KWAZULU-NATAL PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA



NATIONAL SENIOR CERTIFICATE

GRADE 10



MARKS: 100

DURATION: 2 hours

This question paper consists of 8 pages, a data sheet and a periodic table.

INSTRUCTIONS AND INFORMATION

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

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QUESTION 1: MULTUPLE-CHOICE QUESTIONS

Various 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 numbers (1.1 to 1.7) in the ANSWER BOOK, e.g. 1.8 D.

1.1 Which one of the following is equal to 1 Hertz (1Hz)?

A 1 m.
B 1 $m.s^{-1}$
C 1 s
D 1 s^{-1} (2)

1.2 A very loud explosion can damage a person's hearing. This provides evidence that sound waves …

A can be reflected.
B transfer energy.
C can travel through a vacuum.
D are longitudinal waves. (2)

1.3 What is the name given to the process by which a solid changes directly into a gas?

A Evaporation.
B Condensation.
C Sublimation.
D Freezing. (2)

1.4 Which ONE of the following combinations shows two elements combining in the same fixed ratio?

A H_2O and H_2O_2
B SO_2 and SO_3
C NO_2 and N_2O_4
D $FeC\ell_2$ and $FeC\ell_3$ (2)

1.5 What volume (in dm^3) does 1 gram of hydrogen gas occupy at STP?

A 5,6
B 11,2
C 22,4
D 44,8 (2)

1.6 What will the formula of compound XY be if it consists of 1 mole of X and 1,5 moles of Y?

A XY_2
B X_2Y
C X_3Y_2
D X_2Y_3 (2)

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1.7 What is the chemical name for $Fe_2(SO_4)_3$?

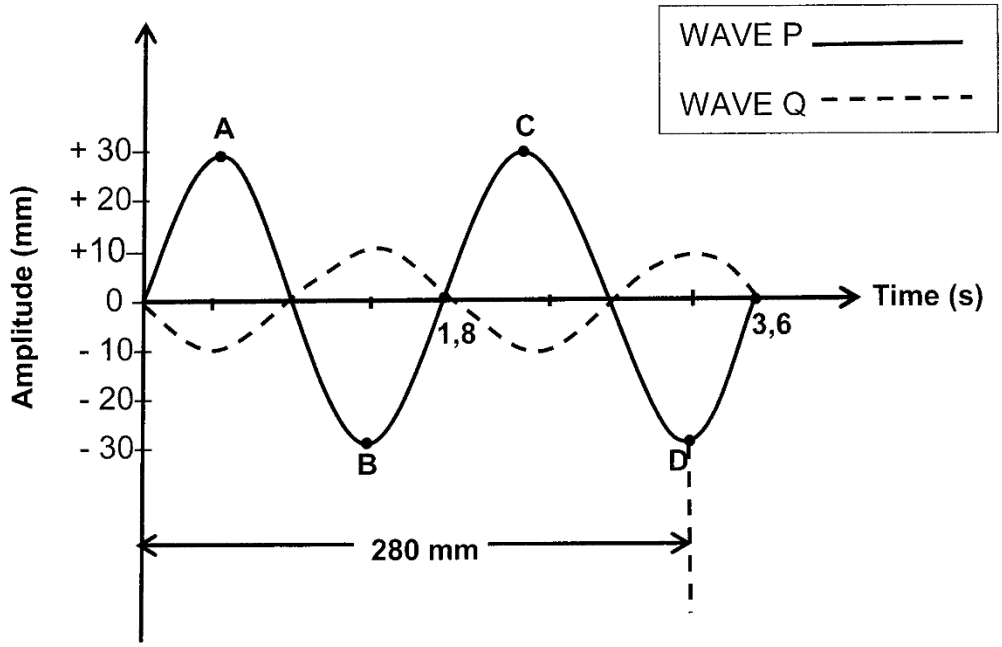
A Iron (II) sulphite
B Iron (II) sulphate
C Iron (III) sulphate
D Iron (III) sulphite



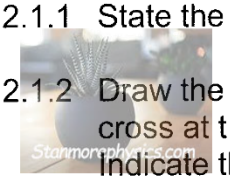
(2)
[14]

QUESTION 2

2.1 The graph below shows two waves **P** and **Q**, that are travelling in the same medium at the same time.



2.1.1 State the Principle of superposition of waves. (2)



2.1.2 Draw the shape of the resultant wave as the two waves (P and Q) cross at t = 1,35s.
Indicate the value of the resultant amplitude on your diagram. (3)

2.1.3 What type of interference is illustrated at t = 1,35s? (1)

2.1.4 Refer to **wave P** and give TWO reasons why a particle at point A and another particle at point C are in phase. (2)

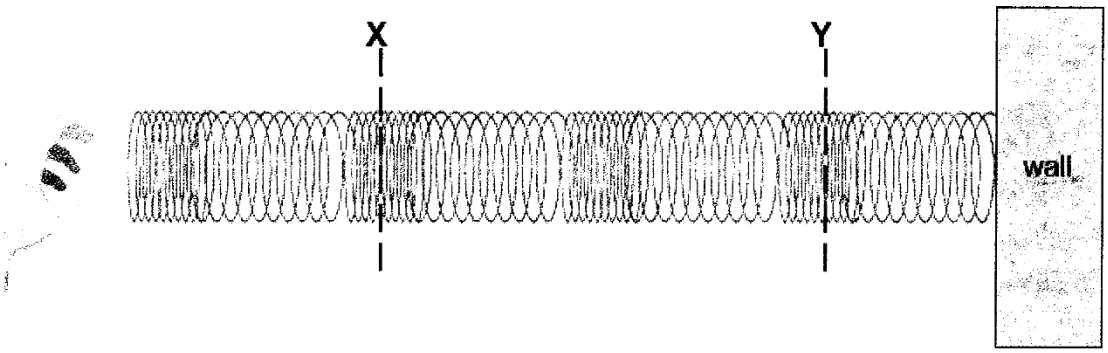
2.1.5 Determine the frequency of **wave Q**. (3)

2.1.6 Calculate the value of the wavelength of **wave Q**. (3)

2.1.7 Calculate the speed of **wave Q**. (3)

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2.2 A learner uses a slinky spring to demonstrate the movement of a LONGITUDINAL WAVE. The slinky spring is fixed to a wall at one end while it is held at the other end. He vibrates the spring using his hand.



2.2.1 Describe the hand movement that would be required in order to produce the wave pattern in the sketch above. Choose from PERPENDICULAR TO or PARALLEL TO the medium. (1)

2.2.2 Explain the answer to Question 2.2.1. (1)

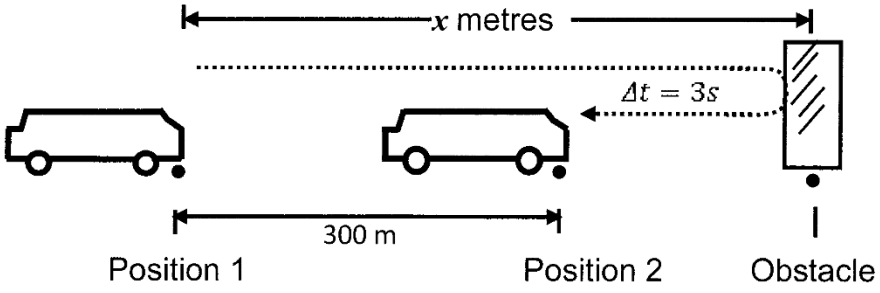
2.2.3 Calculate the period of the wave if it takes 5 seconds for a disturbance to move from position X to position Y. (3)

2.2.4 What will happen to the disturbance mentioned in Question 2.2.3 immediately AFTER striking the wall?
Choose from MOVES TO THE LEFT, MOVES TO THE RIGHT or STOPS MOVING. (1)
[23]

QUESTION 3

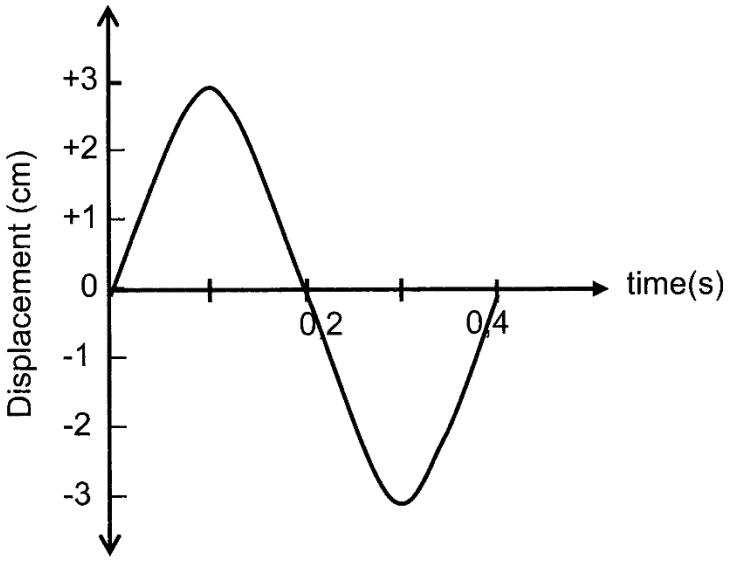
3.1 Define the term *echo*. (2)

3.2 A motorist of a moving car sees an obstacle on the road ahead when he is at position 1 as indicated in the diagram below. Position 1 is x metres away from the obstacle. He sounds the car hooter while at position 1 and receives an echo 3 seconds later at position 2. The distance between position 1 and position 2 is 300m.



If the speed of sound in air is 340 m.s^{-1} SHOW BY CALCULATION that the distance between position 2 and the obstacle is 360m. (5)

3.3 The diagram below shows the waveform produced by a pure sound note.



The LOUDNESS of this sound note is now DECREASED to ONE-THIRD of its original value and the PITCH is HALVED.

3.3.1 What is the value (in cm) of the new maximum displacement of particles in the medium? (2)

3.3.2 What is the value (in seconds) of the new period? (2)

3.3.3 Explain the answer to Question 3.3.2. (2)

3.4 What is the frequency range for medical equipment that use ultrasound? (1)
[14]

QUESTION 4

4.1 Study the following physical and chemical processes below. Substances X, Y and Z are either reactants used or products formed during each process.

PROCESS I: Silver nitrate is used in the manufacture of glass mirrors.
$2AgNO_3(s) + Heat \rightarrow 2X + 2NO_2(g) + O_2(g)$

PROCESS II: Carbon monoxide fumes from a motor car engine is released into the atmosphere and forms carbon dioxide.
$CO(g) + Y \rightarrow 2CO_2(g) + Heat$

PROCESS III: A block of ice melts completely.
$H_2O(s) \rightarrow Z$

Write down the:

4.1.1 symbol for substance X (1)

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4.1.2 phase in which substance X exists (1)

4.1.3 formula for substance Y (1)

4.1.4 name of substance Z (1)

4.1.5 process that represents a synthesis reaction
Write down either I, II or III (1)

4.1.6 process that represents a decomposition reaction.
Write down either I, II or III. (1)

4.2 A learner performed two experiments at two different temperatures. One experiment was carried out at 30°C and the other at 50°C.
In both experiments 178,50g of potassium bromide was reacted with 53,50g of iron (III) hydroxide to produce potassium hydroxide and iron III bromide.

EXPERIMENT	TEMPERATURE (° C)	MASS OF POTASSIUM HYDROXIDE FORMED (grams)	MASS OF IRON (III) BROMIDE FORMED (grams)
1	30	84	(i)
2	50	84	(ii)

4.2.1 Write down a balanced equation for the reaction between potassium bromide and iron (III) hydroxide. (3)

4.2.2 Write down the value of (i). (1)

4.2.3 How will the mass (ii) formed in experiment 2 compare to the mass (i) formed in experiment 1?
Choose from MORE THAN (i), LESS THAN (i) or THE SAME AS (i). (1)

4.2.4 Explain the answer to Question 4.2.3 by referring to a relevant law in chemistry. (3)
[14]

QUESTION 5

5.1 Define the mole in terms of Avogadro's *number of particles.* (2)

5.2 Determine the number of oxygen atoms in 9,8g of H_2SO_4. (5)

5.3 The percentage hydrogen in a 34g sample of H_2O_2 is found to be 5,88%.

5.3.1 How will the percentage hydrogen be affected if the mass of the H_2O_2 sample is increased from 34g to 68g?
Choose from INCREASES, DECREASES or REMAINS THE SAME. (1)

5.3.2 NAME the law that was applied in Question 5.3.1. (1)

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5.4 A learner prepares a solution of NaOH of concentration 0,22 mol.dm^{-3}. She does this by dissolving 4,4g of NaOH in distilled water.

5.4.1 Define the term *concentration*. (2)

5.4.2 Determine the volume of the solution required to prepare the 0,22 mol.dm^{-3} solution. (4)

[15]

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QUESTION 6

A learner analysed a 100g sample of hydrated aluminium chloride ($A\ell C\ell_3 \cdot \mathbf{n}H_2O$) and found that 44,72g of the sample was composed of water.

6.1 Define the term *water of crystallization*. (2)

6.2 Determine the value of **n** in the $A\ell C\ell_3 \cdot \mathbf{n}H_2O$. (5)

6.3 Determine the percentage hydrogen in the 100g sample. (3)

[10]



QUESTION 7

Ammonium chloride reacts with calcium hydroxide according to the following balanced equation.

$$2NH_4C\ell(s) + Ca(OH)_2(s) \longrightarrow 2NH_3(g) + CaC\ell_2(s) + 2H_2O(\ell)$$

If 5,60g of $Ca(OH)_2$ is used up completely in this reaction, calculate:

7.1 the number of moles of $NH_4C\ell$ required for the reaction (3)

7.2 the volume of NH_3 gas formed at STP (4)

7.3 the percentage yield of NH_3 gas if 2,90 dm^3 of NH_3 is actually produced (3)

[10]

TOTAL MARKS: 100

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PHYSICAL CONSTANTS: PHYSICS

NAME	SYMBOL	VALUE
Acceleration due to gravity *Swaartekragversnelling*	g	$9,8\ m{\cdot}s^{-2}$
Speed of light in a vacuum *Spoed van lig in 'n vacuum*	c	$3,0 \times 10^{8}\ m{\cdot}s^{-1}$
Planck's constant *Planck se konstante*	h	$6,63 \times 10^{-34}\ J{\cdot}s$

FORMULAE: WAVES, SOUND AND LIGHT

$v = f\lambda$	$T = \frac{1}{f}$
$v = \frac{\Delta x}{\Delta t}$	$E = hf$
$c = f\lambda$	$E = h\frac{c}{\lambda}$

PHYSICAL CONSTANTS: CHEMISTRY

NAME	SYMBOL	VALUE
Avogadro's constant	N_A	$6,02 \times 10^{23}\ mol^{-1}$
Molar gas volume at STP	V_m	$22,4\ dm^3{\cdot}mol^{-1}$
Standard temperature	T^{θ}	273 K
Standard pressure	p^{θ}	$1,013 \times 10^{5}\ Pa$

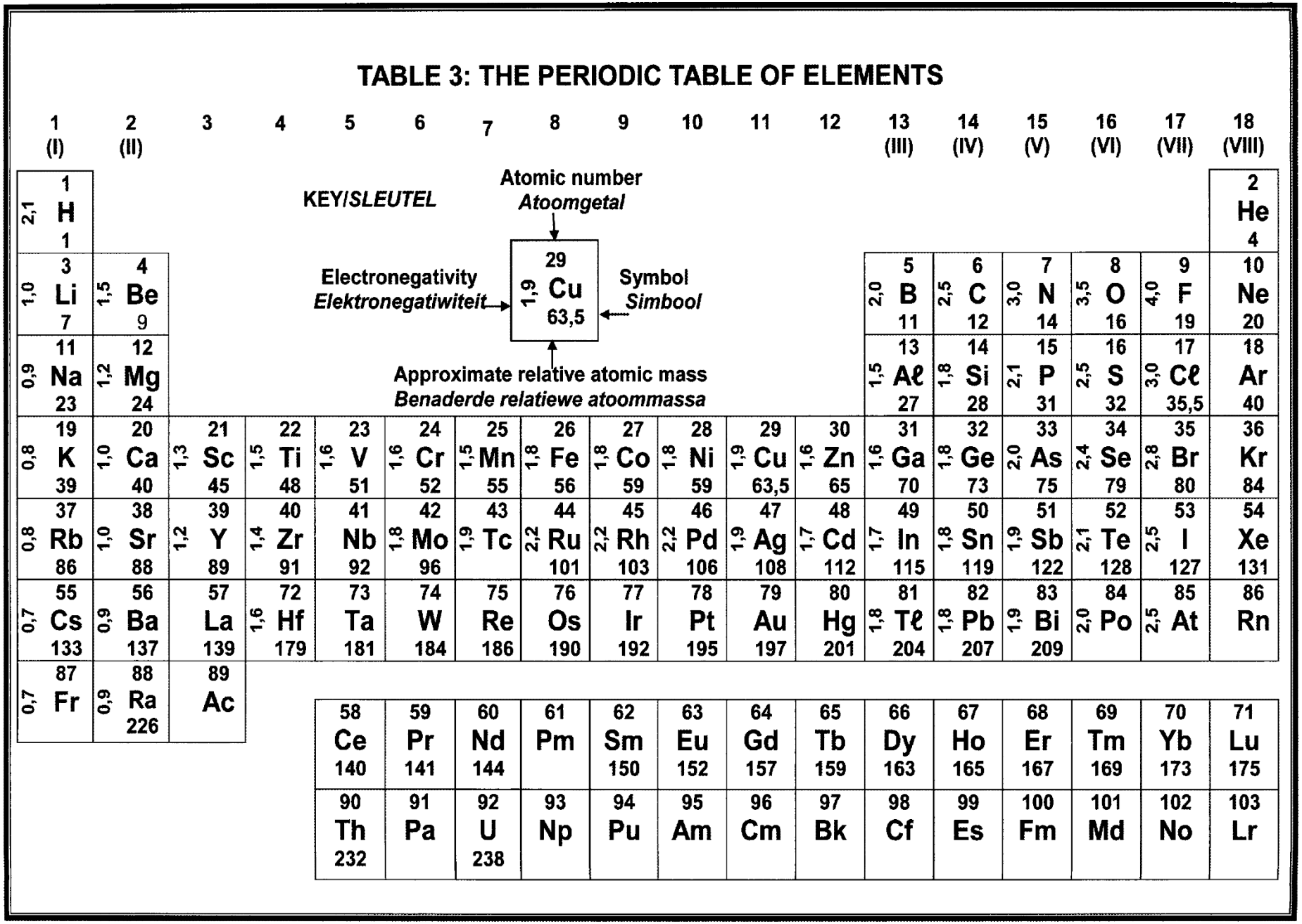
FORMULAE: CHEMISTRY

$n = \frac{m}{M}$	$c = \frac{n}{V}$ or $c = \frac{m}{MV}$	$n = \frac{V}{V_m}$	$n = \frac{N}{N_A}$

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