

WJEC Chemistry GCSE

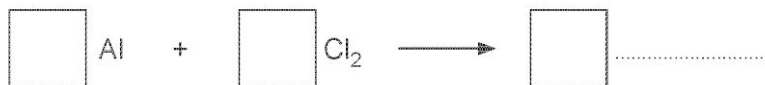
1.2: Atomic Structure and The Periodic Table

Practice Questions

Wales Specification

1.

- (a) Aluminium reacts with chlorine to form aluminium chloride. Complete and balance the symbol equation for the reaction taking place. [2]



- (b) Aluminium oxide, Al_2O_3 , is found in bauxite.

- (i) Calculate the relative formula mass (M_r) of aluminium oxide, Al_2O_3 . [2]

$$A_r(\text{Al}) = 27 \quad A_r(\text{O}) = 16$$

$$M_r(\text{Al}_2\text{O}_3) = \dots\dots\dots$$

- (ii) Using your answer from part (i) calculate the percentage of oxygen present in aluminium oxide, Al_2O_3 . [1]

$$\text{Percentage oxygen present} = \dots\dots\dots \%$$

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2.

- (a) An unknown alkane, X, was found to contain 9.0g of carbon and 2.0g of hydrogen. Calculate the simplest formula for this alkane. [3]

$$A_r(\text{H}) = 1$$

$$A_r(\text{C}) = 12$$

Simplest formula

- (b) Calculate the percentage by mass of carbon in butane, an alkane containing four carbon atoms. [2]

$$A_r(\text{H}) = 1$$

$$A_r(\text{C}) = 12$$

Percentage by mass of carbon = %

5

3.

(a) Potassium reacts with sulfur to form potassium sulfide.

Using the electronic structures below, draw dot and cross diagrams to show how bonding takes place during the formation of potassium sulfide. [3]

potassium = 2,8,8,1

sulfur = 2,8,6

(b) Using the electronic structures below, draw a dot and cross diagram to show the bonding in a molecule of sulfur difluoride, SF₂. [2]

sulfur = 2,8,6

fluorine = 2,7

4.

(a) Give the electronic structure of sodium, Na. [1]

.....

(b) Draw a diagram to show the metallic bonding in sodium. [2]

(c) (i) Sodium reacts vigorously with water.

Give **two** observations you would make when a small piece of sodium is added to a trough of water. [1]

.....
.....

(ii) Name the products of this reaction. [1]

..... and

(d) As you go down Group 1 of the Periodic Table the elements become more reactive.

State the main difference you would see if potassium instead of sodium was added to water. [1]





.....

(e) Explain why Group 1 metal reactivity increases down the group. [2]

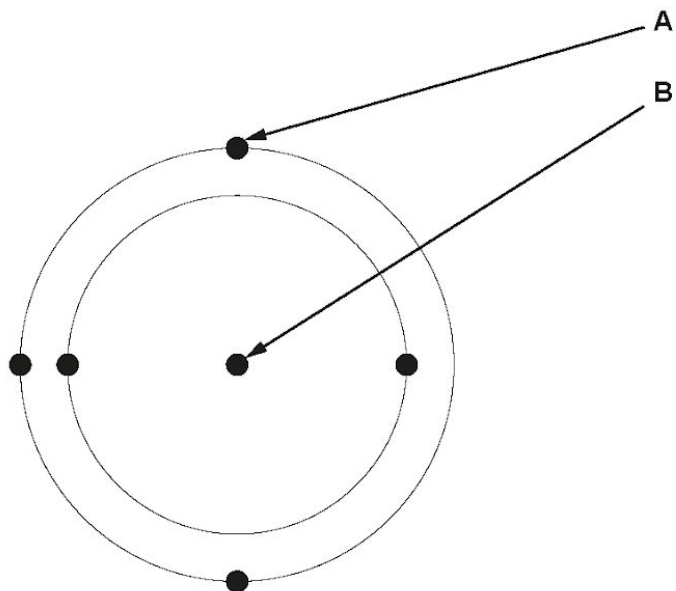
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5.

- (a) Draw lines to match each diagram below with the correct description. One has been done for you. [2]

Diagram	Description
	molecule of a compound
	molecule of an element
	mixture of two elements
	atom

(b) The following diagram shows an atom.



The box below contains some words that could be used in a description of the atom.

neutral	electron	positive
negative	nucleus	orbit

Use only words from the box to complete the table.

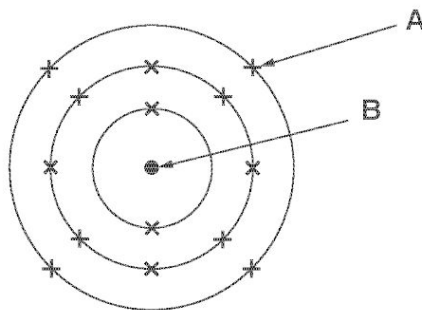
[2]

	Name	Charge
part A
part B

4

6.

The diagram shows an atom of silicon.



(a) Name particle A. [1]

(b) B is the nucleus. Name the two types of particle present in the nucleus of an atom. [2]
..... and

(c) Use the information in the diagram to give

(i) the atomic number of silicon, [1]

(ii) the electronic structure of silicon, [1]

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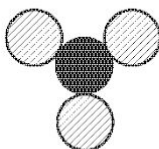
7.

(a) The key below represents atoms of some elements.



(i) Use the key to draw a diagram representing a molecule of nitrous oxide, N_2O . [1]

(ii) Use the key to give the chemical formula for the following molecule. [1]



Formula

(b) The box below shows the symbols and formulae for some gases.



Choose from the box

(i) two elements, and [1]

(ii) two compounds, and [1]

(c) The chemical formula of nitric acid is HNO_3 .

(i) State how many nitrogen atoms are present in the formula, HNO_3 [1]

(ii) Give the total number of atoms shown in the formula. [1]

(d) You may wish to refer to the table of common ions to help you answer parts (i) and (ii).

(i) Give the formulae of the ions present in the compound MgCl_2 . [1]

Positive ion *Negative ion*

(ii) Give the chemical formula for sodium hydroxide. [1]

.....

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8.

(a) Lithium reacts with sulfur to form lithium sulfide.

Using the electronic structures below, draw dot and cross diagrams to show the transfer of electrons and the formation of ions that occur as the reaction takes place. [3]

lithium = 2,1

sulfur = 2,8,6

(b) Sodium chloride and magnesium oxide both have giant ionic structures.

The melting points of the two compounds are given below.

Compound	Melting point(°C)
sodium chloride	801
magnesium oxide	2852

Explain the difference in the melting points of the two compounds. [2]

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- (c) Using the electronic structures below, draw a dot and cross diagram to show the bonding in a molecule of hydrogen peroxide. [2]

The structural formula for hydrogen peroxide is as follows.



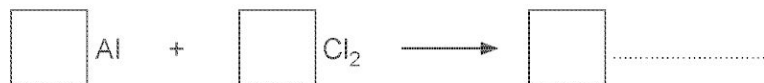
hydrogen = 1

oxygen = 2,6



9.

- (a) Aluminium reacts with chlorine to form aluminium chloride. Complete and balance the symbol equation for the reaction taking place. [2]



- (b) Aluminium oxide, Al_2O_3 , is found in bauxite.

- (i) Calculate the relative formula mass (M_r) of aluminium oxide, Al_2O_3 . [2]

$$A_r(\text{Al}) = 27 \quad A_r(\text{O}) = 16$$

$$M_r(\text{Al}_2\text{O}_3) = \dots\dots\dots$$

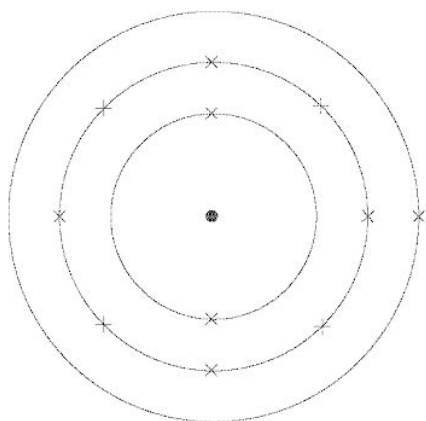
- (ii) Using your answer from part (i) calculate the percentage of oxygen present in aluminium oxide, Al_2O_3 . [1]

$$\text{Percentage oxygen present} = \dots\dots\dots \%$$

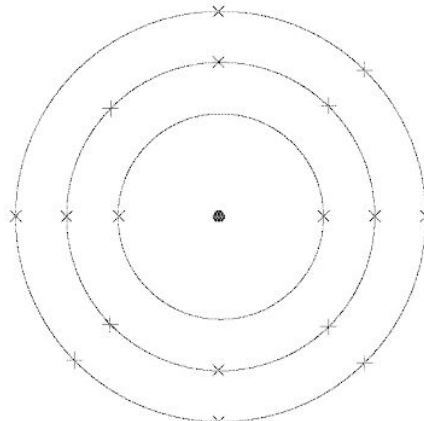
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10.

(a) The diagrams below show the electronic structure of a sodium atom and a chlorine atom.



sodium atom



chlorine atom

(i) Give the number of electrons in the outer shell of [1]

a sodium atom,

a chlorine atom.

(ii) Sodium reacts with chlorine to form a white solid.

I State, in terms of electrons, what happens to sodium and chlorine atoms during this reaction. [2]

.....
.....

II Complete the word equation for this reaction. [1]

sodium + chlorine \longrightarrow

(b) Sodium chlorate, NaClO_3 , is used to bleach paper.

Calculate the relative formula mass (M_r) of sodium chlorate. [2]

$$A_r(\text{O}) = 16 \quad A_r(\text{Na}) = 23 \quad A_r(\text{Cl}) = 35.5$$

$M_r(\text{NaClO}_3) = \dots\dots\dots$

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11.

A laboratory technician prepared a solution of sodium hydroxide, NaOH, in the following way.

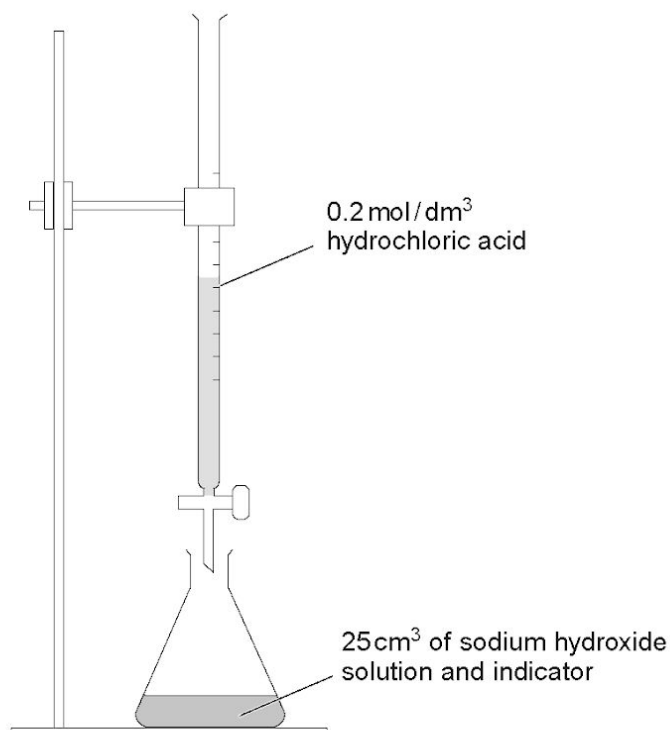
- He weighed out accurately 2.0 g of sodium hydroxide.
- He dissolved the sodium hydroxide in 250 cm³ of water.

The relative formula mass (M_r) of sodium hydroxide is 40.

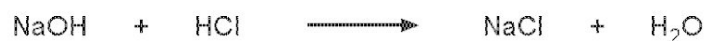
- (a) Use this information to calculate the concentration of this sodium hydroxide solution in mol/dm³. [2]

Concentration of sodium hydroxide solution = mol/dm³

- (b) A student was asked to carry out a titration to check the concentration of the sodium hydroxide solution. She carried out the titration using the apparatus shown below.



The equation for the reaction taking place is as follows.



The titration was carried out three times and the results obtained are shown below.

	Titration		
	1	2	3
Volume of hydrochloric acid added (cm ³)	22.2	22.7	22.6

Calculate the number of moles of hydrochloric acid that reacted and hence the concentration of the sodium hydroxide solution. [4]

Concentration of sodium hydroxide solution = mol/dm³

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12.

An analytical chemist was asked to check the amount of vitamin C in a tablet. Vitamin C tablets contain ascorbic acid, $C_6H_8O_6$, and a starch "filler" which holds them together.

Ascorbic acid reacts with sodium hydroxide solution according to the equation below:



To determine how much vitamin C is present, a tablet was dissolved in water and titrated with sodium hydroxide solution of concentration 0.10 mol/dm^3 . The endpoint was determined using the indicator phenolphthalein. The procedure was repeated three times and the mean value of sodium hydroxide solution needed to neutralise a vitamin C tablet was found to be 17.5 cm^3 .

- (a) Calculate the number of moles of sodium hydroxide in 17.5 cm^3 of the 0.10 mol/dm^3 solution. [2]

Number of moles = mol

- (b) Calculate the relative molecular mass, M_r , of ascorbic acid, $C_6H_8O_6$. [1]

$$A_r(\text{H}) = 1 \quad A_r(\text{O}) = 16 \quad A_r(\text{C}) = 12$$

$M_r = \dots\dots\dots$

- (c) The label on the bottle states that each tablet contains 300 mg (0.3 g) of vitamin C. Using your answers to parts (a) and (b) show whether this statement is correct. [2]

13.

The diagram below shows the early form of the Periodic Table developed by Dmitri Mendeleev.

I									
H 1.01	II		III	IV	V	VI	VII		
Li 6.94	Be 9.01	B 10.8	C 12.0	N 14.0	O 16.0	F 19.0			
Na 23.0	Mg 24.3	Al 27.0	Si 28.1	P 31.0	S 32.1	Cl 35.5	VIII		
K 39.1	Ca 40.1		Ti 47.9	V 50.9	Cr 52.0	Mn 54.9	Fe 55.9	Co 58.9	Ni 58.7
Cu 63.5	Zn 65.4			As 74.9	Se 79.0	Br 79.9			
Rb 85.5	Sr 87.6	Y 88.9	Zr 91.2	Nb 92.9	Mo 95.9		Ru 101	Rh 103	Pd 106
Ag 108	Cd 112	In 115	Sn 119	Sb 122	Te 128	I 127			
Ce 133	Ba 137	La 139		Ta 181	W 184		Os 194	Ir 192	Pt 195
Au 197	Hg 201	Tl 204	Pb 207	Bi 209					
			Th 232			U 238			

(a) State what information Mendeleev used to arrange the elements. [2]

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(b) State one difference and one similarity in the appearance of Mendeleev's table and today's Periodic Table. [2]

Similarity

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Difference

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.....

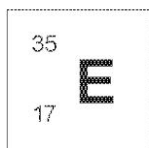
(c) Complete the following table that shows the position of some elements in the modern Periodic Table. [2]

Element	Symbol	Group	Period
helium	0	1
chlorine	Cl	7
calcium	Ca

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14.

An atom of element E is represented as follows.



State and explain what information this gives you about element E.

You may wish to refer to the key on the Periodic Table to help you answer this question. [6 QWC]

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15.

The following diagram shows an outline of the Periodic Table.
The letters shown are NOT the chemical symbols of the elements.

	A																		

(a) Give the letter of the element which is found in Group 0 and Period 2. [1]

.....

(b) Give the letters of the two elements which you would expect to have similar chemical properties. Give a reason for your choice.

Letters and

Reason [2]

(c) The table below shows the properties of three elements 1, 2 and 3.

Element	Properties			
	Melting Point (°C)	Boiling Point (°C)	Appearance	Malleable or brittle
1	1084	2927	shiny brown solid	malleable
2	1414	2900	shiny grey solid	brittle
3	115	445	yellow solid	brittle

State, giving reasons, which of elements 1, 2 or 3 could be element C in the Periodic Table above. [2]

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16.

(a) The formula for calcium chloride is CaCl_2 .

Give the names of the two elements present in this compound. [1]

..... and


(b) Name a metal which is in the same period of the Periodic Table as argon. [1]

.....

(c) (i) A formula for nitrogen oxide is N_2O .

A molecule of nitrogen oxide can be drawn as follows.



Give the name of the element which is represented by . [1]

.....

(ii) Draw your own key to represent hydrogen and carbon atoms. Use your key to draw a molecule of methane, CH_4 . [2]

Key

hydrogen	
carbon	

Methane

(d) Fizzy drinks such as lemonade contain carbonic acid. Each molecule of carbonic acid contains two atoms of hydrogen, one atom of carbon and three atoms of oxygen. [1]

Give the formula for carbonic acid.

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17.

- (a) Atoms consist of particles called electrons, neutrons and protons.

Complete the following table by giving the charge on an electron and the mass of a neutron.

[2]

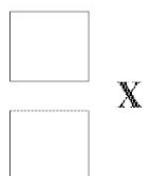
	Mass	Charge
electron	negligible
neutron	neutral (0)
proton	1	positive (+1)

- (b) Potassium is represented as ${}_{19}^{39}\text{K}$.

Element X has 9 electrons, 10 neutrons and 9 protons.

Write the information for element X in the same form as above.

[1]



- (c) Chlorine has two isotopes: chlorine-35 and chlorine-37.

Complete the table below.

[2]

	chlorine-35	chlorine-37
Atomic number	17	17
Mass number	35	37
Number of electrons	17
Number of neutrons	18
Number of protons	17	17

(d) The atomic number of sodium is 11.

Place a tick (✓) in the box next to the electronic structure of sodium.

[1]

- 11
- 2,9
- 4,7
- 2,4,5
- 2,8,1

(e) Element Z is found in Group 2 and in Period 4 of the Periodic Table.

Place a tick (✓) in the box next to the electronic structure of element Z.

[1]

- 2,4
- 4,2
- 2,8,2
- 2,8,8,2
- 2,8,8,4

7

18.

The following table shows information about some atoms, A–E.

A–E are not the chemical symbols for the elements.

Atom	A	B	C	D	E
atomic number	3	6		10	11
mass number		12	14	20	23
number of protons	3	6	6	10	11
number of neutrons	4	6	8	10	
number of electrons	3	6	6	10	11

(a) Complete the table. [3]

(b) (i) Give the electronic structure of element D. [1]

(ii) Use this information to explain why this element is found in Period 2 and Group 0. [2]

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.....
.....

(c) Choose the letters, A–E, of the atoms that represent isotopes and give a reason for your choice. [2]

Letters and

Reason

.....

8

19.

The table below shows some information about elements A-F. The letters are not the chemical symbols of the elements.

Element	Colour	Melting point (°C)	Boiling point (°C)	Conducts electricity	Density (g/cm ³)
A	dull grey	1414	2900	yes	2.03
B	pale yellow	-219	-188	no	0.0017
C	orange brown	-7	59	no	3.10
D	shiny brown	1084	2927	yes	8.92
E	shiny grey	1538	2861	yes	7.87
F	colourless	-157	-153	no	0.0033

(a) State which of the elements A-F are gases at room temperature. [1]

.....

(b) Give the letter of the element A-F that has the biggest difference between melting point and boiling point. [1]

.....

(c) The following diagram shows an outline of the Periodic Table.



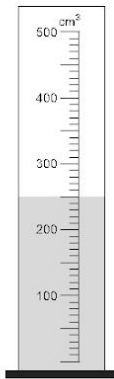
(i) Element A is found in area Y of the Periodic Table. Explain how the information in the table supports this. [2]

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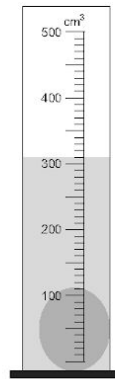
(ii) From elements B-F, identify all that would be found in area X. [1]

.....

- (d) A student has a sample of element **D** of mass 540 g. She measures its volume using a measuring cylinder as shown below.



Measuring cylinder before adding sample of element **D**



Measuring cylinder after adding sample of element **D**

- (i) Using the information given above and the equation below, calculate the density of the sample of element **D**. [2]

$$\text{density} = \frac{\text{mass}}{\text{volume}}$$

*Density of sample of element **D** = g/cm³*

- (ii) Another pupil obtained a value of 9.10 g/cm³. Suggest why this value is different to that given in the table. [2]

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