

WJEC Chemistry GCSE

4: The Periodic Table and Properties of Elements

Practice Questions

England Specification

1.

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]

.....

.....

.....

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

Similarity

.....

.....

Difference

.....

.....

(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	.....	.....

6

2.

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.



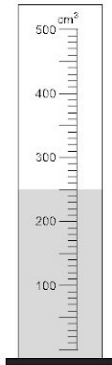
(i) Element A is found in area Y of the Periodic Table. Explain how the information in the table supports this. [2]

.....

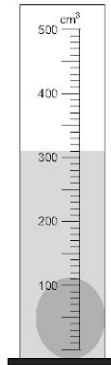
(ii) From elements B-F, identify all that would be found in area X. [1]

.....

- (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]

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

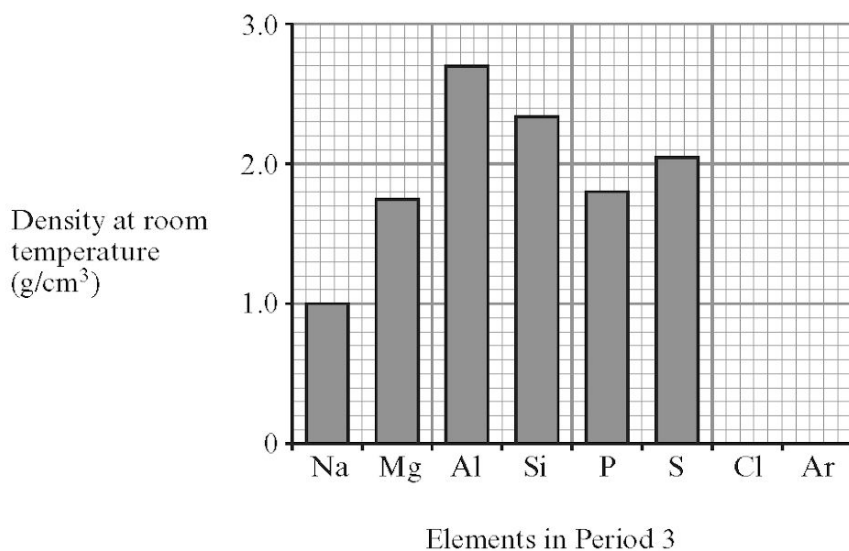
*Density of sample of element **D** = g/cm³*

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

.....

3.

(a) A bar chart of the densities *at room temperature* of all the elements in Period 3 of the Periodic Table is shown below.



(i) Name **all** the **metals** in this period. [1]

.....

(ii) Name the element in this period that has both metallic and non-metallic properties. [1]

.....

(iii) Give the reason that the bars for chlorine and argon are too small to be seen. [1]

.....

.....

(iv) Give the trend in the densities of the **metals** going across this period. [1]

.....

(b) The table below gives the melting points of all the elements in Period 3.

Element	Na	Mg	Al	Si	P	S	Cl	Ar
Melting point (°C)	98	650	660	1410	44	113	-101	-189

How well does the evidence in the table support the following statement?

'The melting points of non-metals decrease from left to right across the Periodic Table.' [2]

.....

4.

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

	A															B	
													C		D		
											E						
															F		

(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]

.....

5

5.

(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.

6

6. 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]

.....

.....

.....

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

Letters and

Reason

.....

7.

The following table shows some information about some Group 7 elements.

Name	Formula	State at room temperature (20°C)	Colour of vapour	Melting point (°C)
chlorine	Cl ₂	gas	yellow-green	-101
bromine	.....	liquid	orange-brown	-7
iodine	I ₂	solid	purple	114

(a) Give the formula for bromine. [1]

(b) A pupil predicted the **boiling point** of chlorine to be -10°C.

Using the information in the table, suggest **two** reasons why the pupil gave this value. [2]

.....

.....

.....

(c) Chlorine is a poisonous gas.

State **one** use of chlorine which relates to its poisonous nature. [1]

.....

(d) Fluorine is above chlorine in this group of the Periodic Table.

Use the information in the table to predict **two** properties of fluorine. [2]

.....

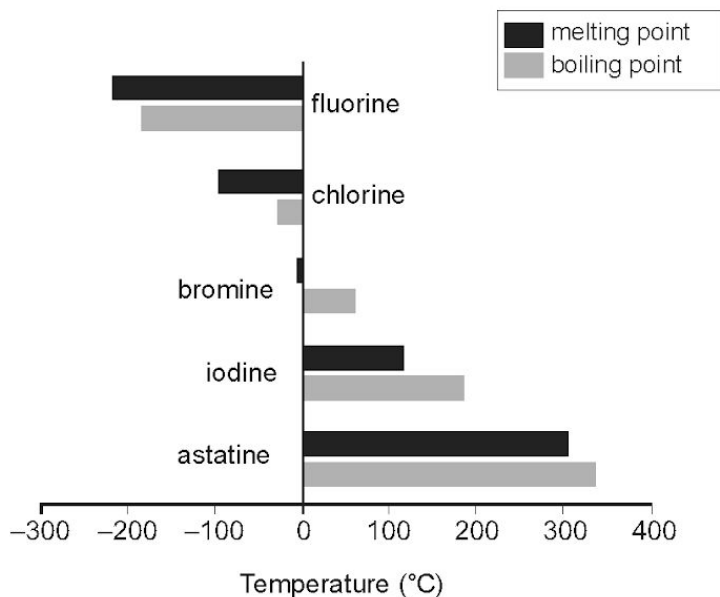
.....

.....

6

8.

(a) The following chart shows the melting points and boiling points of the elements in Group 7.



Give the state (solid, liquid or gas) of bromine at room temperature giving the reasons for your answer. [2]

.....

.....

.....

(b) The following table shows the observations made when some Group 7 elements react with hydrogen.

Element	Observations
chlorine	explodes in sunlight
bromine	violent reaction when heated
iodine	reacts when heated strongly

Describe the trend in reactivity within the group and use this trend to predict how astatine would react with hydrogen. [2]

.....

.....

- (c) Group 7 elements also react with iron. Balance the following symbol equation that shows the reaction of iron and fluorine. [1]



- (d) Chlorine and iodine can be extracted from seawater by electrolysis.

- (i) Balance the following electrode equation showing how chlorine is formed. [1]



- (ii) Chlorides make up 55% of the salts present in seawater and it is therefore economically viable to extract chlorine from seawater. Suggest a reason why iodine is no longer extracted in this way. [1]

.....

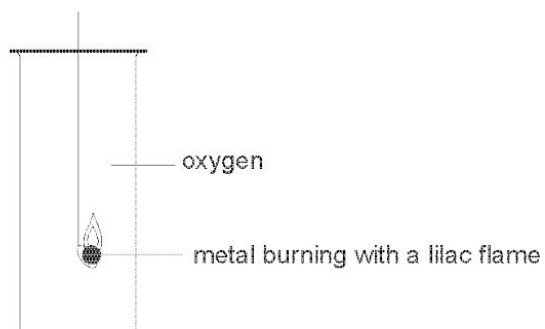
.....

- (iii) State the property of chlorine and iodine that make them suitable for use in disinfectants and antiseptics. [1]

.....

8

9. A Group 1 metal is burned in a gas jar containing oxygen.



- (a) Use the information in the diagram above to name the Group 1 metal. [1]

.....

- (b) Write a word equation for the reaction taking place. [1]

..... + \longrightarrow

- (c) Give the name of a Group 1 metal that would react less vigorously than the metal named in (a) above. [1]

.....

- (d) A similar reaction can be carried out using chlorine instead of oxygen. The product obtained is a white solid.

- (i) Choose from the box below a solution that could be used to show that the white solid contains chloride ions. [1]

limewater silver nitrate sodium hydroxide sulfuric acid

Solution

- (ii) State what must be done to the white solid in order to carry out the test. [1]

.....

- (iii) Give the colour of the precipitate formed. [1]

.....

6

10.

- (a) Lithium, sodium, potassium and rubidium are the first four members of Group 1 in the Periodic Table.

The following table gives the melting points and boiling points of lithium, potassium and rubidium.

Element	Melting point (°C)	Boiling point (°C)
lithium	180	1330
sodium	-	-
potassium	64	774
rubidium	39	688

Using the information in the table, choose from below the pair of values most likely to be the melting point and the boiling point of sodium. [1]

Pair A
59 910

Pair B
113 735

Pair C
98 890

Pair D
134 1498

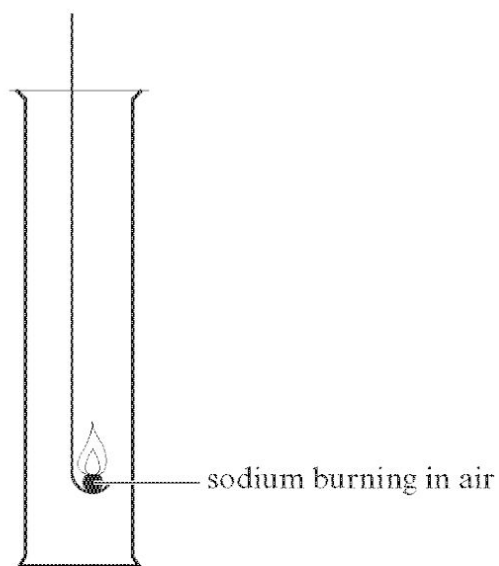
Pair

- (b) State why sodium is stored in oil. [1]

.....

.....

(c) Sodium burns vigorously in air.



(i) Give the colour of the flame. [1]

.....

(ii) Give the word equation for the reaction that takes place when sodium burns in air. [2]

..... + →

(iii) Sodium also reacts vigorously with chlorine. Balance the symbol equation for the reaction between sodium and chlorine. [1]



6

11. Lithium, sodium and potassium are Group 1 metals.

(a) A teacher wanted to demonstrate the similarities and differences in how each metal reacted with water. She added a small piece of each metal separately to a trough of water.

Describe what you would see when each metal is added to water and state how the observations can be used to establish the trend in reactivity within the group. [6 QWC]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(b) The teacher then demonstrated the reaction of sodium with oxygen.

Complete and balance the symbol equation for this reaction. [2]



8

12. (a) The following box contains the names of six ionic compounds.

sodium chloride	sodium carbonate	copper(II) sulfate
ammonium chloride	potassium sulfate	lithium carbonate

State which of the compounds in the box you would expect to

- (i) give a yellow flame in a flame test, [1]

.....

- (ii) produce bubbles when reacting with hydrochloric acid. [1]

.....

- (b) A student has two colourless solutions in unlabelled bottles. He knows that one is potassium chloride and that the other is potassium iodide. Describe a test that could be carried out to distinguish between the solutions, giving the observations expected in both cases. [3]

.....

.....

.....

- (c) Compounds containing ammonium ions can be identified by heating gently with sodium hydroxide solution and testing the gas produced.

Name the gas produced and describe how you would positively identify this gas. [2]

.....

.....

- (d) Iron(III) chloride solution produces a brown precipitate when it reacts with sodium hydroxide solution.

Write a balanced ionic equation for this reaction. You should include state symbols. [3]



10

13.

(a) Draw a line from each gas below to the observation made in identifying it. [3]

Gas	Observation
	relights a glowing splint
carbon dioxide	turns flame red
ammonia	turns limewater milky
oxygen	pops with a burning splint
	turns damp red litmus blue

(b) The following box contains observations made when testing for some common metal ions.

lilac flame	yellow flame	green flame
blue precipitate	brown precipitate	green precipitate
	white precipitate	

Choose from the box the result you would expect for the following tests. [3]

A flame test is carried out on a sample of sodium chloride

.....

A flame test is carried out on a sample of copper(II) sulfate

.....

Sodium hydroxide solution is added to a solution of iron(III) chloride

.....

6

14. (a) When bromine is passed over heated iron wool it glows and forms iron(III) bromide.
Write a balanced symbol equation for the reaction. [3]



- (b) Name the substance used to test for the presence of bromide ions in iron(III) bromide solution and give the expected result. [2]

.....
.....
.....

5

15. (a) A Year 11 class investigated tests used to identify positive and negative ions. The results recorded by one pupil are shown below.
Put a **circle** around the **three incorrect** observations. [3]

Flame tests		Testing negative ions		
Metal ion	Flame colour	Ion	Test	Observation
Na ⁺	yellow	Cl ⁻	add dilute nitric acid followed by silver nitrate solution	yellow precipitate
K ⁺	lilac			
Cu ²⁺	brick-red	CO ₃ ²⁻	add dilute hydrochloric acid	bubbles formed
Adding sodium hydroxide to metal ions in solution		SO ₄ ²⁻	add dilute hydrochloric acid followed by barium chloride solution	white precipitate
Metal ion solution	Colour of precipitate			
Cu ²⁺	blue			
Fe ²⁺	green			
Fe ³⁺	white			

- (b) Compounds containing ammonium ions, NH₄⁺, are identified by adding sodium hydroxide solution, warming and testing the gas formed with damp red litmus paper. The damp red litmus paper turns blue.

The symbol equation below shows the reaction between ammonium chloride and sodium hydroxide solution.



- Name the **three** products of the reaction. [1]

16.

(a) Lithium, sodium and potassium are elements in Group 1 of the Periodic Table.

The following table shows what a student recorded when these elements reacted with water. Two of the observations are **incorrect**.

Element	Observations	pH of solution
lithium	bubbles slowly on the surface of the water	6
sodium	bubbles rapidly and melts into a ball	12
potassium	burns with an orange flame	13

Identify the errors and give the correct observations below. [2]

Error 1

Correction

Error 2

Correction

(b) A student carries out tests to prove that a powder contains sodium ions and chloride ions. The following box gives some tests for ions and some expected observations.

white precipitate	yellow precipitate	no reaction	cream precipitate
flame test	add sodium hydroxide solution	add silver nitrate solution	
add universal indicator	yellow flame	red flame	green flame

Select the appropriate tests and results to complete the following table. [4]

Ion	Test used	Observation expected
sodium		
chloride		