

CHEMISTRY



KS3 SCIENCE EXAM PREPARATION STUDENT BOOK

ATOMIC STRUCTURE

Please complete all of these questions in this book and store this work in your student revision files.

This will provide a useful resource for revision.

Name	
Class	
Teacher	

Revision Question Book
KS3 Science

This book is suitable for
students carrying out the KS3
Science course



In the following book there are several questions based on KS3 Science. These questions are additional to the work which you do on in your lessons.

To gain the highest grade possible in KS3 Science it is recommended that you complete these questions at home or in revision sessions outside of lessons.

This will both familiarise yourself with both the concepts found in the syllabus and the examination technique found in examinations.

The mark scheme to the questions is integrated in the book for you to use independently.

To improve competency in answering questions on KS3 Science and achieve mastery in this module, answer all of these questions independently.

When you have completed your work in this book, please store this work in your student files.

Many thanks for all of your hard work in Science.

Mr. Turnbull



1.5 Explain why the reactivity of the elements increases going down Group 1 from lithium to rubidium but decreases going down Group 7 from fluorine to iodine.

[4 Marks]

.....

.....

.....

.....

.....

.....



Q2.

This question is about atomic structure and elements.

Complete the sentences.

[2 Marks]

2.1 The atomic number of an atom is the number of _____

2.2 The mass number of an atom is the number of _____

2.3 Explain why an atom has no overall charge.

Use the relative electrical charges of sub-atomic particles in your explanation.

[2 Marks]

.....

.....

.....

.....

2.4 Explain why fluorine and chlorine are in the same group of the periodic table.

Give the electronic structures of fluorine and chlorine in your explanation.

[2 Marks]

.....

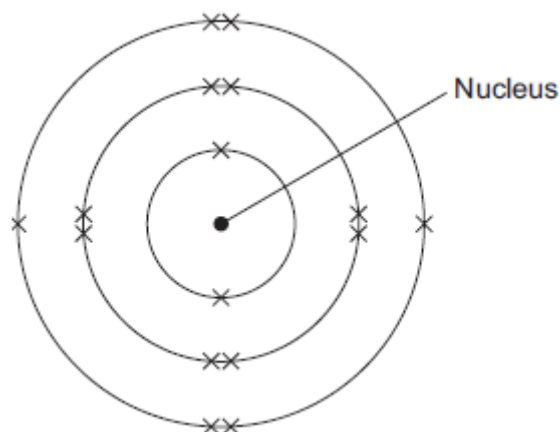
.....

.....

.....



2.5 The diagram shows the electronic structure of an atom of a non-metal.



What is the chemical symbol of this non-metal?

Tick (✓) **one** box.

[1 Mark]

Ar ☐

O ☐

S ☐

Si ☐

When elements react, their atoms join with other atoms to form compounds.

Complete the sentences.

[2 Marks]

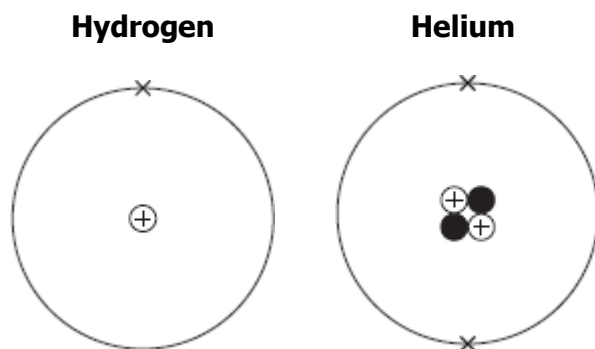
2.6 Compounds formed when non-metals react with metals consist of particles called

_____.

2.7 Compounds formed from only non-metals consist of particles called _____.

**Q3.**

The Sun produces helium atoms from hydrogen atoms by nuclear fusion reactions.



3.1 Describe the differences in the atomic structures of a hydrogen atom and a helium atom.

[3 Marks]

.....

.....

.....

.....

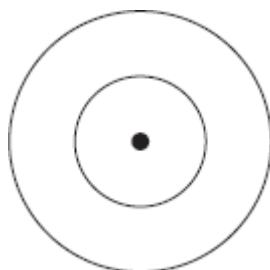
.....

.....

The Sun consists of 73% hydrogen and 25% helium. The rest is other elements. One of the other elements in the Sun is neon. Use the Chemistry Data Sheet to help you to answer these questions.

3.2 Complete the diagram to show the electronic structure of a neon atom.

[1 Mark]



3.3 Why is neon in the same group of the periodic table as helium?

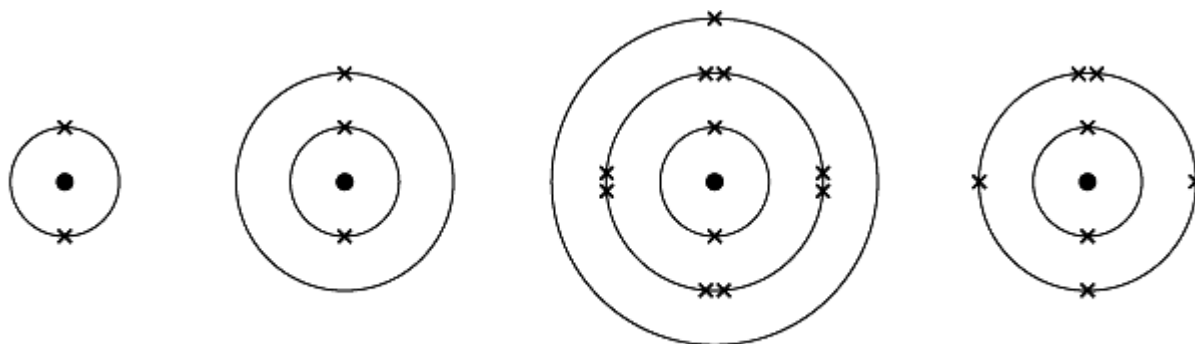
[1 Mark]

.....

.....

**Q4.**

The diagrams show the electronic structure of four different atoms.

**Atom A****Atom B****Atom C****Atom D**

Use the Chemistry Data Sheet to help you to answer these questions.

4.1 Name the two sub-atomic particles in the nucleus of an atom.

[1 Mark]

.....

.....

4.2 Why is there no overall electrical charge on each atom?

[1 Mark]

.....

.....

4.3 Why is **Atom A** unreactive?

[1 Mark]

.....

.....

4.4 Which **two** of these atoms have similar chemical properties?
Give a reason for your answer.

[2 Marks]

.....

.....

.....

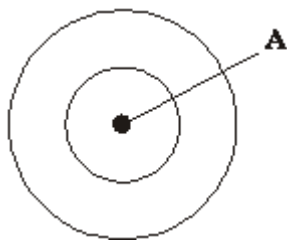
.....

**Q5.**

This question is about oxygen atoms. The periodic table on the Data Sheet may help you to answer this question.

5.1 Oxygen atoms have 8 electrons.

Complete the diagram to represent the arrangement of electrons in an oxygen atom.
Use crosses (×) to represent the electrons.

[1 Mark]**5.2** Name the part of the oxygen atom that is labelled **A** on the diagram.**[1 Mark]**

.....

.....

5.3 Two isotopes of oxygen are oxygen-16 and oxygen-18.

Explain, in terms of particles, how the nucleus of an oxygen-18 atom is different from the nucleus of an oxygen-16 atom.

[2 Marks]

.....

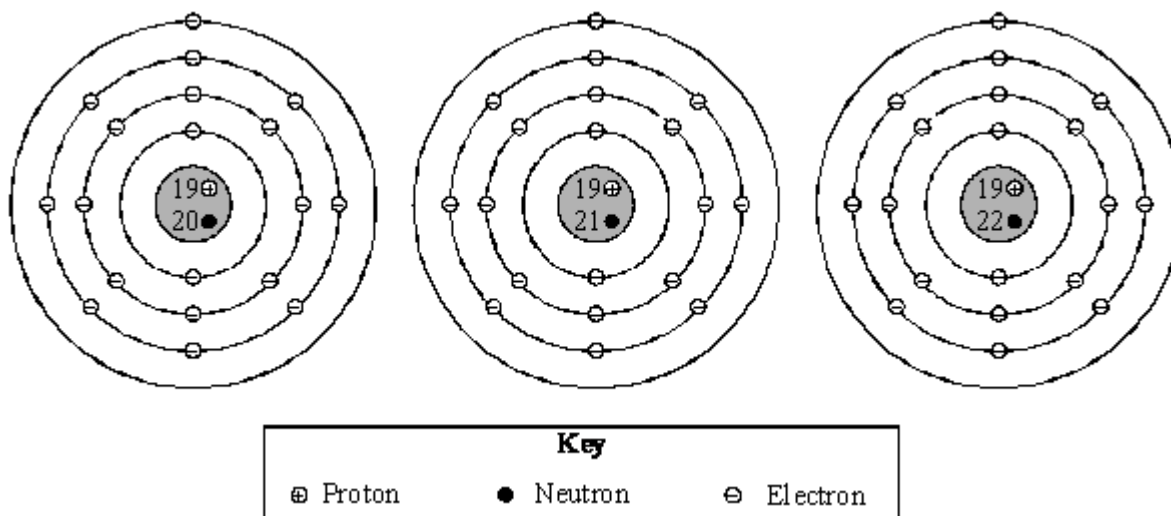
.....

.....

.....

**Q6.**

The diagrams show three **isotopes** of potassium.



6.1 In what way does the atomic structure show you that they are all **atoms**?

[1 Mark]

.....

.....

6.2 Explain why these three atoms are called *isotopes* of potassium.

[3 Marks]

.....

.....

.....

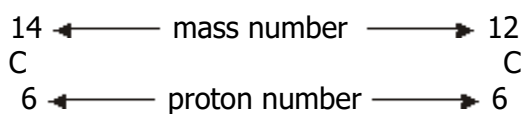
.....

.....

.....

**Q7.**

The two carbon atoms represented below are isotopes.

ISOTOPE 1ISOTOPE 2

7.1 Describe **two** ways in which the isotopes are similar.

[2 Marks]

.....

.....

.....

.....

7.2 Describe as fully as you can **one** way in which they are different.

[2 Marks]

.....

.....

.....

.....

**Q8.**

Use the Periodic Table of Elements on the Data Sheet to help you to answer this question.

8.1 Describe, in as much detail as you can, the structure of a fluorine atom.

[3 Marks]

.....

.....

.....

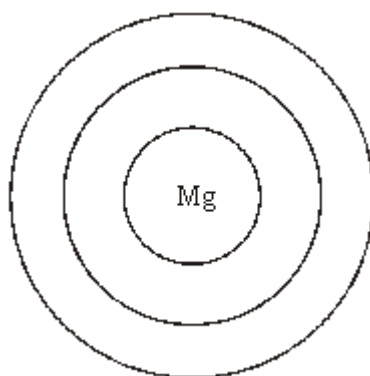
.....

.....

.....

8.2 Complete the diagram to show the electronic structure of a magnesium atom.

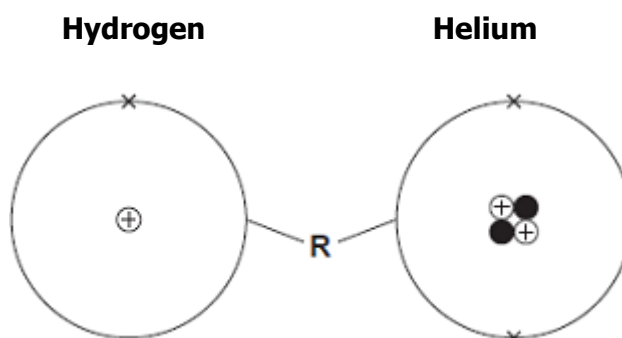
[1 Mark]



**FOUNDATION TIER**

1. The Sun is mainly hydrogen and helium.

The diagrams show an atom of hydrogen and an atom of helium.



Draw a ring around the correct answer to complete each sentence.

[1 Mark]

1.1 The centre of each atom is called the

molecule.
nucleus.
shell.

1.2 The circle (labelled **R**) around the centre of each atom

[1 Mark]

is called

a bond.
an electrical charge.
an energy level (shell).



1.3 Use the diagrams in part (a) to help you to answer these questions.

Draw **one** line from each question to its correct answer.

[3 Marks]

Question	Answer
How many protons are there in the hydrogen atom?	1
How many electrons are there in the helium atom?	2
What is the mass number of the helium atom?	3
	4

1.4 The Sun is 73% hydrogen and 25% helium. The rest is other elements.

What is the percentage of other elements in the Sun?

[1 Mark]

_____ %

One of the other elements in the Sun is neon.
Neon is in the same group of the periodic table as helium.

Use the Chemistry Data Sheet to help you to answer these questions.

1.5 How many protons are there in a neon atom?

[1 Mark]

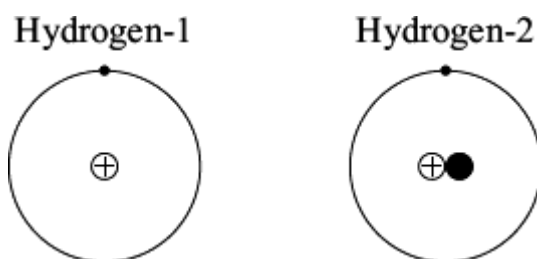
1.6 Which group of the periodic table are helium and neon in?

[1 Mark]

**Q2.**

Two isotopes of hydrogen are hydrogen-1 (${}^1_1\text{H}$) and hydrogen-2 (${}^2_1\text{H}$).

The diagrams represent atoms of hydrogen-1 and hydrogen-2.



Use the correct words from the box to complete the sentences.

electrons neutrons protons

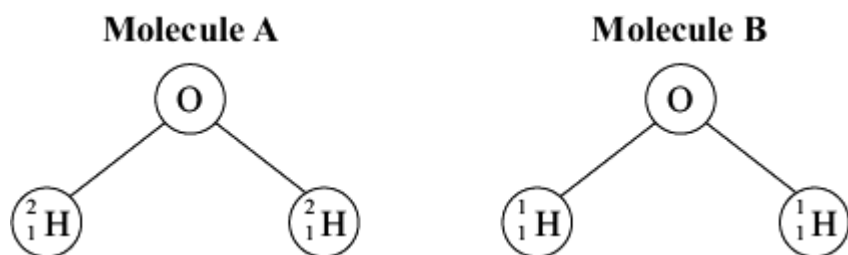
2.1 The positive particles, $\oplus$, in the nucleus of atoms are called

[1 Mark]

2.2 The particles with no charge, $\bullet$, in the nucleus of atoms are called

[1 Mark]

2.3 The diagrams show two different types of water molecule.



Draw a ring around the correct answer to complete the sentence.

Molecule **A** is

heavier than
lighter than
the same mass as

molecule **B**.



Explain your answer.

[2 Marks]

.....

.....

.....

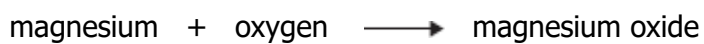
**Q3.**

Magnesium burns in oxygen.



3.1 Use the Chemistry Data Sheet to help you to answer this question.

The word equation for magnesium burning is:



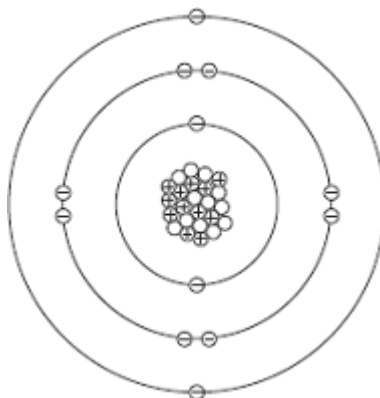
Draw **one** line from each substance to its correct description.

[3 Marks]

Substance	Description
magnesium	compound
magnesium oxide	metal
oxygen	mixture
	non-metal



3.2 The diagram represents a magnesium atom.



Complete the table to show the name of each particle and the charge of each particle in the magnesium atom.

[2 Marks]

Name of particle	Charge
proton	+1
neutron	_____
_____	-1

Use the Chemistry Data Sheet to help you to answer these questions.

Draw a ring around the correct answer to complete each sentence.

[2 Marks]

3.3 In a magnesium atom, the protons and neutrons are in the

core.
nucleus.
shell.

3.4 The number of protons in a magnesium atom is the

atomic number
mass number.
group number.



3.5 The sum of the protons and neutrons in a magnesium

[1 Mark]

atom is the

atomic number.

mass number.

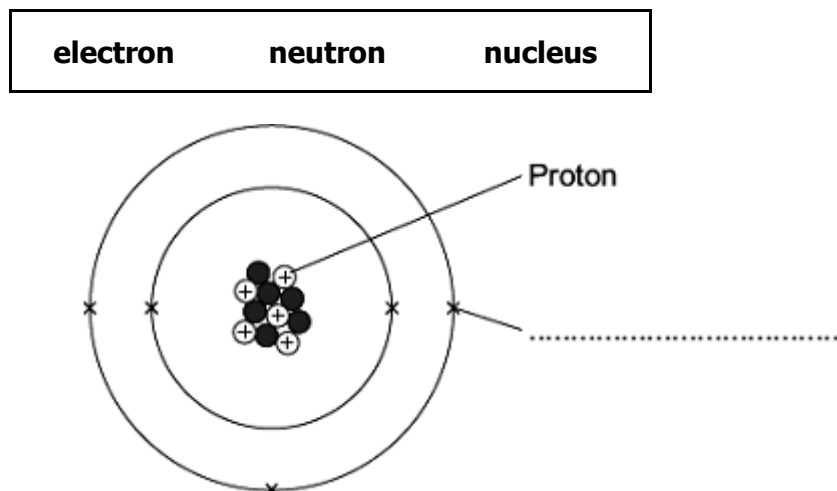
group number.

**Q4.**

The diagram represents an atom of an element.

4.1 Choose **one** word from the box to complete the label on the diagram.

[1 Mark]



4.2 What is the atomic (proton) number of this atom? _____

[1 Mark]

4.3 Name the element.

Use the periodic table on the Data Sheet to help you answer this question.

[1 Mark]

The name of the element is _____.

4.4 Draw a ring around the mass number of this atom.

[1 Mark]

5 11 16

4.5 Another atom of this element has a different mass number.

Draw a ring around the correct word in the box to complete the sentence.

[1 Mark]

Atoms of the same element with different numbers of

are called isotopes.

electrons
neutrons
protons

**Q5.**

This question is about atoms and molecules.

5.1 In the diagrams below:

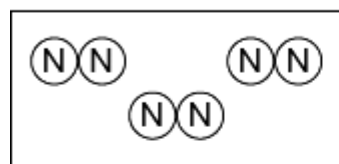
(N) is a nitrogen atom

(O) is an oxygen atom

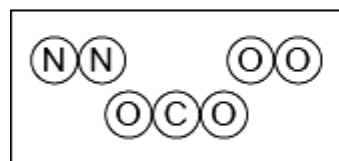
(C) is a carbon atom.

Draw **one** line from each diagram to its correct description.
One line has been done for you.

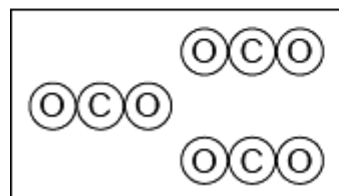
[2 Marks]

Diagram**Description**

Compound



Element



Mixture

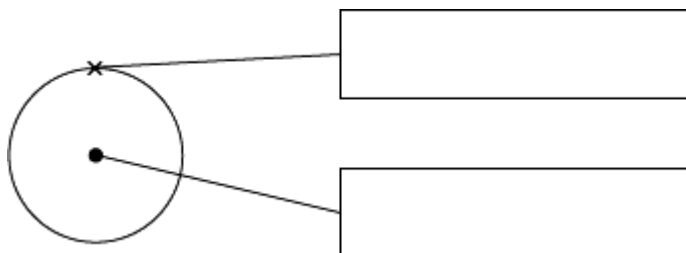
Polymer



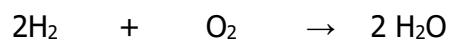
5.2 The diagram below shows a hydrogen atom.
Use words from the box to write the correct labels on the diagram.

[2 Marks]

alloy	electron	group	nucleus
-------	----------	-------	---------



5.3 This chemical equation represents the reaction of hydrogen burning.



Complete the sentence to describe what is happening in this chemical reaction.

Hydrogen reacts with

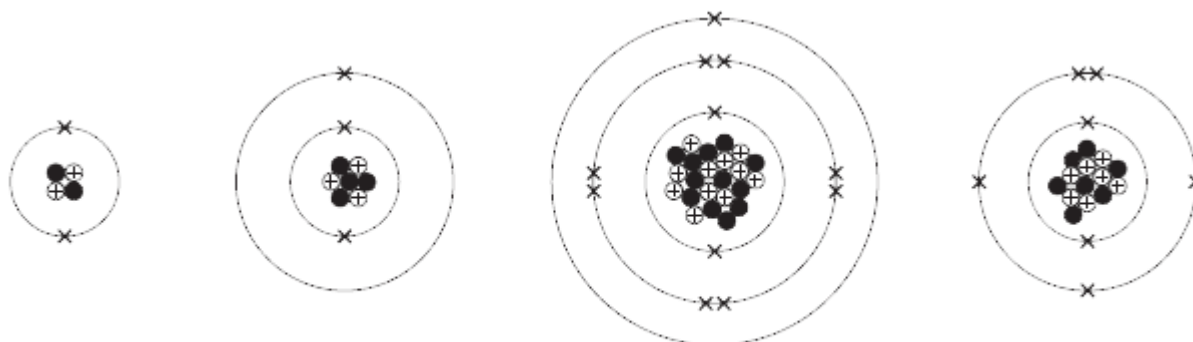
[2 Marks]

.....

.....

**Q6.**

The diagrams show the sub-atomic particles in four different atoms.

**Atom A****Atom B****Atom C****Atom D**

Use the Chemistry Data Sheet to help you to answer these questions.

Draw a ring around the correct answer to complete each sentence.

[2 Marks]

6.1 The centre of each atom is called the

energy level.
molecule.
nucleus.

6.2 The centre of each atom contains neutrons and

bonds.
electrons.
protons.

6.3 Complete the sentence.

[1 Mark]

There is no overall electrical charge on each atom because the
number of _____ is equal to the number of _____

6.4 What is the name of the element represented by atom **D**? _____

[1 Mark]



6.5 Which **two** of the atoms, **A**, **B**, **C** and **D**, are in the same group of the periodic table?

Give a reason for your answer.

Atom and atom

Reason

[2 Marks]

.....

.....



CHEMISTRY DATA SHEET



The Periodic Table of Elements

1	2	3	4	5	6	7	0
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	4 He helium 2
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	20 Ne neon 10
39 K potassium 19	40 Ca calcium 20	70 Ga gallium 31	73 Ge germanium 32	75 As arsenic 33	79 Se selenium 34	80 Br bromine 35	40 Ar argon 18
85 Rb rubidium 37	88 Sr strontium 38	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	204 Tl thallium 81	207 Pb lead 82	209 Bi bismuth 83	209 Po polonium 84	210 At astatine 85	222 Rn radon 86
[223] Fr francium 87	[226] Ra radium 88	[286] Nh nihonium 113	[289] Fl flerovium 114	[289] Mc moscovium 115	[293] Lv livermorium 116	[293] Ts tennessine 117	[294] Og oganeson 118

1 H hydrogen 1	1 H hydrogen 1
--------------------------------	--------------------------------

relative atomic mass	atomic symbol	name	atomic (proton) number
----------------------	---------------	------	------------------------

59 Co cobalt 27	59 Ni nickel 28	63.5 Cu copper 29	65 Zn zinc 30
103 Rh rhodium 45	106 Pd palladium 46	108 Ag silver 47	112 Cd cadmium 48
192 Ir iridium 77	195 Pt platinum 78	197 Au gold 79	201 Hg mercury 80
278 Mt meitnerium 109	281 Ds darmstadtium 110	281 Rg roentgenium 111	285 Cn copernicium 112
270 Hs hassium 108	270 Bh bohrium 107	269 Sg seaborgium 106	270 Db dubnium 105
267 Rf rutherfordium 104	267 Ac* actinium 89	267 Ac* actinium 89	267 Ac* actinium 89

* The Lanthanides (atomic numbers 58 – 71) and the Actinides (atomic numbers 90 – 103) have been omitted. Relative atomic masses for Cu and Cl have not been rounded to the nearest whole number.



MARK SCHEME HIGHER

1.1 atomic weights

allow atomic masses

1

1.2 proton

allow proton number

1

1.3 F/fluorine

allow F₂

1

1.4 any **one** from:

- copper has a higher density
- copper is stronger
- copper is harder
- copper is less reactive

allow named property

ignore colour, conductivity, melting point and boiling point

allow converse for potassium

1

1.5 relative distance from nucleus

allow more / fewer energy levels / shells or larger / smaller atom

1

relative attraction to nucleus

allow more / less shielding

1

relative ease of gain or loss of electron

1

opposite explanation of ease of gain or loss of electron for other group

1

max 3 marks if 'outer' not mentioned

[8]

**2.1** protons

allow "protons or electrons", but do not allow "protons and electrons"

1**2.2** protons plus / and neutrons**1****2.3** (because the relative electrical charges are) $-(1)$ for an electron and $+(1)$ for a proton

allow electrons are negative and protons are positive

1

and the number of electrons is equal to the number of protons

if no other mark awarded, allow 1 mark for the charges cancel out

1**2.4** (the electronic structure of) fluorine is 2,7 and chlorine is 2,8,7

allow diagrams for the first marking point

1

(so fluorine and chlorine are in the same group) because they have the same number of or 7 electrons in their highest energy level or outer shell

if no other mark awarded, allow 1 mark for have the same / similar properties

1**2.5** S**1****2.6** ions**1****2.7** molecules**1****[9]**



3.1 hydrogen has one proton whereas helium has two protons

accept numbers for words

accept hydrogen only has one proton

ignore references to groups

1

hydrogen has one electron whereas helium has two electrons

accept hydrogen only has one electron

allow helium has a full outer shell (of electrons)

1

hydrogen has no neutrons **or** helium has two neutrons

*if no other mark awarded, allow helium has more electrons / protons / neutrons for **1** mark*

1

3.2 2 electrons on first shell **and**

8 electrons on outer shell

1

3.3 they have a stable arrangement of electrons

accept they have full outer energy level / shell of electrons

*do **not** accept they have the same number of electrons in their outer energy level / shell*

allow they are noble gases

ignore they are in group 0

1

[5]

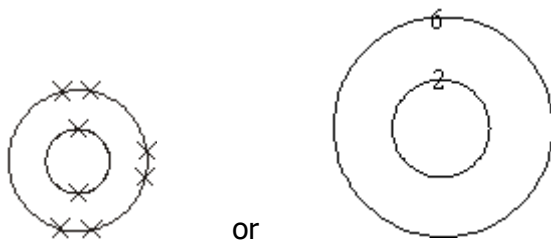
**4.1** protons (**and**) neutrons*both needed for 1 mark**ignore p / + and n / 0**do **not** accept electrons***1****4.2** because the number of protons is equal to the number of electrons*allow protons and electrons balance / cancel out**allow positive / + and negative / - balance / cancel out***1****4.3** *it = atom A*because atom A has a full highest energy level **or** full outer shell*allow all the shells are full **or** no incomplete shell***or** because atom A has a stable arrangement of electrons*allow because atom A is in Group 0 / a noble gas***1****4.4** (atom) B / lithium / Li (**and**)

(atom) C / sodium / Na

*both needed for 1 mark***1**

because they have the same number/one outer electron(s)

*linked to answer for first mark**accept because both need to lose one / an electron**allow because (atoms) B and C are in Group 1 / the same group / are alkali metals***1****[5]**

**5.1**

or

1

allow any arrangement of electrons on the shells
*accept o, x, - **or** e as representing electrons*

5.2 nucleus

accept nucleus (protons plus neutrons)
*do **not** accept protons plus neutrons on its own*
allow nuclei / nukes / neucleus / phonetic spelling
*do **not** accept neutron*

1**5.3** it has **2** more neutrons **or** converse

*accept 'it has more neutrons' **or** 'different number of neutrons' for **1 mark***
*'2 more protons / electrons + correct number of neutrons' = max **1 mark***

orO-16 has 8 neutrons (**1 mark**)(*)O-18 has 10 neutrons (**1 mark**)(*)

()if incorrectly calculated but shows more neutrons in O-18 allow for **1 mark***
accept it has more particles

or*it has 2 more particles for **1 mark****ignore any reference to charges**just 2 more without reference to particles = **0 marks*****2****[4]**



6.1 same number of protons and electrons

accept equal numbers of protons and electrons

*do **not** accept they are neutral*

1

6.2 same element

accept all atoms are potassium

1

same number of protons

accept same atomic number

accept they all have 19+

1

different number of neutrons

accept different mass numbers

*do **not** accept different atomic masses*

1

[4]



7.1 same number/six electrons;
 same number/six protons;
 react in same way **not** same element or both carbon
any two for 1 mark each

2

7.2 different number of neutrons
gains 1 mark

but

or

$^{14}_6\text{C}$ has two more neutrons
gains 1 mark

different mass number

or

but two mass units bigger
gains 2 marks

$^{14}_6\text{C}$ has 8 neutrons while
gains 2 marks

$^{12}_6\text{C}$ has 6 neutrons

2

[4]



8.1 9 protons /Proton Number 9
mass / atomic number is neutral

1

10 neutrons

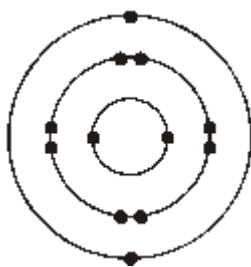
1

electron arrangement 2,7 / 9 electrons

incorrect configurations neutral

*if no points scored, allow 1 mark for nucleus surrounded by electrons **or** nucleus contains neutrons and protons*

1



8.2

Mark is for 2,8,2 arrangements.

accept electrons anywhere in correct orbit

1

[4]



FOUNDATION

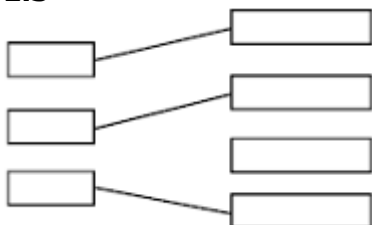
1.1 nucleus

1

1.2 an energy level (shell)

1

1.3



3

1.4 2 / two(%)

1

1.5 10 / ten

1

1.6 (group) 0

accept noble gases

ignore (group) 8

1

[8]



2.1 protons

1

2.2 neutrons

1

2.3 heavier than

1

H-2 atoms are heavier than H-1 atoms

*can be awarded even if they do not circle heavier than***or**

the hydrogen atoms are heavier / more particles in the nucleus of the

hydrogen atoms / one more particle in each hydrogen atom / aneutron in each hydrogen atom etc*must be linked to heavier than**a correct explanation of the increase in mass by ref. to the particles in the hydrogen atoms**ignore reference to particles in the oxygen atoms***or**

molecule A has more particles / neutrons

*do **not** accept incorrect numbers of particles**accept molecule A has more protons and neutrons**molecule A has higher mass numbers***or**

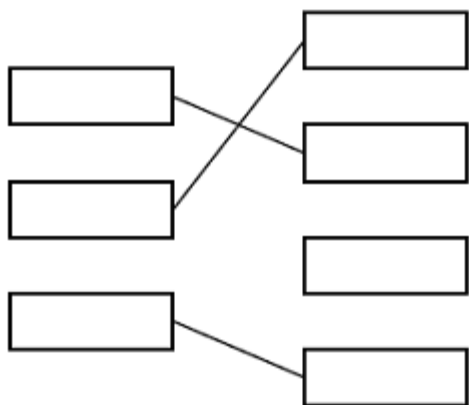
molecule A has a larger nuclear mass / atomic mass

A has two more neutrons than B

*hydrogen has a greater mass number in A**all the numbers in the molecule A**add up to 6 and in molecule B add up to 4**molecule A has**and B*

1

[4]

**3.1**

*one mark for each substance linked correctly to its description
do **not** accept more than one line from each substance*

3**3.2** 0 / zero / none / no charge**1**

electron

1**3.3** nucleus**1****3.4** atomic number**1****3.5** mass number**1****[8]**



4.1 electron	1
4.2 5	1
4.3 boron <i>accept B</i>	1
4.4 11	1
4.5 neutrons	1
	[5]



5.1 NN linked to element

1

OCO linked to compound

1

5.2 electron

1

nucleus

must be correct order

1

5.3 (reacts with) oxygen

1

to produce water

must be names

accept hydrogen oxide

allow steam

1

[6]



6.1 nucleus

1

6.2 protons

1

6.3 protons / + / positive

electrons / – / negative

*both words needed in any order for **1** mark*

1

6.4 nitrogen

allow N or N₂

6.5 B and C

*both letters needed in any order for **1** mark*

*allow Li **and** Na*

1

(both) have one electron **or** same number of electrons in the outer energy level / shell

*allow both are in Group **1***

allow both are alkali metals

*allow both can lose only one electron **or** become +1 ions*

allow this mark if no letters given in boxes

1

[6]



CHEMISTRY DATA SHEET



The Periodic Table of Elements

1	2	Key						3	4	5	6	7	0							
		relative atomic mass atomic symbol name atomic (proton) number																		
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	4 He helium 2
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	63.5 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	[97] 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	[209] Po polonium 84	[210] At astatine 85	[222] Rn radon 86			
[223] Fr francium 87	[226] Ra radium 88	[227] Ac* actinium 89	[267] Rf rutherfordium 104	[270] Db dubnium 105	[269] Sg seaborgium 106	[270] Bh bohrium 107	[270] Hs hassium 108	[278] Mt meitnerium 109	[281] Ds darmstadtium 110	[281] Rg roentgenium 111	[285] Cn copernicium 112	[286] Nh nihonium 113	[289] Fl flerovium 114	[289] Mc moscovium 115	[293] Lv livermorium 116	[293] Ts tennessine 117	[294] Og oganesson 118			

* The Lanthanides (atomic numbers 58 – 71) and the Actinides (atomic numbers 90 – 103) have been omitted. Relative atomic masses for Cu and Cl have not been rounded to the nearest whole number.



Acknowledgements

This document has been produced by Mr J Turnbull.

All relevant information has been credited in the document.

This document has been produced for educational purposes only.

This document has been produced for the KS3 Science Specification.

