



WORKBOOK



Online Chem Tuition

Atomic Structure and the Periodic Table

TOPIC ONE


2ND APRIL



HELLO!

Welcome to your AQA GCSE Chemistry revision session. This workbook is designed to be straightforward and directly aligned with what I'll cover in the live lesson, it offers a practical way to apply your knowledge as you learn.

What's in the Workbook:

- **Questions:** These are selected to match the lesson topic, providing you with a chance to practice and solidify your understanding.
- **Symbols Guide:**
 - HT** - Indicates advanced content aimed at **Higher Tier** students.
 -  - Signifies material for **GCSE Chemistry** students only.

Using the Workbook During Lesson:

- **Stay Engaged:** Be ready to participate and use the workbook alongside the lesson. You can use the chat to ask questions or get help.
- **Peer Learning:** Take advantage of the group setting. Your classmates' questions can provide additional insights.

Zoom Lesson:

Make sure you have your workbook and a pen ready and join us [here](#).

See you on Zoom!



ALISON GREEN



ATOMIC STRUCTURE

ATOMS

The smallest part of an element that can exist.
Consists of protons, neutrons, and electrons.
Atoms are very small, having a radius of about 0.1 nm (1×10^{-14} m)

ELEMENTS

Made up of only one type of atom, represented by symbols (e.g., O for oxygen, Na for sodium).
Approximately 100 elements are listed in the periodic table.

COMPOUNDS

Formed from elements through chemical reactions, containing two or more elements chemically combined in fixed proportions.
Represented by formulae (e.g., H_2O for water).

MIXTURES

Consist of two or more elements or compounds not chemically combined. The components can be separated by physical processes like filtration or distillation.

DEVELOPMENT OF THE ATOMIC MODEL

Evolved from the idea of indivisible atoms to the discovery of subatomic particles (electrons, protons, and neutrons) and the development of models like the plum pudding model and the nuclear model of the atom.

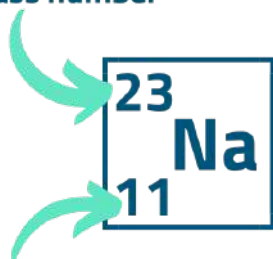
ATOMIC STRUCTURE

Most of the mass of an atom is located in the nucleus, that contains protons and neutrons.

Particle	Relative mass	Relative Charge
Proton	1	+1
Neutron	1	0
Electron	very small	-1

The sum of the protons and neutrons in an atom

Mass number



Atomic number

The number of protons in an atom of an element.
All atoms of a particular element have the same number of protons.

The number of protons (+) and electrons (-) are always equal in an atom – so atoms have no overall charge.

ISOTOPES

Atoms of the same element with the same number of protons but different numbers of neutrons.

RELATIVE ATOMIC MASS

An average value that takes account of the abundance of the isotopes of an element.

$$A_r = \frac{(\% \text{ isotope 1} \times \text{mass}) + (\% \text{ isotope 2} \times \text{mass})}{100}$$

ELECTRONIC CONFIGURATION

Electrons orbit the nucleus of an atom in shells or energy levels. Shells are filled from the inside shell outwards. Electrons cannot fill a new shell until the current one is full.

Shell	1st	2nd	3rd	4th
Maximum number of electrons	2	8	8	8

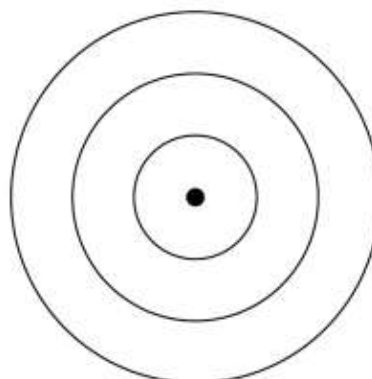
IONS

Particles that contain a different number of protons and electrons, so have an overall charge.
Positive charge = lost electron(s)
Negative = gained electron(s)



ATOMIC STRUCTURE

Q1. Complete the diagram to show the electronic structure of an aluminium atom. Use the periodic table.



[1 mark]

AQA June 22 H Q1.4

Q2. Give the meaning of 'isotopes'. You should answer in terms of subatomic particles.

[2 marks]

AQA June 21 H Q2.1

Q3. Give the numbers of electrons and neutrons in an atom of the isotope ${}_{31}^{69}\text{Ga}$.

[2 marks]

AQA June 21 H Q2.3

Q4. Table below shows information about the three isotopes of neon

Mass number	Percentage abundance (%)
20	90.48
21	0.27
22	9.25

Calculate the relative atomic mass (A_r) of neon. Give your answer to 3 significant figures.

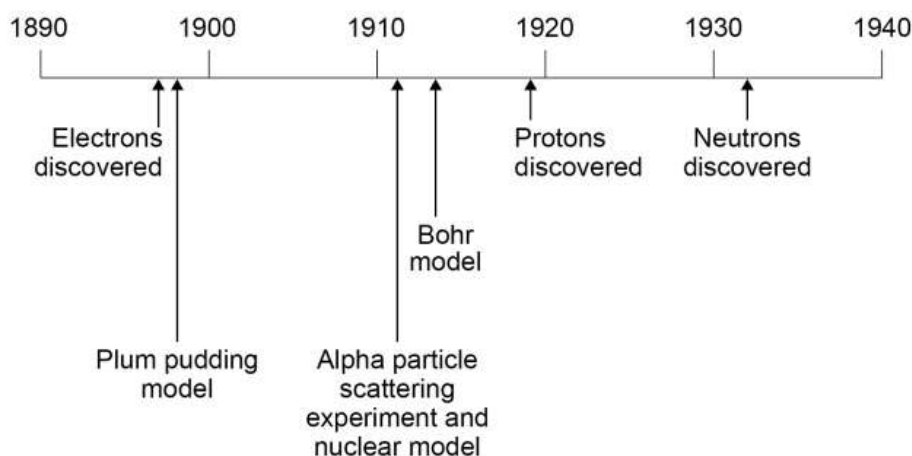
[3 marks]

AQA June 22 H Q5.5



ATOMIC STRUCTURE

These questions are about the development of scientific theories. Below is a timeline of some important steps in the development of the model of the atom.



Q5. The plum pudding model did not have a nucleus. Describe three other differences between the nuclear model of the atom and the plum pudding model.

[3 marks]

AQA June 20 H Q5.1

Q6. Niels Bohr adapted the nuclear model. Describe the change that Bohr made to the nuclear model.

[2 marks]

AQA June 20 H Q5.2



ATOMIC STRUCTURE

Q7. The model of the atom changed as new evidence was discovered. The plum pudding model suggested that the atom was a ball of positive charge with electrons embedded in it. Evidence from the alpha particle scattering experiment led to a change in the model of the atom from the plum pudding model. Explain how.

[4 marks]

AQA June 19 H Q

Q8. Chadwick's experimental work on the atom led to a better understanding of isotopes. Explain how his work led to this understanding.

[3 marks]

AQA June 19 H Q



PERIODIC TABLE

THE PERIODIC TABLE

The periodic table arranges elements in order of increasing atomic (proton) number, organising them into groups and periods based on their electronic structure and chemical properties.

GROUPS

Elements in the same group have the same number of electrons in their outer shell, leading to similar chemical properties. For example, Group 1 elements (alkali metals) are highly reactive and have a single electron in their outer shell.

PERIODS

Elements in the same period have the same number of electron shells. Moving across a period from left to right, the number of electrons in the outer shell increases, and the elements change from metals to non-metals.

DEVELOPMENT OF THE PERIODIC TABLE

Before the discovery of protons, neutrons, and electrons, scientists attempted to organise elements based on their **atomic weights**. However, this led to inaccuracies and misplaced elements in the periodic table. Dmitri Mendeleev, a Russian chemist, overcame these challenges by **leaving gaps** in his periodic table for elements that had not yet been discovered. He also **rearranged some elements based on their properties** rather than their atomic weights alone. The discovery of isotopes helped explain why the order based on atomic weights was not always correct.

METALS AND NON-METALS

Metals are found on the left side of the periodic table and lose electrons to form positive ions. Non-metals are found on the right side and tend to gain electrons to form negative ions.

GROUP 1 - ALKALI METALS

These elements are highly reactive, especially with water, and their reactivity increases down the group.

TRANSITION METALS

Located in the central block of the periodic table, they have high melting points and densities, and can form ions with different charges. They form coloured compounds and used as catalysts.

The Periodic Table of Elements

1		2		Key										3	4	5	6	7	0	
				relative atomic mass atomic symbol atomic (proton) number										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 sulphur 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	[227] 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	[285] Rg roentgenium 111	[286] Cn copernicium 112	[289] Nh nihonium 113	[289] Fl flerovium 114	[289] Mc moscovium 115	[293] Lv livermorium 116	[293] Ts tennessine 117	[294] Og oganesson 118			

GROUP 7 - HALOGENS

These elements are non-metals and become less reactive down the group. A more reactive halogen can displace a less reactive one from a compound.

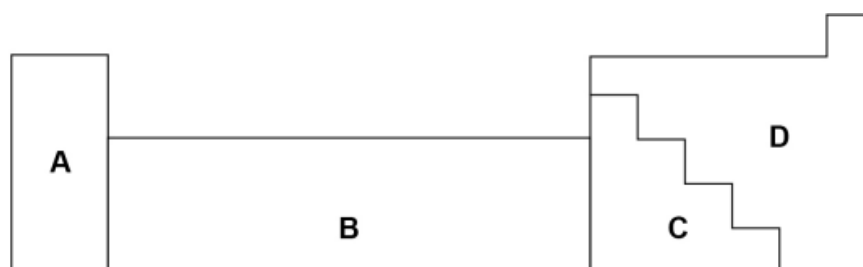
GROUP 0 - NOBLE GASES

They have full outer electron shells, making them very stable and unreactive. Boiling point increases going



PERIODIC TABLE

Diagram below shows an outline of part of the periodic table.



Q9.a) Element Q is a dull solid with a melting point of $44\text{ }^{\circ}\text{C}$. Element Q does not conduct electricity. Which section of the periodic table above is most likely to contain element Q?

[1 mark]

AQA June 22 H Q1.1

Q9.b) Element R forms ions of formula R^{2+} and R^{3+} . Which section of the periodic table above is most likely to contain element R?

[1 mark]

AQA June 22 H Q1.2

Q9.c) Give two differences between the physical properties of the elements in Group 1 and those of the transition elements.



[2 marks]

AQA June 22 H Q1.3

Q10. Give two observations you could make when a small piece of potassium is added to water.

[2 marks]

AQA June 21 H Q4.1

Q11. Explain why the reactivity of elements changes going down Group 1.

[4 marks]

AQA June 21 H Q4.3



PERIODIC TABLE

Q12.a) Rubidium and potassium are added to water. Predict one observation you would see that shows that rubidium is more reactive than potassium.

[1 mark]

AQA June 22 H Q5.1

Q12.b) Complete the equation for the reaction of rubidium with water. You should balance the equation. [3 marks]



[3 marks]

AQA June 22 H Q5.3

Q13. Sodium is in Group 1 of the modern periodic table. Describe what you would see when sodium reacts with chlorine.

[2 marks]

AQA June 19 H Q1.6

Q14. Astatine (At) is below iodine in Group 7.

Predict:

- the formula of an astatine molecule _____
- the state of astatine at room temperature _____

[2 marks]

AQA June 19 H Q1.5

Q15. Name the products formed when chlorine solution reacts with potassium iodide solution.

[1 mark]

AQA June 19 H Q7.1

Q16. Explain why the reactivity of the halogens decreases going down the group.

[3 marks]

AQA June 20 H Q8.5



PERIODIC TABLE

In the 19th century, some scientists tried to classify the elements by arranging them in order of their atomic weights. Below is the periodic table Mendeleev produced in 1869. His periodic table was more widely accepted than previous versions.

	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7
Period 1	H						
Period 2	Li	Be	B	C	N	O	F
Period 3	Na	Mg	Al	Si	P	S	Cl
Period 4	K Cu	Ca Zn	* *	Ti *	V As	Cr Se	Mn Br
Period 5	Rb Ag	Sr Cd	Y In	Zr Sn	Nb Sb	Mo Te	* I

Q17.a) The atomic weight of tellurium (Te) is 128 and that of iodine (I) is 127. Why did Mendeleev reverse the order of these two elements?

[1 mark]

AQA June 19 H Q1.1

Q17.b) Mendeleev left spaces marked with an asterisk * He left these spaces because he thought missing elements belonged there. Why did Mendeleev's periodic table become more widely accepted than previous versions?

[3 marks]

AQA June 19 H Q1.2

Q18. Gallium was discovered six years after Mendeleev published his periodic table. Give two reasons why the discovery of gallium helped Mendeleev's periodic table to become accepted.

[2 marks]

AQA June 21 H Q2.5



ADDITIONAL RESOURCES

Congratulations on completing the first workbook!

To further enhance your understanding and support your revision, I've curated a list of additional resources.



VIDEO

SEPARATING TECHNIQUES

This Facebook live recording goes through key definitions and gives an overview of separating techniques.

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VIDEO

ATOMS & IONS

This Facebook live recording goes through how to calculate the number of protons, neutrons and electrons in atoms and ions.

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Here are three videos from my course.



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