

The Periodic Table – 2019 Nov IGCSE

1. 0620/31/O/N/19/No.5

This question is about the halogens and compounds of the halogens.

(a) The properties of some halogens are shown in the table.

element	melting point in °C	boiling point in °C	density of liquid at its boiling point in g/cm ³	atomic radius in nm
chlorine	-101	-35	.....	0.099
bromine	-7	59	3.12	0.114
iodine	114	.....	4.93	0.133
astatine	302	337	6.35	

(i) Complete the table to estimate:

- the density of liquid chlorine
- the boiling point of iodine.

[2]

(ii) Describe the trend in the atomic radius of the halogens down the group.

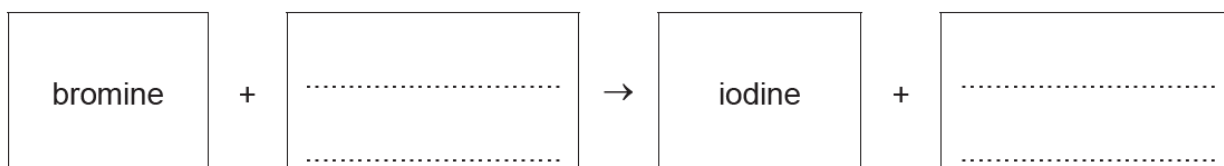
..... [1]

(iii) Predict the physical state of bromine at 50 °C.
Give a reason for your answer.

.....
.....
..... [2]

(b) Bromine reacts with an aqueous potassium salt to form iodine and a different potassium salt.

Complete the word equation for this reaction.



[2]

(c) Fluorine is above chlorine in Group VII of the Periodic Table.

- (i) Explain, using ideas about the reactivity of the halogens, why chlorine does **not** react with aqueous sodium fluoride.

.....
..... [1]

- (ii) Balance the chemical equation for the reaction of fluorine with ammonia.



- (iii) A compound of fluorine has the formula XeO_3F_2 .

Complete the table to calculate the relative molecular mass of XeO_3F_2 .
Use your Periodic Table to help you.

type of atom	number of atoms	relative atomic mass	
xenon			
oxygen	3	16	$3 \times 16 = 48$
fluorine			

relative molecular mass = [2]

- (iv) The compound XeO_3F_2 readily undergoes reduction.

What is meant by the term *reduction*?

..... [1]

[Total: 13]

This question is about the halogens and compounds of the halogens.

(a) The properties of some halogens are shown in the table.

element	melting point in °C	boiling point in °C	density of liquid at boiling point in g/cm ³	colour
fluorine	-220	-188	1.51	
chlorine	-101	.....	1.56	light green
bromine	-7	59	3.12	red-brown
iodine	114	184	.....	grey-black

(i) Complete the table to estimate:

- the boiling point of chlorine
- the density of iodine.

[2]

(ii) Describe the trend in the melting points of the halogens down the group.

..... [1]

(iii) Predict the physical state of bromine at -20 °C.

..... [1]

(iv) Which **one** of the following is most likely to be the colour of fluorine?

Tick **one** box.



dark green

light grey-black

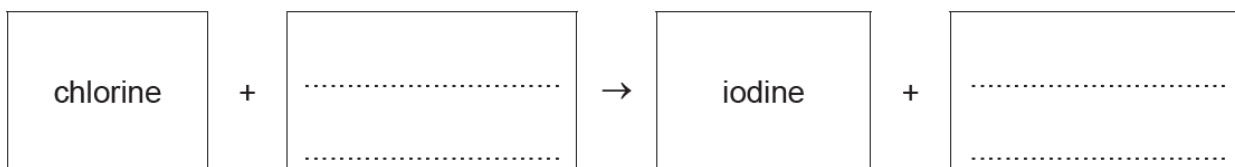
light yellow

purple

[1]

(b) Chlorine reacts with an aqueous potassium salt to form iodine and a different potassium salt.

(i) Complete the word equation for this reaction.



[2]

(ii) When aqueous sodium fluoride is added to chlorine, no reaction occurs.

Explain, using ideas about the reactivity of the halogens, why **no** reaction occurs.

.....
..... [1]

(iii) State **one** use of chlorine.

..... [1]

(c) Aqueous silver nitrate is used to test for chloride ions and iodide ions.

(i) The solutions are first acidified with dilute nitric acid.

Explain why dilute hydrochloric acid is **not** used to acidify the solutions.

..... [1]

(ii) Complete the table to show the expected observations.

ion	observations on adding aqueous silver nitrate
chloride (Cl^-)	
iodide (I^-)	

[3]

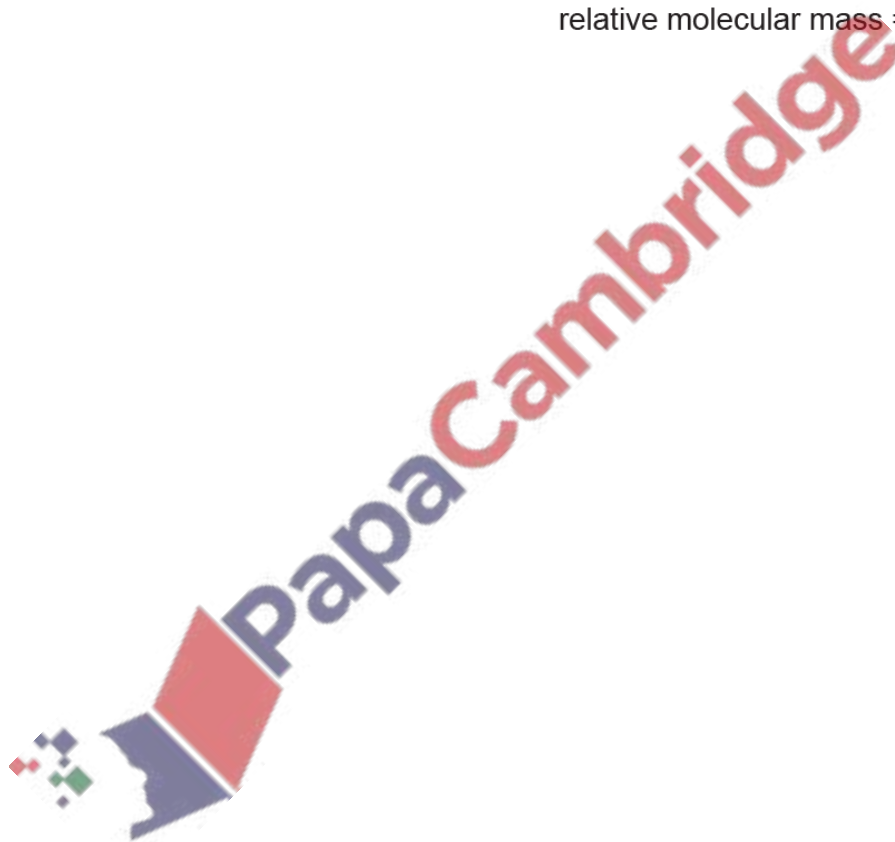
(d) A compound of chlorine has the formula $C_6H_4Cl_2$.

Complete the table to calculate the relative molecular mass of $C_6H_4Cl_2$.
Use your Periodic Table to help you.

type of atom	number of atoms	relative atomic mass	
carbon	6	12	$6 \times 12 = 72$
hydrogen			
chlorine			

relative molecular mass = [2]

[Total: 15]



This question is about Group I elements.

(a) The properties of some Group I elements are shown in the table.

element	melting point in °C	boiling point in °C	relative thermal conductivity	atomic radius / pm
lithium	.....	1342	84	152
sodium	97	883	142	186
potassium	63	760	102	.....
rubidium	39	686	58	248

(i) Complete the table to estimate:

- the melting point of lithium
- the atomic radius of potassium.

[2]

(ii) Describe the trend in the boiling points of the Group I elements down the group.

..... [1]

(iii) Caesium is below rubidium in Group I.

Use the information in the table to suggest why it is difficult to predict the thermal conductivity of caesium.

..... [1]

(iv) Predict the physical state of rubidium at 45°C.
Give a reason for your answer.

..... [2]

(b) Lithium reacts with oxygen to form lithium oxide.

(i) Balance the chemical equation for this reaction.



(ii) Is lithium oxide an acidic oxide or a basic oxide?
Give a reason for your answer.

.....
.....
..... [1]

(iii) State the name of the particle which is lost from a lithium atom when it forms a lithium ion.

..... [1]

(iv) A compound of lithium has the formula $\text{C}_2\text{H}_5\text{Li}$.

Complete the table to calculate the relative molecular mass of $\text{C}_2\text{H}_5\text{Li}$.
Use your Periodic Table to help you.

type of atom	number of atoms	relative atomic mass	
carbon			
hydrogen	5	1	$5 \times 1 = 5$
lithium			

relative molecular mass = [2]

[Total: 12]

The Periodic Table is very useful to chemists.

Refer only to elements with atomic numbers 1 to 36 in the Periodic Table provided when answering **Question 1**.

(a) Use information from the Periodic Table provided to identify **one** element which:

- (i) has atoms with exactly 9 protons [1]
- (ii) has atoms with 0 neutrons [1]
- (iii) has atoms with exactly 23 electrons [1]
- (iv) has atoms with an electronic structure of 2,8,6 [1]
- (v) forms ions with a charge of 3⁻ containing 18 electrons [1]
- (vi) forms ions with a charge of 2⁺ containing 10 electrons [1]
- (vii) has a relative atomic mass that shows it has at least two isotopes. [1]

(b) State which metal in the first 36 elements:

- (i) is the Group I element which reacts most vigorously with water [1]
- (ii) reacts with air to form lime. [1]

(c) One element in the first 36 elements is used as the fuel in a fuel cell.

- (i) Name this element. [1]

- (ii) Write the overall chemical equation for the reaction which occurs when the element in (c)(i) reacts in a fuel cell.

..... [2]

[Total: 12]