



Rewarding Learning

General Certificate of Secondary Education
2024–2025

Centre Number

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Candidate Number

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Single Award Science: Chemistry

Unit 2

Foundation Tier



[GSA21]

GSA21

MONDAY 19 MAY 2025, MORNING

TIME

1 hour.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.

You must answer the questions in the spaces provided.

Do not write outside the boxed area on each page or on blank pages.

Complete questions in black ink and use a dark HB pencil for drawings and graphs.

Do not write with a gel pen.

Answer **all ten** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 60.

Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.

You may use a scientific calculator.

Quality of written communication will be assessed in Question 9.

A Data Leaflet, which includes a Periodic Table of the Elements, is included in this question paper.

14883



20GSA2101

- 1 (a) Given below are three materials and some of their uses.
Use lines to match each material to its use.

Material

wool

glass

steel

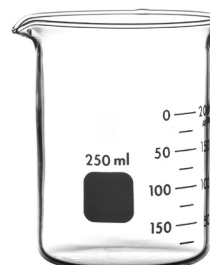
Use



fork



hat



beaker

[2]



- (b) Use ticks (✓) to complete the table below to show if each material is natural or synthetic.

Material	Natural	Synthetic
wool		
nylon		
wood		
plastic		

[2]

The frames of most sunglasses are made from plastic.



- (c) Give two reasons why plastic is more suitable than metal to use in the frames of sunglasses.

Circle **two** answers.

lightweight : good conductor of heat : does not rust
shatters easily : heavy

[2]

- (d) Some materials produce new properties when their particle size is reduced. What name is given to this **type** of material?

Choose from:

nanomaterial synthetic material smart material

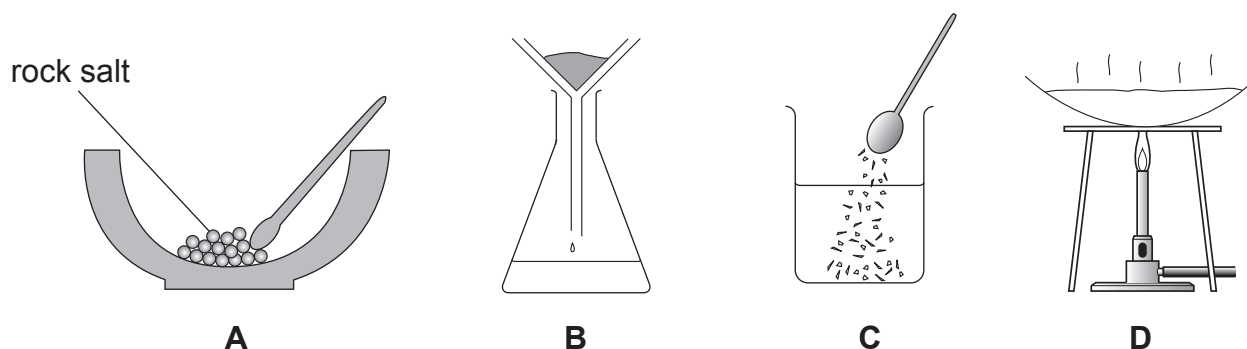
[1]

[Turn over



2 Rock salt is a mixture of salt and sand.

The diagrams below show the steps used to separate a sample of pure salt from rock salt. The steps are **not** in the correct order.



(a) Use the letters, **A**, **B**, **C** and **D**, to put the steps in the correct order.

_____ [2]

(b) Which step, **A**, **B**, **C** or **D**, uses evaporation?

_____ [1]

(c) Complete the sentences below about dissolving.

Choose from:

soluble

insoluble

solvent

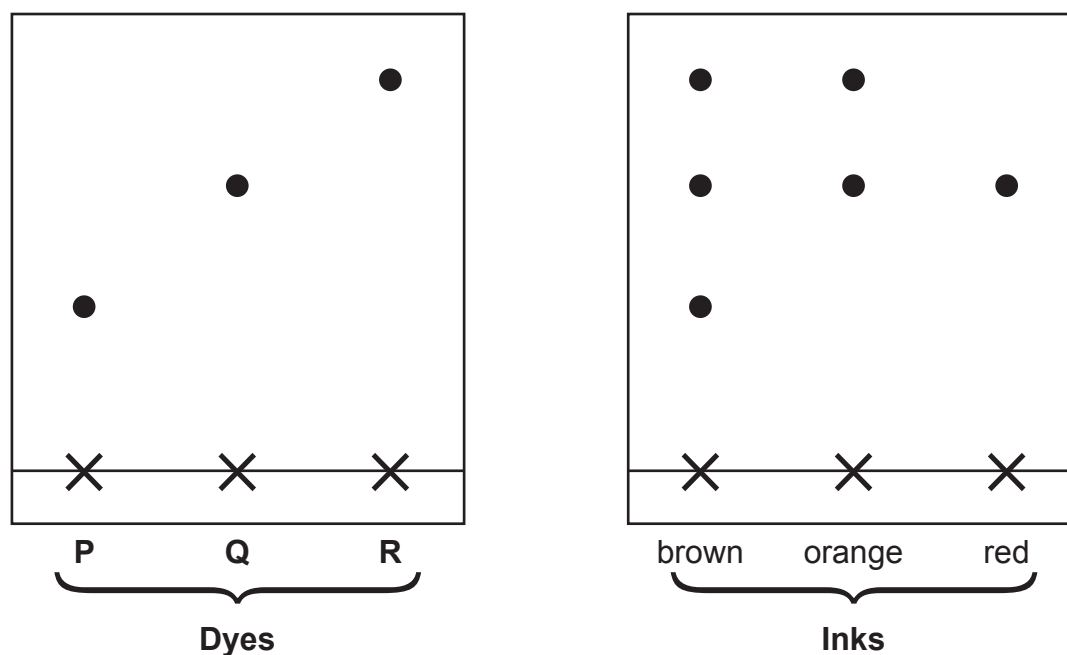
solution

Salt dissolves in water because salt is _____.

Water is the _____ because it dissolves the salt. [2]



- (d) The chromatograms below show the dyes **P**, **Q** and **R** that make up the different coloured inks brown, orange and red.



- (i) The red ink only contains one dye. Which dye, **P**, **Q** or **R**, does red ink contain?

_____ [1]

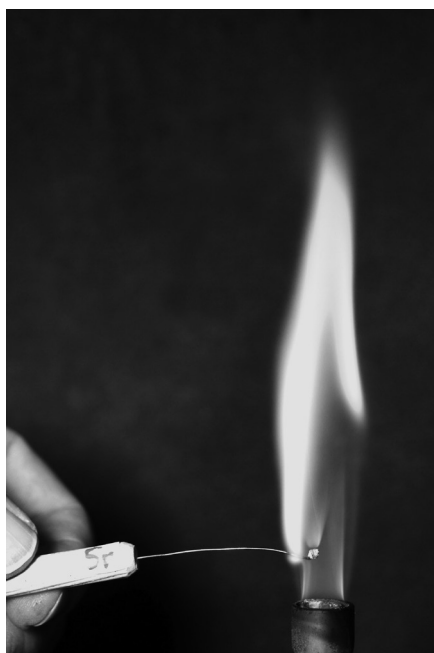
- (ii) Which dye, **P**, **Q** or **R**, is the most soluble?

_____ [1]

[Turn over



- 3 The photograph below shows a teacher demonstrating a flame test to his class.



- (a) What colour of Bunsen burner flame should be used to carry out the flame test?

_____ [1]

- (b) The teacher wants to test two different chemicals using the same piece of nichrome wire. Describe how he should **clean** the wire between tests.

_____ [2]

- (c) Complete the table below about flame colours for different metal ions.

Metal ion	Flame colour
calcium	
	blue-green

[2]



4 Below is an outline of the modern Periodic Table.

The letters **A**, **B**, **C**, **D** and **E** represent the positions of some elements.

A 10x10 grid representing a simplified periodic table. The grid is divided into three main sections: a 2x2 block on the left, a large central block, and a 4x2 block on the right. The central block is 10 columns wide and 4 rows high. The right block is 4 columns wide and 4 rows high. The letters A, B, C, D, and E are placed in specific cells: A is in the top-right cell of the right block; B is in the second row, second column of the central block; C is in the second row, seventh column of the central block; D is in the third row, eighth column of the central block; and E is in the fourth row, first column of the central block.

Use **only** the elements shown above to answer the following questions.

(a) Which letter, **A**, **B**, **C**, **D** or **E**, shows the position of:

an alkali metal? _____

a non-metal element? _____

a Period 5 element? _____

[3]

(b) Complete the following sentences.

The first periodic table was produced in 1869 by the Russian scientist, Dmitri Mendeleev. His table did not include Group 0 elements, called the _____ gases, because they had not been discovered at that time.

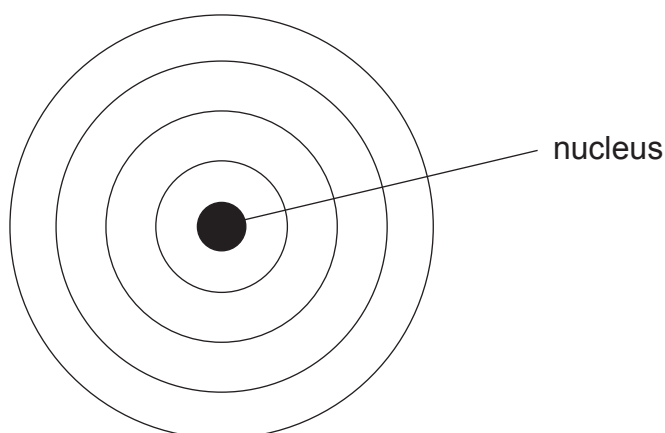
[1]

[Turn over



5 An atom of potassium has 19 electrons.

(a) Complete the diagram below to show the electronic configuration (structure) of a potassium atom.



[1]

(b) How many electrons does a potassium atom lose to become a potassium ion?

_____ [1]

(c) The compound potassium sulfate has the formula K_2SO_4 .

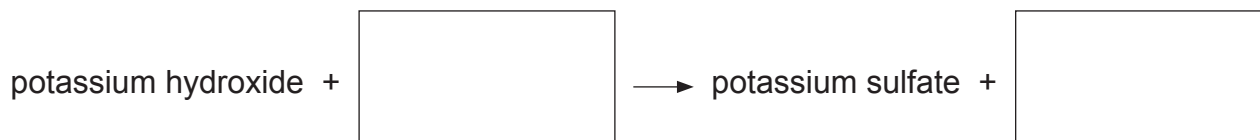
(i) How many elements are present in K_2SO_4 ?

_____ [1]

(ii) How many atoms are represented by the formula K_2SO_4 ?

_____ [1]

(d) Potassium sulfate can be made from the reaction of an alkali with an acid.
Complete the word equation below to show the formation of potassium sulfate.



[2]



6 (a) The table below gives the colour of four indicators at different pH values.

Indicator	pH value													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
methyl red	R	R	R	R	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
universal	R	R	O	O	Y	Y	G	B	B	I	I	I	V	V
alizarin yellow	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	R	R	R
thymol blue	Y	Y	Y	Y	Y	Y	Y	Y	B	B	B	B	B	B

Key

R = Red O = Orange Y = Yellow G = Green B = Blue I = Indigo V = Violet

Use this information and your knowledge to answer the following questions.

(i) What colour is alizarin yellow indicator in a strong alkali?

_____ [1]

(ii) What colour is universal indicator in hydrochloric acid?

_____ [1]

(iii) Name the indicator that is the same colour over the largest pH range.

_____ [1]

(b) A scientist is adding an alkali to an acid and needs to stop when the pH is 7.

(i) What name is given to this **type** of reaction?

_____ [1]

(ii) Explain why universal indicator is the **best** indicator to show when the mixture is pH 7.

_____ [1]

[Turn over



- 7 A student wanted to find the rate of reaction between magnesium and hydrochloric acid. The word equation for this reaction is given below.

magnesium + hydrochloric acid → magnesium chloride + hydrogen

- (a) Use **one** of the chemicals from the word equation above to complete the following sentence.

To find the rate of this reaction the student could measure the volume of

_____ produced in a given period of time. [1]

- (b) This reaction is exothermic. What is meant by the term **exothermic**?

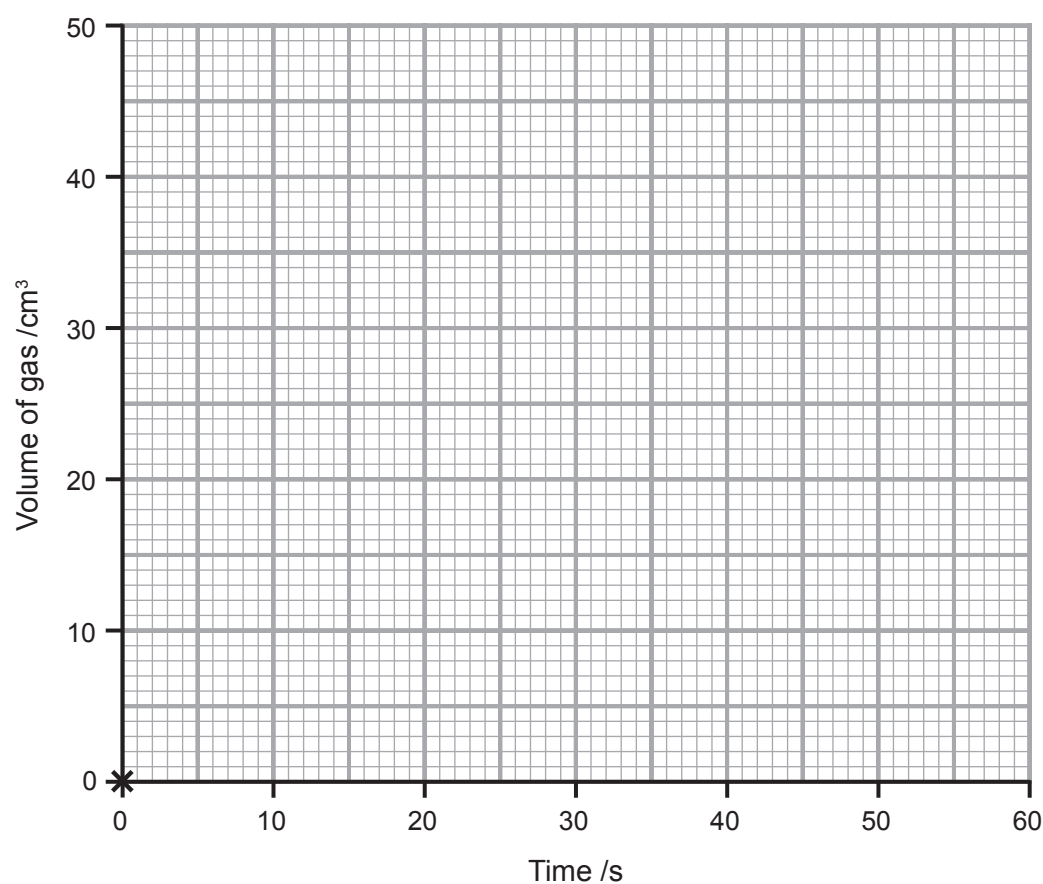
_____ [1]



- (c) The table below shows the volume of gas produced during this reaction over 60 seconds.

Time /s	0	10	20	30	40	50	60
Volume of gas /cm ³	0	18	34	45	48	48	48

- (i) On the grid below plot and draw a line graph for these results.
The first point has been plotted for you.



[3]

- (ii) Describe fully the trend shown by these results.

[2]

[Turn over]



- 8 In recent years local councils have tried to reduce the amount of waste produced. In 2005, **1 064 090** tonnes of waste were produced and in 2020, **913 546** tonnes of waste were produced.

(a) Calculate the decrease in the amount of waste produced from 2005 to 2020.

_____ tonnes [1]

- (b) Local councils also tried to increase the amount of waste that is recycled. The table below shows the recycling targets that were set by local councils and the percentages of waste actually recycled between 2005 and 2020.

Year	Waste recycling target /%	Waste actually recycled /%
2005	15.0	17.0
2010	35.0	35.5
2015	40.0	41.0
2020	45.0	52.0

- (i) Give **one** trend shown by this information.

_____ [1]

- (ii) In which year did local councils **exceed** their target by the greatest percentage?

_____ [1]



(c) It is important to recycle plastics because most are non-biodegradable.

(i) What is meant by the term **non-biodegradable**?

[1]

(ii) Explain why it is important to reduce the amount of waste being sent to landfill.

[1]

[Turn over



9 Sodium and potassium are alkali metals that react with cold water. Describe how a teacher could demonstrate these reactions to their students.

Your answer should include:

- how to carry out the demonstration safely;
- **two** similarities in the observations made during these reactions; and
- **two** differences in the observations made during these reactions.

In this question you will be assessed on the quality of your written communication skills, including the use of specialist scientific terms.

[6]



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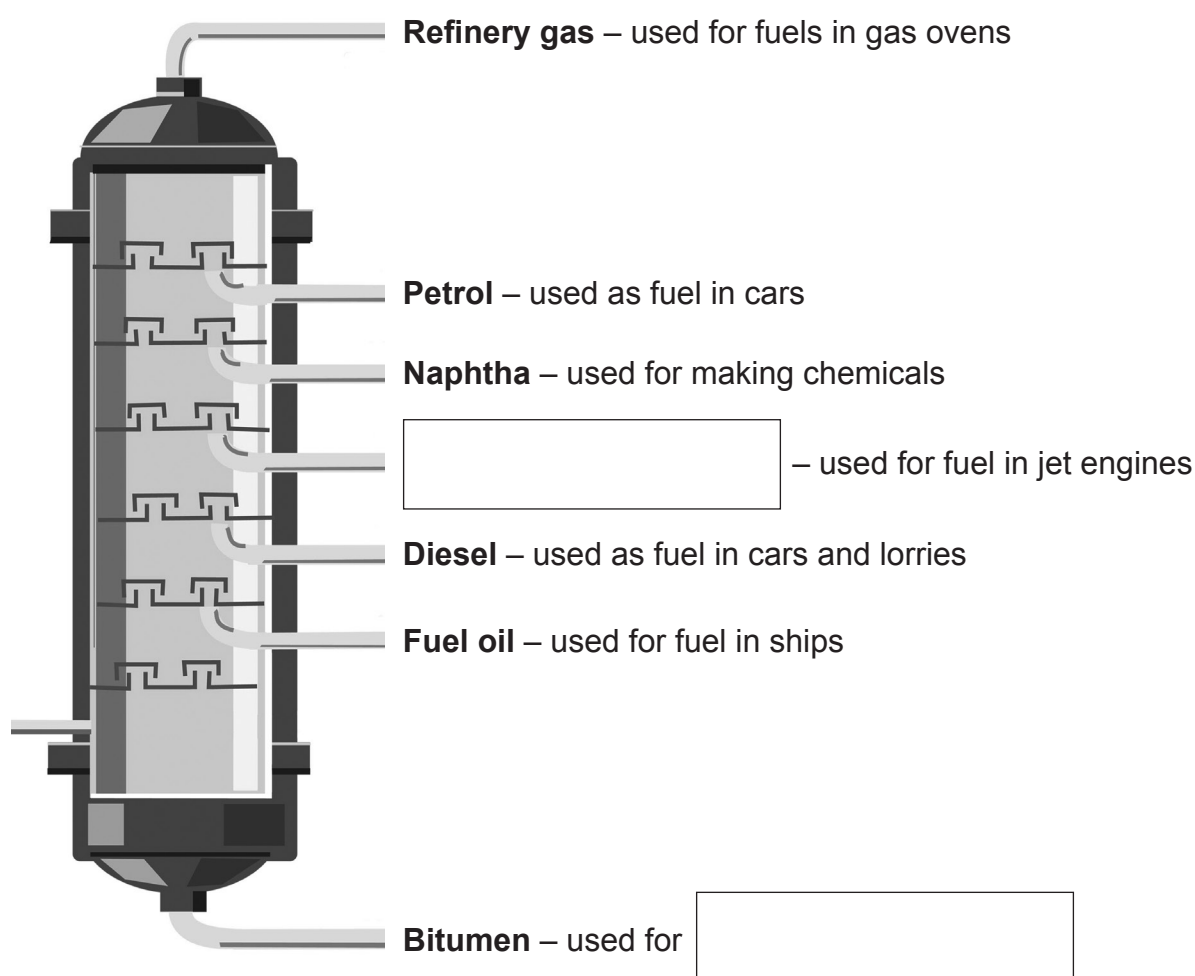
10 (a) Complete the following sentences about crude oil.

Crude oil is a fossil fuel formed from the remains of animals that died
_____ of years ago. It is a mixture of hydrocarbons,
which are compounds that contain only the elements
_____ and _____.

[2]

Different hydrocarbons are separated from crude oil by fractional distillation.

(b) Complete the diagram below to name the chemical used for fuel in jet engines
and **one** use for bitumen. [2]



(c) (i) Complete the table below about some hydrocarbons.

Name	Molecular formula	Structural formula
butane	C_4H_{10}	
	C_2H_6	<pre> H H H-C-C-H H H</pre>
propane		<pre> H H H H-C-C-C-H H H H</pre>

[3]

(ii) Pentane is a hydrocarbon that contains five carbon atoms.
How many hydrogen atoms will be in a molecule of pentane?

[1]

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Question Number	Marks
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Total Marks	
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Examiner Number

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SYMBOLS OF SELECTED IONS

Positive ions

Name	Symbol
Ammonium	NH_4^+
Chromium(III)	Cr^{3+}
Copper(II)	Cu^{2+}
Iron(II)	Fe^{2+}
Iron(III)	Fe^{3+}
Lead(II)	Pb^{2+}
Silver	Ag^+
Zinc	Zn^{2+}

Negative ions

Name	Symbol
Butanoate	$\text{C}_3\text{H}_7\text{COO}^-$
Carbonate	CO_3^{2-}
Dichromate	$\text{Cr}_2\text{O}_7^{2-}$
Ethanoate	CH_3COO^-
Hydrogencarbonate	HCO_3^-
Hydroxide	OH^-
Methanoate	HCOO^-
Nitrate	NO_3^-
Propanoate	$\text{C}_2\text{H}_5\text{COO}^-$
Sulfate	SO_4^{2-}
Sulfite	SO_3^{2-}

Data Leaflet

Including the Periodic Table of the Elements

For the use of candidates taking
Science: Chemistry,
Science: Double Award
or Science: Single Award

Copies must be free from notes or additions of any
kind. No other type of data booklet or information
sheet is authorised for use in the examinations

SOLUBILITY IN COLD WATER OF COMMON SALTS, HYDROXIDES AND OXIDES

Soluble
All sodium, potassium and ammonium salts
All nitrates
Most chlorides, bromides and iodides EXCEPT silver and lead chlorides, bromides and iodides
Most sulfates EXCEPT lead and barium sulfates Calcium sulfate is slightly soluble
Insoluble
Most carbonates EXCEPT sodium, potassium and ammonium carbonates
Most hydroxides EXCEPT sodium, potassium and ammonium hydroxides
Most oxides EXCEPT sodium, potassium and calcium oxides which react with water

gcse examinations chemistry

THE PERIODIC TABLE OF ELEMENTS
Group

1		2																		0																			
7 Li Lithium 3		9 Be Beryllium 4																		4 He Helium 2																			
23 Na Sodium 11		24 Mg Magnesium 12																		20 Ne Neon 10																			
39 K Potassium 19		40 Ca Calcium 20		45 Sc Scandium 21		48 Ti Titanium 22		51 V Vanadium 23		52 Cr Chromium 24		55 Mn Manganese 25		56 Fe Iron 26		59 Co Cobalt 27		59 Ni Nickel 28		64 Cu Copper 29		65 Zn Zinc 30		70 Ga Gallium 31		73 Ge Germanium 32		75 As Arsenic 33		79 Se Selenium 34		80 Br Bromine 35		84 Kr Krypton 36					
85 Rb Rubidium 37		88 Sr Strontium 38		89 Y Yttrium 39		91 Zr Zirconium 40		93 Nb Niobium 41		96 Mo Molybdenum 42		98 Tc Technetium 43		101 Ru Ruthenium 44		103 Rh Rhodium 45		106 Pd Palladium 46		108 Ag Silver 47		112 Cd Cadmium 48		115 In Indium 49		119 Sn Tin 50		122 Sb Antimony 51		128 Te Tellurium 52		127 I Iodine 53		131 Xe Xenon 54					
133 Cs Caesium 55		137 Ba Barium 56		139 La [*] Lanthanum 57		178 Hf Hafnium 72		181 Ta Tantalum 73		184 W Tungsten 74		186 Re Rhenium 75		190 Os Osmium 76		192 Ir Iridium 77		195 Pt Platinum 78		197 Au Gold 79		201 Hg Mercury 80		204 Tl Thallium 81		207 Pb Lead 82		209 Bi Bismuth 83		210 Po Polonium 84		210 At Astatine 85		222 Rn Radon 86					
223 Fr Francium 87		226 Ra Radium 88		227 Ac [†] Actinium 89		261 Rf Rutherfordium 104		262 Db Dubnium 105		266 Sg Seaborgium 106		264 Bh Bohrium 107		277 Hs Hassium 108		268 Mt Meitnerium 109		271 Ds Darmstadtium 110		272 Rg Roentgenium 111		285 Cn Copernicium 112																	

1

H

Hydrogen

1

* 58 – 71 Lanthanum series
† 90 – 103 Actinium series



a = relative atomic mass (approx)
x = atomic symbol
b = atomic number

140	Ce Cerium 58	141	Pr Praseodymium 59	144	Nd Neodymium 60	145	Pm Promethium 61	150	Sm Samarium 62	152	Eu Europium 63	157	Gd Gadolinium 64	159	Tb Terbium 65	162	Dy Dysprosium 66	165	Ho Holmium 67	167	Er Erbium 68	169	Tm Thulium 69	173	Yb Ytterbium 70	175	Lu Lutetium 71
232	Th Thorium 90	231	Pa Protactinium 91	238	U Uranium 92	237	Np Neptunium 93	242	Pu Plutonium 94	243	Am Americium 95	247	Cm Curium 96	245	Bk Berkelium 97	251	Cf Californium 98	254	Es Einsteinium 99	253	Fm Fermium 100	256	Md Mendelevium 101	254	No Nobelium 102	257	Lr Lawrencium 103