energy vs time for the reaction in 7.2.2. (2)
[12]

TOTAL : 100

DATA FOR PHYSICAL SCIENCES GRADE 12
PAPER 1 (PHYSICS)

GEGEWENS VIR FISIESE WETENSKAPPE GRAAD 12
VRAESTEL 1 (FISIKA)

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

NAME/*NAAM*	SYMBOL/*SIMBOOL*	VALUE/*WAARDE*
Acceleration due to gravity *Swaartekragversnelling*	g	$9{,}8\ m{\cdot}s^{-2}$
Gravitational constant *Swaartekragkonstante*	G	$6{,}67 \times 10^{-11}\ N{\cdot}m^2{\cdot}kg^{-2}$
Radius of Earth *Radius van Aarde*	R_E R_A	$6{,}38 \times 10^{6}\ m$
Mass of Earth *Massa van Aarde*	M_E M_A	$5{,}98 \times 10^{24}\ kg$
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	$6{,}63 \times 10^{-34}$
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*

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

FORCE/*KRAG*

$F_{net} = ma$	$p = mv$
$F_{net}\Delta t = \Delta p$ $\Delta p = mv_f - mv_i$	$w = mg$
$F = \frac{Gm_1m_2}{r^2}$	$g = \frac{Gm}{r^2}$
$f_s^{max} = \mu_s N$ / $f_s^{maks}\ \mu_s N$	$f_k = \mu_k N$

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 $dm^3 \cdot mol^{-1}$
Standard temperature *Standaardtemperatuur*	T^θ	273 K
Charge on electron *Lading op elektron*	e	$-1{,}6 \times 10^{-19}$ C
Avogadro's constant *Avogadrokonstante*	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/*of* $c = \frac{m}{MV}$	$n = \frac{V}{V_m}$
$\frac{c_a V_a}{c_b V_b} = \frac{n_a}{n_b}$	$pH = -\log[H_3O^+]$

TABLE 3: THE PERIODIC TABLE OF ELEMENTS
TABEL 3: DIE PERIODIEKE TABEL VAN ELEMENTE

KEY/*SLEUTEL*

Atomic number / *Atoomgetal*: 29
Electronegativity / *Elektronegatiwiteit*: 1,9
Symbol / *Simbool*: Cu
Approximate relative atomic mass / *Benaderde relatiewe atoommassa*: 63,5

(Cells: electronegativity; atomic number, symbol, approximate relative atomic mass)

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; 1 H 1																	2 He 4
1,0; 3 Li 7	1,5; 4 Be 9											2,0; 5 B 11	2,5; 6 C 12	3,0; 7 N 14	3,5; 8 O 16	4,0; 9 F 19	10 Ne 20
0,9; 11 Na 23	1,2; 12 Mg 24											1,5; 13 Aℓ 27	1,8; 14 Si 28	2,1; 15 P 31	2,5; 16 S 32	3,0; 17 Cℓ 35,5	18 Ar 40
0,8; 19 K 39	1,0; 20 Ca 40	1,3; 21 Sc 45	1,5; 22 Ti 48	1,6; 23 V 51	1,6; 24 Cr 52	1,5; 25 Mn 55	1,8; 26 Fe 56	1,8; 27 Co 59	1,8; 28 Ni 59	1,9; 29 Cu 63,5	1,6; 30 Zn 65	1,6; 31 Ga 70	1,8; 32 Ge 73	2,0; 33 As 75	2,4; 34 Se 79	2,8; 35 Br 80	36 Kr 84
0,8; 37 Rb 86	1,0; 38 Sr 88	1,2; 39 Y 89	1,4; 40 Zr 91	41 Nb 92	1,8; 42 Mo 96	1,9; 43 Tc	2,2; 44 Ru 101	2,2; 45 Rh 103	2,2; 46 Pd 106	1,9; 47 Ag 108	1,7; 48 Cd 112	1,7; 49 In 115	1,8; 50 Sn 119	1,9; 51 Sb 122	2,1; 52 Te 128	2,5; 53 I 127	54 Xe 131
0,7; 55 Cs 133	0,9; 56 Ba 137	57 La 139	1,6; 72 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; 81 Tℓ 204	1,8; 82 Pb 207	1,9; 83 Bi 209	2,0; 84 Po	2,5; 85 At	86 Rn
0,7; 87 Fr	0,9; 88 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