

- 1 Give two physical properties shown by transition elements which are **not** shown by Group I elements.

1

2 [2]

[Total: 2]

- 2 Describe the trend in the reactivity of Group I elements.

.....

..... [1]

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[Total: 1]

- 3 Copper is a transition element. It can have variable oxidation states.

State **two** other chemical properties of transition elements which make them different from Group I elements.

1

2 [2]

[Total: 2]

- 4 Predict **one** difference in the appearance of aqueous solutions of nickel compounds compared to aqueous solutions of sodium compounds.

.....

..... [1]

[Total: 1]

- 5 This question is about the elements in Period 3 of the Periodic Table.

Na	Mg	Al	Si	P	S	Cl	Ar
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State which Period 3 element is a green gas at room temperature and pressure.

..... [1]

[Total: 1]

- 6 Give **two** ways in which the properties of transition elements differ from the properties of Group I metals.

1

2 [2]

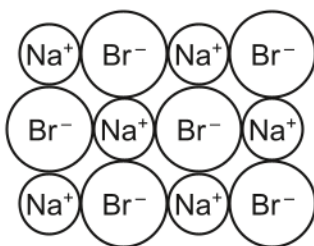
[Total: 2]

- 7 The diagram shows the structures of five substances, **A**, **B**, **C**, **D** and **E**.

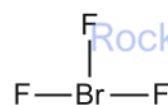
A



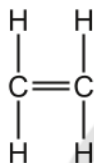
B



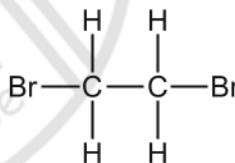
C



D



E



Which structure, **A**, **B**, **C**, **D** or **E**, contains atoms of **two** different halogens?

..... [1]

[Total: 1]

- 8 Group V chlorides are covalent molecules. The boiling points of some Group V chlorides are shown.

chloride	boiling point / °C
NCl_3	71
PCl_3	
AsCl_3	130
SbCl_3	238

- (a) Suggest the approximate boiling point of PCl_3 .

..... [1]



- (b) Explain the trend in boiling points in terms of attractive forces between particles.

.....

..... [2]

[Total: 3]

- 9 When chlorine reacts with aqueous potassium bromide a displacement reaction occurs.

- (a) Describe the colour change of the solution.

from to [2]

- (b) Write a chemical equation for this reaction.

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..... [2]

[Total: 4]

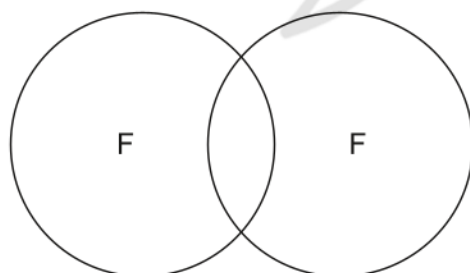
- 10 Fluorine is a Group VII element. Fluorine forms compounds with metals and non-metals.

- (a) Predict the physical state of fluorine at room temperature and pressure.

..... [1]

- (b) Fluorine exists as diatomic molecules.

Complete the dot-and-cross diagram to show the electron arrangement in a molecule of fluorine.
Show outer shell electrons only.



[2]

- (c) Write a chemical equation for the reaction between sodium and fluorine.

..... [2]

- (d) Explain why chlorine does **not** react with aqueous sodium fluoride.

.....

..... [1]

[Total: 6]

- 11 Titanium is extracted from an ore called rutile. Rutile is an impure form of titanium(IV) oxide, TiO_2 .

Rutile is mixed with coke and heated in a furnace through which chlorine gas is passed. The product is gaseous titanium(IV) chloride, TiCl_4 .

Titanium(IV) chloride is heated with an excess of magnesium, in an atmosphere of argon.

- (a) Balance the chemical equation for the reaction.



- (b) Titanium(IV) chloride can be reacted with sodium instead of magnesium.

The reaction between titanium(IV) chloride and sodium is similar to the reaction between titanium(IV) chloride and magnesium.

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Write a chemical equation for the reaction between titanium(IV) chloride and sodium.

..... [1]

- (c) Suggest why the reaction between titanium(IV) chloride and magnesium is done in an atmosphere of argon and **not** in air.

..... [1]

[Total: 3]

- 12 Across a period, the elements change from metallic to non-metallic.

- (a) Describe how the type of oxide changes across this period.

..... [2]

- (b) Describe how the type of bonding in the chlorides formed by these elements changes across this period.

..... [2]

[Total: 4]

- 13 The table shows some properties of four Group I elements.

element	melting point / $^{\circ}\text{C}$	boiling point / $^{\circ}\text{C}$	atomic radius /nm
sodium	98	883	0.191



potassium	63	760	
rubidium	39		0.250
caesium	29	671	0.272

- (a) (i) Complete the table by predicting:
- the boiling point of rubidium
 - the atomic radius of potassium.

[2]

- (ii) Describe the trend in the melting point of the Group I elements down the group.

..... RocketRevise [1]

- (iii) Deduce the physical state of potassium at 60 °C.
Explain your answer.

..... [2]

[Total: 5]

- 14 In the Periodic Table, the elements are arranged in columns called Groups and in rows called Periods.

- (a) Complete the table for some of the elements in Period 3.

group number	I	II	III	IV	V	VI	VII
symbol	Na	Mg	Al	Si	P	S	Cl
number of valency electrons							
valency							

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- (b) What is the relationship between the group number and the number of valency electrons?

..... [1]



- (c) Explain the relationship between the number of valency electrons and the valency for the elements Na to Al,

.....

for the elements P to Cl.

.....

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[4]

[Total: 7]

- 15** Ammonia reacts with oxygen at high temperatures in the presence of a suitable catalyst to form nitric oxide, NO.



- (a) Explain how this chemical equation shows ammonia acting as a reducing agent.

.....
 [1]

- (b) Suggest a suitable catalyst for the reaction from the list of metals. Give a reason for your answer.

aluminium calcium platinum potassium sodium

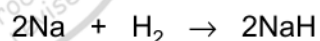
suitable catalyst

reason [2]

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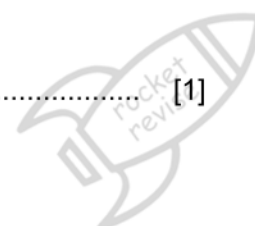
[Total: 3]

- 16** The symbol equation for the production of sodium hydride is shown.



- (a) Write a word equation for this reaction.

..... [1]





(b) Suggest why the hydrogen must be dry.

..... [1]

[Total: 2]

17 When potassium is added to water a chemical reaction occurs.

State **two** observations that can be made when potassium is added to water.

.....

..... [2]

RocketRevise [Total: 2]

18 Chromium is a transition element.

- Chromium has a high melting point.
- Chromium is a good conductor of electricity.
- Many chromium compounds are soluble in water.
- Hydrated chromium(III) sulfate is green.
- Chromium forms the chlorides CrCl_2 and CrCl_3 .
- Oxides of chromium act as catalysts in the manufacture of poly(ethene).

(a) Use this information to give **two** properties of chromium which are different from properties of Group I elements such as sodium.

1

2 [2]

(b) Use this information to give **two** properties of chromium which are similar to properties of Group I elements such as sodium.

1

2 [2]

[Total: 4]

19 When Group I metals are added to water they fizz and an alkaline solution forms.

(a) Name the gas given off.

..... [1]

(b) Identify the ion present in the solution which makes the solution alkaline.

..... [1]

[Total: 2]

- 20 Describe **two** ways in which the physical properties of Group I metals are different from those of transition metals.

1

.....

2

..... [2]

[Total: 2]

- 21 Group I metals are very reactive. Transition elements are also metals but are less reactive than Group I metals.

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State **two** physical properties of Group I metals which are similar to those of transition metals.

1

2 [2]

[Total: 2]

- 22 Element **Z** is in Period 3 and Group V.

(a) Identify element **Z**.

..... [1]

(b) Explain in terms of electron transfer why **Z** behaves chemically as a non-metal.

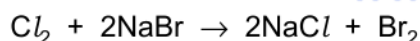
.....

..... [2]

[Total: 3]

- 23 Chlorine reacts with aqueous sodium bromide.

The equation for the reaction is shown.



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(a) State the type of reaction shown.

..... [1]

(b) Why is there **no** reaction between iodine and aqueous sodium bromide?

..... [1]

[Total: 2]



24 The table shows some properties of four metals in Group I of the Periodic Table.

metal	melting point / °C	boiling point / °C	relative electrical conductivity
sodium	98	883	_____
potassium	63	760	14
rubidium	_____	686	8
caesium	29	669	5

(a) Complete the table to estimate:

- the melting point of rubidium
- the relative electrical conductivity of sodium.

[2]

(b) What is the physical state of caesium at 20 °C?

Give a reason for your answer.

.....

.....

.....

[2]

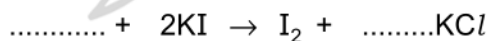
(c) Describe the trend in the boiling points of the Group I metals.

.....

[Total: 5]

25 Iodide is formed when chlorine reacts with aqueous potassium iodide.

(a) Complete the chemical equation for this reaction.



[2]



- (b) When aqueous iodine is mixed with aqueous potassium chloride, there is no reaction.

Suggest, in terms of chemical reactivity, why there is no reaction.

..... [1]

[Total: 3]

- 26 This question is about Group I elements.

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

- (a) Complete the table to estimate:

- the melting point of lithium [2]
- the atomic radius of potassium. [2]

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

..... [1]

- (c) 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.

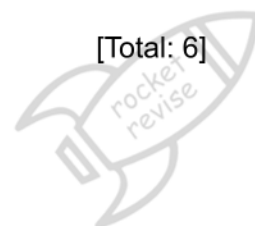
..... [1]

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

..... [2]

[Total: 6]

- 27 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 this question.

State which metal in the first 36 elements:

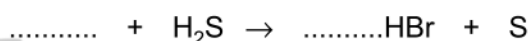
(a) is the Group I element which reacts most vigorously with water [1]

(b) reacts with air to form lime. [1]

[Total: 2]

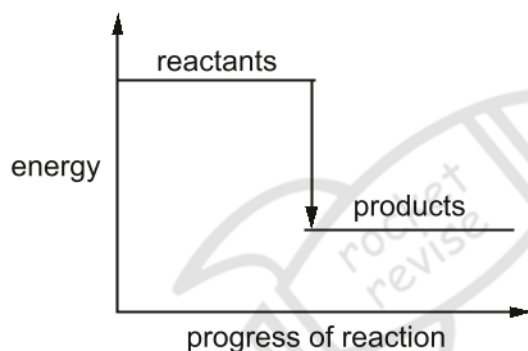
28 Bromine reacts with hydrogen sulfide, H_2S .

(a) Complete the chemical equation for this reaction.



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[2]

(b) The energy level diagram for this reaction is shown.



Explain how this diagram shows that the reaction is exothermic.

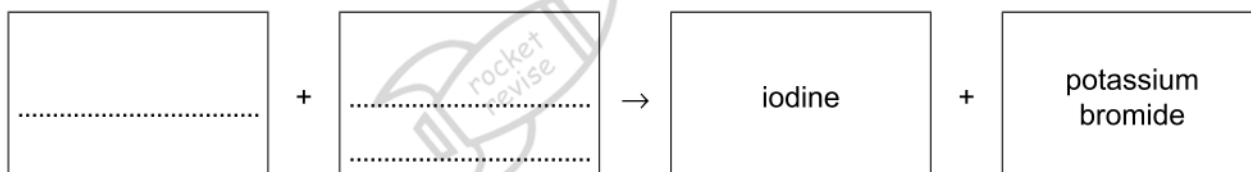
.....
.....

[1]

[Total: 3]

29 This question is about iodine and compounds of iodine.

(a) Complete the word equation to show the halogen and halide compound which react to form the products iodine and potassium bromide.



[2]

- (b) Explain, in terms of the reactivity of the halogens, why aqueous iodine does **not** react with aqueous potassium chloride.

.....

..... [1]

[Total: 3]

- 30 The table shows the properties of some Group VII elements.

element	boiling point in °C	density at room temperature in g/cm ³	physical state at room temperature
fluorine	-188	0.0017	
chlorine		0.0032	gas
bromine	59	3.1	liquid
iodine	184	4.9	solid

- (a) Use this information to:

- identify the physical state of fluorine at room temperature

.....

- estimate the boiling point of chlorine.

..... [2]

- (b) Suggest why the density of chlorine is much lower than the densities of bromine and iodine.

.....

..... [1]

[Total: 3]

- 31 The table shows the properties of some Group I elements.

element	density in g/cm ³	melting point in °C	relative hardness
sodium	0.97	98	4.9
potassium	0.86	63	2.6
rubidium	1.53		1.6
caesium		29	1.0

When potassium reacts with water, it floats and melts into a ball. A flame is observed.



- (a) What colour does potassium give to the flame?

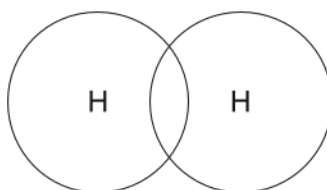
..... [1]

- (b) Use the information in the table to suggest why potassium floats on water.

..... [1]

- (c) Hydrogen is produced when potassium reacts with water.

Complete the dot-and-cross diagram to show the electron arrangement in a molecule of hydrogen.



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[1]

[Total: 3]

- 32 The table gives some information about four different particles, **A**, **B**, **C** and **D**.

particle	number of electrons	number of neutrons	number of protons	electronic structure	charge on particle
A	11	12	11	2,8,1	0
B		14	11	2,8,1	0
C	18	20		2,8,8	0
D	18	20	17		

- (a) Complete the table. The first row has been done for you.

[4]

- (b) Give **two** particles from the table which are isotopes of each other.

..... [1]

- (c) Element **Z** is in the same group of the Periodic Table as **A** and is less reactive than **A**.

State the identity of element **Z**.

..... [1]

- (d) **C** is unreactive.

Use information from the table to explain why.

..... [1]

33 This question is about Group I elements and their compounds.

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

element	boiling point / °C	atomic radius / pm	relative thermal conductivity	observations when it reacts with cold water
sodium	883	186	3.9	rapid bubbling but does not burst into flame
potassium	759	227		very rapid bubbling and bursts into flame
rubidium	688		1.6	
caesium	671	265	1.0	explodes

(a) Complete the table to estimate

- the relative thermal conductivity of potassium
- the atomic radius of rubidium

[2]

(b) Describe the trend in the boiling points of the Group I elements.

..... [1]

(c) Use the information in the table to predict what you would observe when rubidium reacts with cold water.

..... [1]

[Total: 4]



34 The properties of some Group VII elements are shown in the table.

Complete the table to suggest:

- the density of iodine
- the melting point of astatine
- the colour of astatine.

element	melting point in °C	boiling point in °C	density at room temperature in g/cm ³	colour
chlorine	-101	-35	0.0032	green
bromine	-7	59	3.1	red-brown
iodine	114	184		grey-black
astatine		337	6.4	

[3]

[Total: 3]

35 Manganese is a transition element. Sodium is an element in Group I of the Periodic Table.

Describe **three** ways in which the properties of manganese differ from those of sodium.

1

2

3 [3]

[Total: 3]

36 When chlorine is bubbled through a colourless aqueous solution of zinc iodide, the solution turns brown.

Name the brown substance.

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Suggest, using ideas about the reactivity of the halogens, why this reaction occurs.

.....

..... [2]

[Total: 2]



37 Iron is a transition element. Potassium is an element in Group I of the Periodic Table.

Describe **three** ways in which the properties of iron differ from those of potassium.

- 1
- 2
- 3 [3]

[Total: 3]

38 Iron is a transition element.

A list of properties of iron is shown.

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- Iron is a good conductor of electricity.
- Iron forms soluble salts.
- Iron forms coloured compounds.
- Iron has variable oxidation states.
- Iron has a catalyst.
- Iron forms a basic oxide.

Give **two** properties from the list in which iron is similar to Group I elements.

- 1
- 2 [2]

[Total: 2]

