New Specification

Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
2018–2019

Single Award Science
Chemistry

Unit 2
Foundation Tier

[GSA21]

THURSDAY 8 NOVEMBER 2018, MORNING

GSA21

TIME

1 hour.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
Write your answers in the spaces provided in this question paper.
Answer **all eleven** questions.

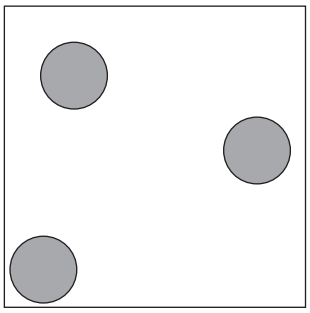
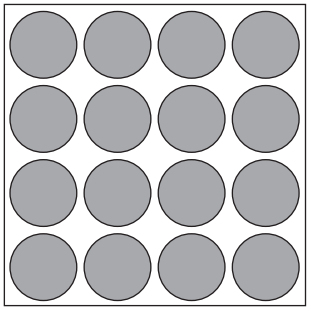
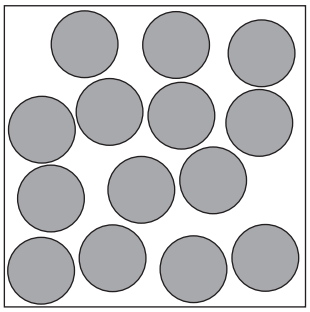
INFORMATION FOR CANDIDATES

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.
A Data Leaflet, which includes a Periodic Table of the elements, is provided.
Quality of written communication will be assessed in Question **10(a)**.

For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
Total Marks	

Examiner Only	
Marks	Remark

1 **(a)** Shown below are particle diagrams representing the three states of matter.
Using lines, match each diagram to the state of matter it represents.

Diagram	**State of matter**
	solid
	liquid
	gas

[2]

(b) Complete the following sentences to describe a change of state.

Choose from:

cooled **freezing** **heated**

evaporating **melting**

When a substance changes state from a solid to a liquid the process

is called _____. The solid needs

to be _____ for this to happen. [2]

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(Questions continue overleaf)

2 In the past electric kettles were made from metal. From around 1970, the metal body of some kettles has been replaced by plastic.

© Trevor Clifford Photography / Science Photo Library

(a) Give **one** property of plastic that makes it a better material than metal for the body of the kettle. Explain your answer.

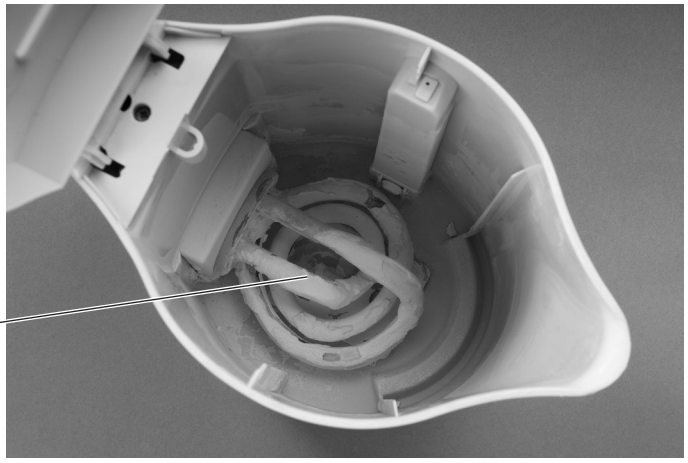
_____

_____

_____ [2]

Examiner Only	
Marks	Remark

The photograph below shows the heating element in an electric kettle.



© Trevor Clifford Photography / Science Photo Library

(b) The heating element is made from metal. Suggest two **properties** that the metal must have to be used in the heating element.

1. _____

2. _____ [2]

(c) Plastic and stainless steel are synthetic materials. What is meant by the term **synthetic**?

_____

_____ [1]

Examiner Only	
Marks	Remark

3 **(a)** Tropical fish can only live in water with a suitable temperature and pH.

© eduardrobert / iStock / Thinkstock

The table below gives the most suitable temperatures and pH ranges for some tropical fish.

Fish	Temperature/°C	pH
reed fish	22–28	6.5–7.5
dinosaur birchir	25–29	7.0–8.2
emerald catfish	21–28	6.5–6.8
rose catfish	22–26	6.0–7.0
disk tetra	23–27	5.0–7.0
ornate birchir	26–28	6.0–8.0

(i) Name a piece of apparatus that could have been used to measure the pH.

_____ [1]

(ii) What is the highest alkaline pH value shown in the table?

_____ [1]

(iii) Name the fish that can live in the widest temperature range.

_____ [1]

Examiner Only	
Marks	Remark

(iv) How many fish named in the table could live in water with a temperature of 23 °C and a pH of 7?

_____ [1]

(v) Suggest **one** temperature in which all these fish could live.

Choose from:

24 °C **25 °C** **26 °C** **27 °C**

_____ [1]

(b) Mary wants to keep some emerald catfish. However the water in her fish tank has a pH of 6. She was advised to add some limestone (calcium carbonate) to the water.

(i) Explain fully what effect adding limestone will have on the pH of the water in her fish tank.

_____

_____

_____ [2]

(ii) What is the formula for calcium carbonate?

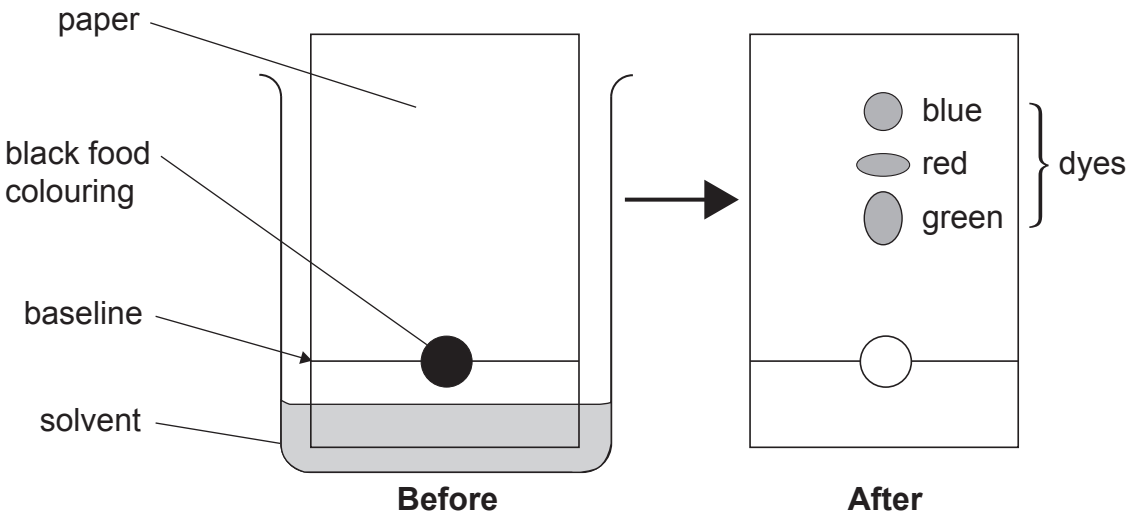
Circle the correct answer.

$CACO_3$: **$CaCO_3$** : **CaC**

[1]

Examiner Only	
Marks	Remark

4 A student separated the different soluble dyes that make up black food colouring as shown below.



(a) What name is given to this method of separation?

_____ [1]

(b) Explain why the baseline should be drawn in pencil.

_____

_____ [1]

(c) What did the student find out about the black food colouring from this experiment?

_____

_____ [1]

(d) Which dye from the black food colouring was the most soluble?

_____ [1]

(e) Red food colouring does **not** contain any other coloured dyes. Describe the result a student would expect if red food colouring was tested in the same way.

_____

_____ [1]

Examiner Only	
Marks	Remark

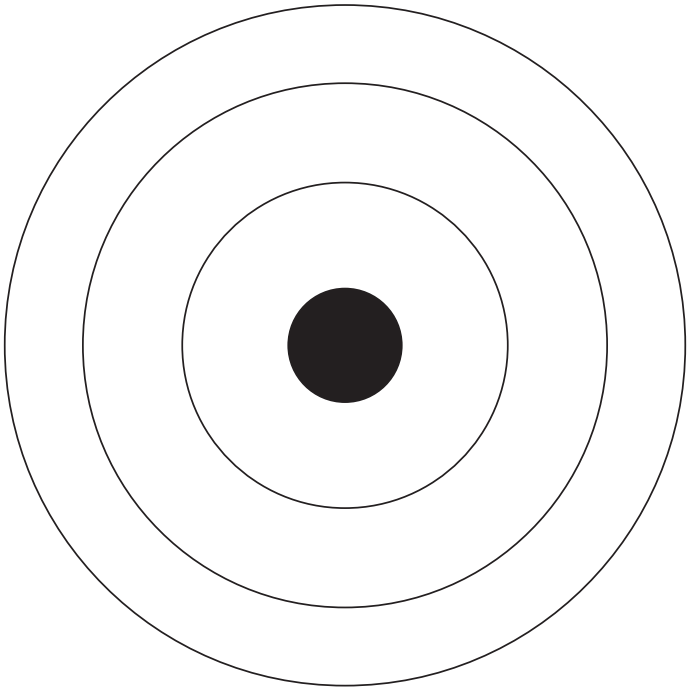
5 Fluorine and chlorine are elements in Group 7 of the Periodic Table.

Examiner Only	
Marks	Remark

(a) What name is given to Group 7 of the Periodic Table?

_____ [1]

(b) Chlorine has 17 electrons. On the diagram below show how these electrons are arranged.



[1]

(c) In terms of the arrangement of electrons, explain why chlorine and fluorine have similar chemical reactions.

_____

_____ [1]

(d) Chlorine and fluorine are found in compounds that can be used as a coolant in fridges. One such compound has the formula $CFCl_3$.

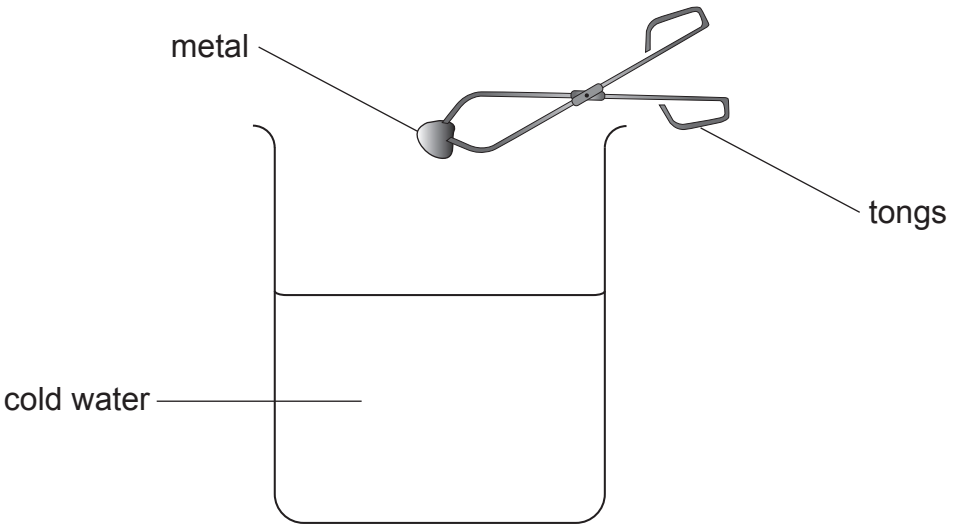
(i) How many elements are represented by the formula $CFCl_3$?

_____ [1]

(ii) How many atoms are represented by the formula $CFCl_3$?

_____ [1]

6 Four metals magnesium, calcium, potassium and copper were added to cold water to investigate their reactivity.



(a) Which metal magnesium, calcium, potassium or copper when added to water:

(i) sinks and does **not** react?

_____ [1]

(ii) burns with a lilac flame?

_____ [1]

(b) Complete the **word** equation for the reaction of potassium with water.

potassium + water ⟶ [ ] + [ ]

[2]

Examiner Only	
Marks	Remark

(c) Using your knowledge of the reactivity series put these four metals in order of reactivity.
Put the **most** reactive first.

Examiner Only	
Marks	Remark

_____ (most reactive)

_____

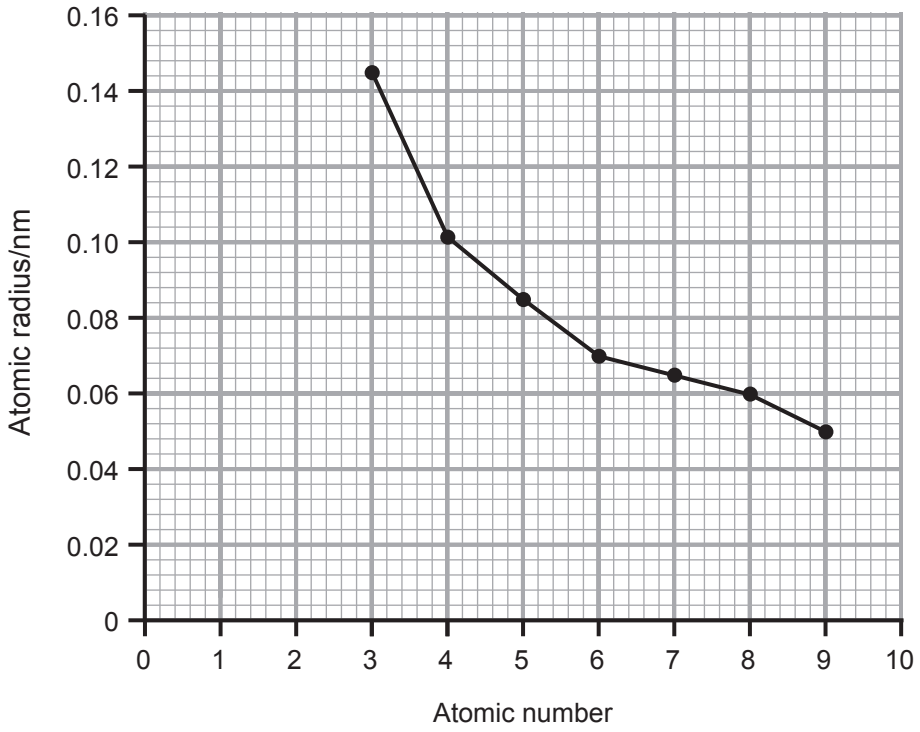
_____

_____ (least reactive) [2]

(d) Name **one** metal used in the investigation that is in the same period of the Periodic Table as calcium.

_____ [1]

7 The graph below shows the atomic radius (size) of some elements in Period 2 of the Periodic Table.



(a) What is meant by the term **atomic number**?

_____

_____ [1]

(b) **(i)** State the trend shown by the information in the graph.

_____

_____ [1]

(ii) Predict the atomic radius of the element with an atomic number of 10.

_____ nm [1]

(iii) Name an element that is in the same group as the element with atomic number 10.

You may find your Data Leaflet helpful.

_____ [1]

Examiner Only	
Marks	Remark

(c) Name the element shown in the graph that has the largest atomic radius.

You may find your Data Leaflet helpful.

_____ [1]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

8 Coal, oil and gas are fossil fuels that are useful sources of energy.

(a) Complete the following sentences.

The main element in coal is _____.

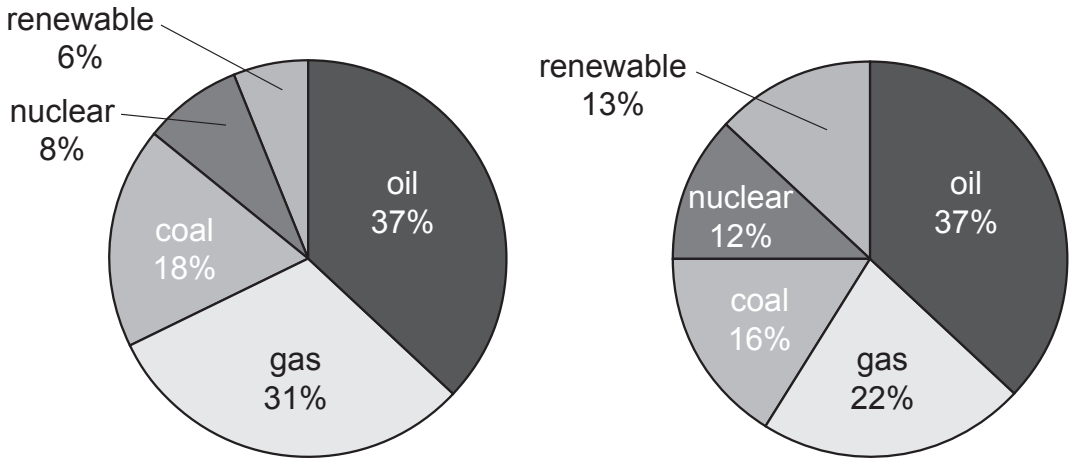
Natural gas (CH_4) contains the elements

_____ and _____.

A molecule containing only the two elements found in CH_4 can be

described as a _____. [3]

(b) The pie charts below show the percentage of different energy sources used in the USA and in Europe.



USA **Europe**

(i) Calculate the total percentage of coal, oil and gas used in **Europe**.

_____ % [1]

(ii) State **one** similarity and **one** difference in the energy sources used in the USA and in Europe as shown in the pie charts above.

Similarity _____

_____

Difference _____

_____ [2]

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(Questions continue overleaf)

9 Thermochromic plastic is an example of a smart material, it changes colour as temperature changes. It is used in making baby bottles and forehead thermometers.

(a) What is meant by the term **smart material**?

_____

_____ [2]

(b) The table below gives information about the colour changes of four thermochromic plastics (**P**, **Q**, **R** and **S**) as they are heated.

	Temperature at which colour changes/°C			
Plastic	**Red**	**Green**	**Blue**	**Black**
P	20	21	25	41
Q	36	39	41	45
R	25	70	100	105
S	34	36	38	40

A child's temperature is normally around 36 °C, but when they are ill it can go as high as 38 °C.

(i) Which plastic (**P**, **Q**, **R** or **S**) would be most suitable to make a forehead thermometer to show if a child is ill?

_____ [1]

Examiner Only	
Marks	Remark

The following instructions were given to make up a bottle of powdered milk for a baby.

1. Boil water in a kettle to 100 °C to kill the bacteria that causes illness.
2. Fill the baby bottle with the boiled water.
3. Allow the water to cool, but not below 70 °C.
4. Add the powdered milk to the bottle.
5. Leave to cool to room temperature.

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(ii) Explain fully why the colour changes of Plastic **R** would make it most suitable to manufacture baby bottles.

_____

_____

_____

_____ [2]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

10 **(a)** Describe how fingerprints are collected at a crime scene and why they are useful in helping to solve a crime.

Your answer should include:

- how powder is used to collect a fingerprint from a white surface
- an alternative to powder that can be used to reveal fingerprints.

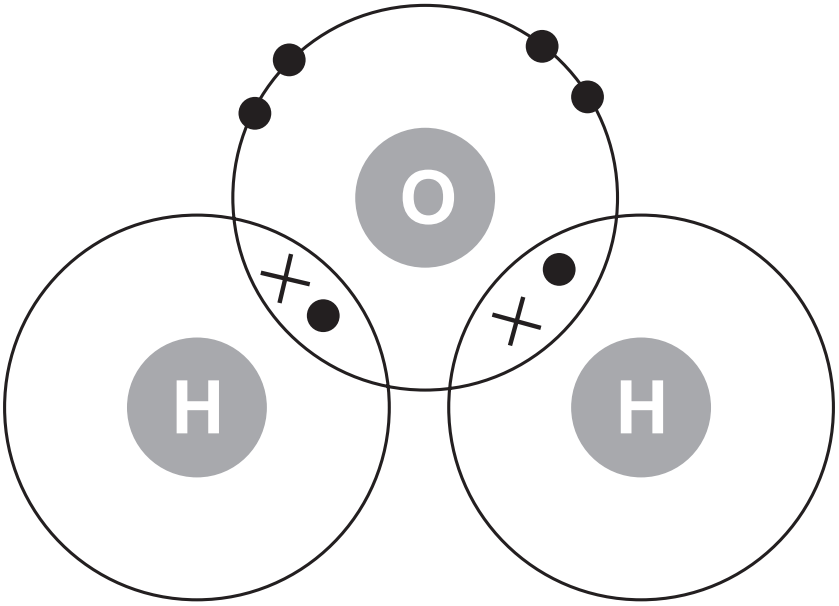
In this question you will be assessed on your written communication skills including the use of specialist scientific terms.

_____ [6]

(b) Describe **one** other use for fingerprints.

_____ [1]

11 **(a)** Shown below is a diagram of the bonding in a molecule of water (H_2O).



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(i) Hydrogen and oxygen form a bond by sharing a pair of electrons. What name is given to this type of bonding?

_____ [1]

(ii) Complete the following sentence.

Choose from:

two metals : two non-metals : a metal and a non-metal

This type of bonding normally happens between

_____ [1]

(b) Explain, in terms of electrons, why elements in Group 0 do **not** usually form bonds.

_____

_____ [1]

THIS IS THE END OF THE QUESTION PAPER

Examiner Only	
Marks	Remark

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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	$C_3H_7COO^-$
Carbonate	CO_3^{2-}
Dichromate	$Cr_2O_7^{2-}$
Ethanoate	CH_3COO^-
Hydrogencarbonate	HCO_3^-
Hydroxide	OH^-
Methanoate	$HCOO^-$
Nitrate	NO_3^-
Propanoate	$C_2H_5COO^-$
Sulfate	SO_4^{2-}
Sulfite	SO_3^{2-}

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

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Rewarding Learning

New Specification

Rewarding Learning

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

gcse examinations

chemistry

For first teaching from September 2017

THE PERIODIC TABLE OF ELEMENTS

Group

1	2											3	4	5	6	7	0
							1 **H** Hydrogen 1										4 **He** Helium 2
7 **Li** Lithium 3	9 **Be** Beryllium 4											11 **B** Boron 5	12 **C** Carbon 6	14 **N** Nitrogen 7	16 **O** Oxygen 8	19 **F** Fluorine 9	20 **Ne** Neon 10
23 **Na** Sodium 11	24 **Mg** Magnesium 12											27 **Al** Aluminium 13	28 **Si** Silicon 14	31 **P** Phosphorus 15	32 **S** Sulfur 16	35.5 **Cl** Chlorine 17	40 **Ar** Argon 18
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						

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

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

a X b

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