Questions

Q1.

Some questions must be answered with a cross in a box (☒). If you change your mind about an answer, put a line through the box (☒) and then mark your new answer with a cross (☒).

This question is about gases.

Some damp litmus paper is placed in a gas.
The litmus paper is bleached.

Which gas bleaches damp litmus paper?

(1)

- ☐ **A** carbon dioxide
- ☐ **B** chlorine
- ☐ **C** hydrogen
- ☐ **D** oxygen

(Total for question = 1 mark)

Q2.

Some questions must be answered with a cross in a box (☒). If you change your mind about an answer, put a line through the box (☒) and then mark your new answer with a cross (☒).

This question is about elements in group 7, the halogens.

Which halogen is a green gas at room temperature and pressure?

(1)

- ☐ **A** bromine
- ☐ **B** chlorine
- ☐ **C** fluorine
- ☐ **D** iodine

(Total for question = 1 mark)

Q3.

The elements in group 7 of the periodic table are known as the halogens.

Explain why chlorine is more reactive than iodine.

(3)

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.....

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.....

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.....

(Total for question = 3 marks)

Q4.

A piece of burning sodium is placed into a gas jar containing chlorine gas, as shown in Figure 5.

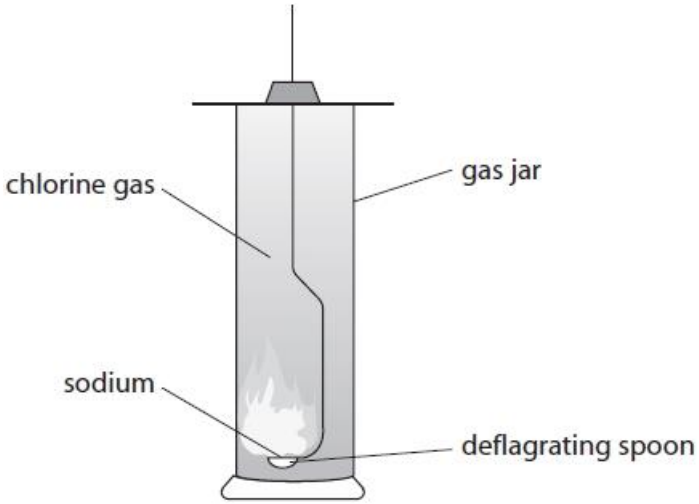

Figure 5

At the end of the reaction, the inside of the gas jar is coated with white crystals.

Identify the white crystals.

(1)

.....

(Total for question = 1 mark)

Q5.

Hydrogen chloride gas and sulfur dioxide gas are dissolved in separate test tubes of water. Blue litmus paper is dipped into each test tube.

State and explain the colour change you would observe in each test tube.

(3)

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.....

.....

(Total for question = 3 marks)

Q6.

The elements in group 7 of the periodic table are known as the halogens.

Sodium also reacts with bromine.

(i) Write the balanced equation for the reaction between sodium and bromine.

(2)

.....

(ii) In another experiment, a student adds colourless sodium bromide solution to chlorine water.

State what you would **see** in this reaction.

(1)

.....

(iii) The ionic equation for the reaction between sodium bromide and chlorine is:

$$2Br^- + Cl_2 \rightarrow 2Cl^- + Br_2$$

Explain which species has been oxidised in this reaction.

(2)

.....

.....

.....

(Total for question = 5 marks)

Q7.

This question is about elements in group 7, the halogens.

Bromine, chlorine and iodine all react with heated iron wool.

Figure 9 shows the speed of these reactions.

halogen	description of reaction with heated iron wool
bromine	reacts quickly
chlorine	reacts very quickly
iodine	reacts slowly

Figure 9

(i) When iron wool is heated with chlorine, iron chloride is formed.
Write the word equation for this reaction.

(1)

.....

.....

(ii) Give the name of the halogen in Figure 9 that is the most reactive with iron.

(1)

.....

(iii) 34.4 % of the mass of iron chloride is iron.
Calculate the mass of iron and the mass of chlorine in 125 g of iron chloride.

(3)

.....

.....

.....

mass of iron = ... g

mass of chlorine = ... g

(Total for question = 5 marks)

Q8.

Fluorine, chlorine, bromine, iodine and astatine are elements in group 7.

Describe the test to show that a gas is chlorine.

(2)

.....

.....

.....

.....

(Total for question = 2 marks)

Q9.

Potassium reacts with fluorine to form potassium fluoride.
Potassium fluoride is a solid.

Complete the balanced equation for this reaction and add the state symbols.

(3)

.....K (.....) + F_2(g) → .....KF (.....)

(Total for question = 3 marks)

Q10.

Aluminium reacts with chlorine to form aluminium chloride.

Write the balanced equation for this reaction.

(3)

.....

(Total for question = 3 marks)

Q11.

Fluorine, chlorine, bromine, iodine and astatine are elements in group 7.

Bromine, chlorine and iodine are dissolved in water to make aqueous solutions.
Potassium iodide solution is added to each of these solutions.

Figure 6 shows the observations.

halogen	initial colour of aqueous solution	final colour of mixture
bromine	orange	brown
chlorine	pale green	brown
iodine	brown	brown

Figure 6

Explain the observations shown in the table.

(4)

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.....

.....

.....

(Total for question = 4 marks)

Q12.

Chlorine, bromine and iodine are elements in group 7 of the periodic table.

If chlorine solution is added to sodium bromide solution a reaction occurs.

chlorine + sodium bromide → sodium chloride + bromine

Give a reason why this reaction occurs.

(1)

.....

.....

(Total for question = 1 mark)

Q13.

Figure 14 shows the melting points and boiling points of elements in group 7 of the periodic table.

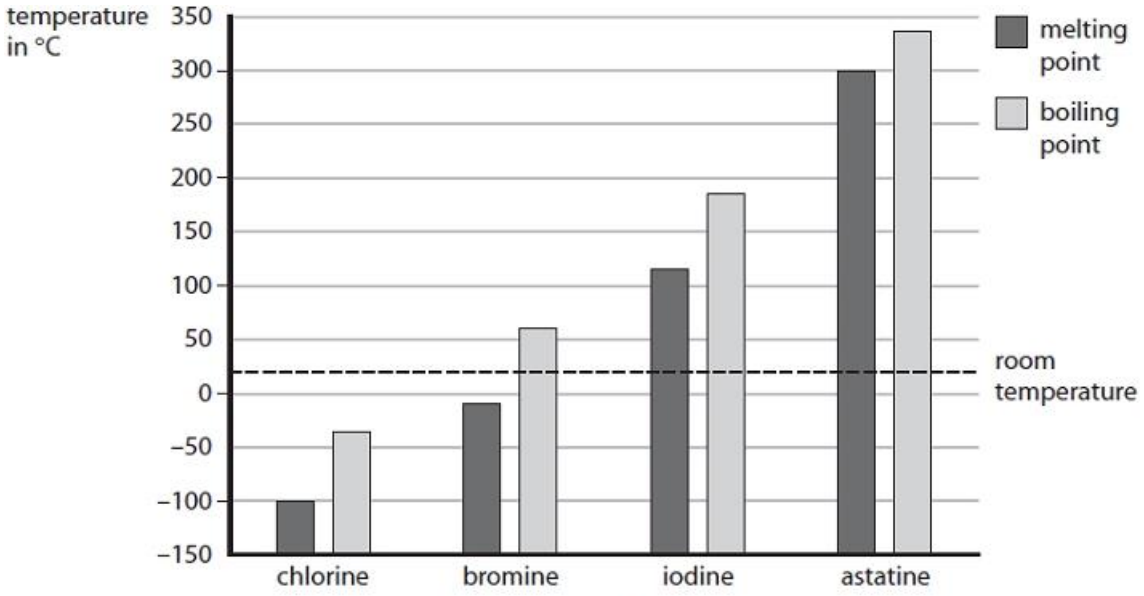


Figure 14

(i) Give, using Figure 14, the boiling point of bromine.

(1)

boiling point of bromine = ... °C

(ii) State which **two** elements from Figure 14 are solids at room temperature.

(1)

.....

(Total for question = 2 marks)

Q14.

Sodium iodide solution is colourless.

When a solution of bromine is added to sodium iodide solution, a reaction occurs.

$$2NaI + Br_2 \rightarrow 2NaBr + I_2$$

(i) The mixture turns brown.

Give the name of the substance causing the brown colour.

(1)

.....

(ii) Explain which substance has been reduced in this reaction.

(2)

.....

.....

.....

.....

(Total for question = 3 marks)

Q15.

Which of the following rows gives the colours of the group 7 elements chlorine and bromine at room temperature?

(1)

	chlorine	bromine
☒ **A**	red-brown	purple
☒ **B**	yellow-green	grey
☒ **C**	yellow-green	red-brown
☒ **D**	grey	red-brown

(Total for question = 1 mark)

Q16.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

This question is about some of the elements in group 7 of the periodic table.

Which row in the table correctly shows the colours and physical states of the elements at room temperature?

(1)

☐ **A**	iodine: purple gas	bromine: yellow liquid
☐ **B**	chlorine: pale green gas	iodine: brown solid
☐ **C**	bromine: red-brown liquid	chlorine: yellow liquid
☐ **D**	iodine: dark grey solid	bromine: red-brown liquid

(Total for question = 1 mark)

Q17.

Figure 2 shows the melting and boiling points of bromine and iodine.

element	melting point in °C	boiling point in °C
bromine	–7	59
iodine	114	184

Figure 2

Using the information in Figure 2, which row shows the physical states of these elements at 50 °C?

(1)

		bromine	iodine
☒	**A**	liquid	gas
☒	**B**	solid	liquid
☒	**C**	gas	solid
☒	**D**	liquid	solid

(Total for question = 1 mark)

Q18.

(i) Figure 13 lists the halogens in the order in which they appear in group 7 of the periodic table.

The melting points of four of the halogens are given.

halogen	melting point in °C
fluorine	−220
chlorine	−101
bromine	−7
iodine	
astatine	302

Figure 13

Estimate the melting point of iodine.

(1)

..... °C

(ii) Bromine reacts with heated iron.

Give the name of one halogen that would react with iron more vigorously than bromine.

(1)

.....

(Total for question = 2 marks)

Q19.

Describe what is **seen** when chlorine water is added to potassium bromide solution and the mixture shaken.

(2)

.....

.....

.....

.....

(Total for question = 2 marks)

Q20.

Describe what you would **see** if damp, blue litmus paper is placed into chlorine gas.

(2)

.....

.....

.....

.....

(Total for question = 2 marks)

Q21.

When the gas hydrogen chloride, HCl, is dissolved in water, a solution forms.
Blue litmus paper dipped in this solution turns red.

State why the litmus paper turns red.

(1)

.....

.....

(Total for question = 1 mark)

Q22.

Fluorine, chlorine, bromine, iodine and astatine are elements in group 7.

There is a trend in the colour and the state of the halogens at room temperature.

Predict the colour and state of astatine at room temperature.

(2)

colour .....

state .....

(Total for question = 2 marks)

Q23.

Chlorine, bromine and iodine are elements in group 7 of the periodic table.

Chlorine is toxic.

State **one** safety precaution that should be taken when using chlorine in the laboratory.

(1)

.....

.....

(Total for question = 1 mark)

Q24.

Answer the questions with a cross in the boxes you think are correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Fluorine, chlorine, bromine and iodine are elements in group 7 of the periodic table.

(i) State the name given to the group 7 elements.

(1)

.....

(ii) Name one other element that is in group 7.
Use the periodic table on the back of this exam paper to help you.

(1)

.....

(iii) Which element is liquid at room temperature and pressure?

(1)

- ☐ **A** fluorine
- ☐ **B** chlorine
- ☐ **C** bromine
- ☐ **D** iodine

(iv) Which element is dark-grey in colour at room temperature and pressure?

(1)

- ☐ **A** fluorine
- ☐ **B** chlorine
- ☐ **C** bromine
- ☐ **D** iodine

(Total for question = 4 marks)

Q25.

Fluorine, chlorine, bromine, iodine and astatine are elements in group 7.

Bromine reacts with hydrogen to form hydrogen bromide.
Hydrogen bromide dissolves in water to form a solution.

State the name of the solution formed.

(1)

.....

(Total for question = 1 mark)

Q26.

Chlorine reacts with hydrogen to form hydrogen chloride.

Write the balanced equation for this reaction.

(3)

.....

.....

(Total for question = 3 marks)

Q27.

Fluorine, chlorine, bromine, iodine and astatine are elements in group 7.

Fluorine reacts vigorously with iron to produce iron(III) fluoride, FeF_3.

Write the balanced equation for this reaction.

(2)

.....

(Total for question = 2 marks)

Q28.

Chlorine, bromine and iodine are elements in group 7 of the periodic table.

Chlorine reacts with hydrogen to form hydrogen chloride.

(i) Write the word equation for this reaction.

(1)

..... → .....

(ii) Hydrogen chloride dissolves in water to form an acidic solution.

State what is **seen** when blue litmus paper is placed into this solution.

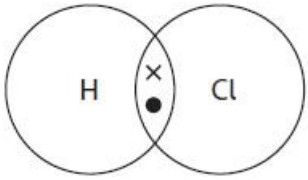
(1)

.....

(iii) A chlorine atom has seven electrons in its outer shell.
A hydrogen atom has one electron in its outer shell.

Complete the dot and cross diagram of a molecule of hydrogen chloride.
Show outer shell electrons only.

(1)



(iv) Name the type of bonding in a molecule of hydrogen chloride.

(1)

.....

(Total for question = 4 marks)

Mark Scheme

Q1.

Question number	Answer	Mark
	B chlorine is the only correct answer. **A**, **C** and **D** are incorrect because only chlorine bleaches litmus	**(1)** **AO1 1**

Q2.

Question number	Answer	Mark
	B chlorine is the only correct answer **A**, **C** and **D** are incorrect because only chlorine is green	**(1)** **AO1 1**

Q3.

Question number	Answer	Additional guidance	Mark
	An explanation linking • outer {shell / electron(s)} is further from nucleus in iodine/ORA (1) • {force / attraction} between nucleus and (electrons in) outer shell is less in iodine/ORA(1) • iodine does not gain (an) electron(s) as readily/ORA (1)	accept reverse argument throughout allow iodine has more shells / larger atomic radius / ORA reject 'more outer shells' chlorine has {fewer (electron) shells / smaller atomic radius} allow shielding arguments for either MP1 OR MP2 for either iodine or chlorine allow outer electrons / incoming electron if no other mark scored (group 7 elements) gain one electron (when they react) (1)	**(3)** **AO1 1**

Q4.

Question number	Answer	Additional guidance	Mark
	sodium chloride	allow NaCl ignore 'salt' reject sodium chlorine / incorrect formula	**(1)** **AO2 1**

Q5.

Question number	Answer	Additional guidance	Mark
	An explanation to include three from : **HCl** • goes red (1) • (HCl) is an acid (1) **SO_2** • goes red (1) • (SO_2 solution) is an acid (1)	all MPs are marked independently allow pink for red reject other colours for MP1 reject references to test for chlorine/ bleaching for MP1 allow hydrogen chloride for HCl allow pink for red reject other colours for MP3 reject references to test for chlorine/ bleaching for MP3 both go red/ they go red (2) for MP1 and MP3 both are acids (2) for MP2 and MP4	**(3)** **AO1 1** **AO2 1**

Q6.

Question number	Answer	Additional guidance	Mark
(i)	$2Na + Br_2 \rightarrow 2NaBr$ 1 mark for correct formulae 1 mark for balancing correct formulae	ignore state symbols even if incorrect	(2) AO2 2

Question number	Answer	Additional guidance	Mark
(ii)	turns yellow / orange (liquid / solution)	reject brown as standalone colour ignore brown as in 'yellow-brown' ignore red as in 'red-orange' reject other changes eg effervescence	(1) AO2 2

Question number	Answer	Additional guidance	Mark
(iii)	bromide (ions)/ $(2)Br^-$ (1) **loses/lost** electrons (1)	reject bromine / Br allow bromine loses electrons for MP2 only reject answers in terms of {chlorine / chloride} being oxidised reject Br_2 loses electrons	(2) AO1 1

Q7.

Question number	Answer	Additional guidance	Mark
(i)	iron + chlorine → (1) → iron chloride (1)	allow = for → MP1: allow iron wool/ reactants in either order/ ignore heat MP2: reject if extra products but ignore heat reject more than one arrow for both marks e.g. iron → chlorine → iron chloride if symbol equation given only allow: $Fe + Cl_2 \rightarrow FeCl_2$ (2) OR $2Fe + 3Cl_2 \rightarrow 2FeCl_3$ (2) all formulae must have correct capital and small letters and subscripts	(2) A02 1

Question number	Answer	Additional guidance	Mark
(ii)	chlorine	allow CL / Cl / Cl_2	**(1)** **A03 2**

Question number	Answer	Additional guidance	Mark
(iii)	iron = 43 **and** chlorine = 82 scores 3 with or without working $\frac{34.4}{100} \times 125$ (1) = 43 given as mass of iron (1) 125 – 43 = 82 given as mass of chlorine (1) OR $\frac{65.6}{100} \times 125$ (1) = 82 given as mass of chlorine (1) 125 – 82 = 43 given as mass of iron (1)	one correct and one incorrect (or missing) value with or without working scores 2 allow ECF allow ECF but must add up to 125g for MP3 allow ECF but must add up to 125g for MP3 allow final answers reversed on answer lines for 2 marks with or without working.	**(3)** **A02 1**

Q8.

Question number	Answer	Additional guidance	Mark
	A description to include (damp) litmus / indicator paper bleaches / goes white (1)	 allow dip litmus into solution reject bleaches then goes red MP2 dependent on MP1	**(2)**

Q9.

Question number	Answer	Additional guidance	Mark
	$2K(s) + F_2(g) \rightarrow 2KF(s)$ 2 K (1) 2 KF (1) s, s (1)	 ignore words	(3)

Q10.

Question Number	Answer	Additional guidance	Mark
	$2Al + 3Cl_2 \rightarrow 2AlCl_3$ (3) LHS (1) RHS (1) balancing of correct formulae (1)	penalise the use of 'CL' or 'AL' once only ignore state symbols allow multiples ignore use of capital L for MP3	(3) AO 2 1

Q11.

Question number	Answer	Additional guidance	Mark
	an explanation linking 4 of the following • {chlorine / bromine} are more reactive than iodine / iodine is the least reactive (1) • (in the reaction of chlorine with potassium iodide) chlorine displaces iodine / iodine formed / iodide ions oxidised (1) • (in the reaction of bromine with potassium iodide) bromine displaces iodine / iodine formed / iodide ions oxidised (1) • brown colour of final mixture is due to iodine (1) • iodine with KI has no reaction / iodine cannot displace iodine from its compound (1)	 ignore iodide in MP1 In MP2 and MP3: allow 'iodide displaced' mark(s) could be scored in word or symbol equations (symbol equations do not have to be balanced and allow I for I_2) allow iodine cannot displace itself	(4)

Q12.

Question number	*Answer*	Additional guidance	Mark
	chlorine is more reactive than bromine / chlorine can displace bromine	ignore "chlorine is more reactive" alone	**(1)**

Q13.

Question number	Answer	Mark
(i)	any value between 51 (°C) and 70 (°C)	**(1)**

Question number	Answer	Mark
(ii)	iodine **and** astatine	**(1)**

Q14.

Question number	Answer	Additional guidance	Mark
(i)	iodine	reject iodide; ignore formulae	**(1)**

Question number	Answer	Additional guidance	Mark
(ii)	An explanation to include: • bromine **(1)** • because electrons are gained **(1)**	Mark independently allow any number of electrons	**(2)**

Q15.

Question number	Answer	Mark
	C yellow-green red-brown is the only correct answer **A** gives the colours for iodine vapour and chlorine gas **B** gives the colours for solid iodine and iodine vapour **D** gives the colours for bromine liquid and iodine vapour	**(1)**

Q16.

Question number	Answer	Mark
	D iodine: dark-grey solid bromine: red-brown liquid Is the only correct answer **A**, **B** and **C** all contain at least one incorrect piece of information	**(1)** **AO1**

Q17.

Question number	Answer	Mark
	D liquid solid is the only correct answer **A**, **B** and **C** are incorrect because bromine is a liquid and iodine is a solid at 50 °C	**(1)**

Q18.

Question Number	Answer	Additional guidance	Mark
(i)	any value from 20 to 301	allow a range within these numbers e.g. 25 to 45 answer may be given in the table. if values are given on the answer line and the table mark only the answer on the answer line	**(1)** AO 1 1

Question Number	Answer	Additional guidance	Mark
(ii)	fluorine/ chlorine	reject iodine / astatine allow $F/F_2/Cl/Cl_2$	**(1)** AO 2 1

Q19.

Question Number	Answer	Additional guidance	Mark
	A description including the following points : • (potassium bromide solution) colourless (1) • (mixture) turns yellow / brown / orange / red (1)	 ignore clear ignore reference to colour of chlorine water /change in colour allow colour combinations *e.g.* yellow-orange reject additional incorrect observations for MP2 but ignore yellow/orange/red/ brown vapours	**(2)** AO 1 2

Q20.

Question Number	Answer	Additional guidance	Mark
	A description to include • (blue litmus) (first turns) red (1) • (then) bleaches / turns white (1)	 allow shades of red and pink but not other colours e.g. red-purple allow colour disappears/goes colourless ignore yellow/ colour fades /discolours white then red = 0; just 'goes white' = 1	**(2)** AO 1 2

Q21.

Question Number	Answer	Additional guidance	Mark
	(the solution is) acid(ic) / contains {hydrogen ions/ H^+}	allow pH < 7 allow hydrogen chloride is acidic If incorrect identity of acidic solution then 0 marks (e.g. chlorine is acidic = 0)	**(1)** AO 2 1

Q22.

Question number	Answer	Additional guidance	Mark
	colour: grey/ black (1) state: solid (1) black/grey (1)	Allow any shade of grey/ gray	**(2)**

Q23.

Question number	Answer	Additional Guidance	Mark
	use of fume-cupboard / fume hood	allow adequate ventilation gloves (to prevent skin absorption) ignore breathing apparatus, gas mask, mask, PPE	**(1)**

Q24.

Question number	Answer	Mark
(i)	halogens	**(1)** **AO1**

Question number	Answer	Additional guidance	Mark
(ii)	astatine	allow At / At_2	**(1)** **AO1**

Question number	Answer	Mark
(iii)	**C** bromine **A** and **B** are not correct as they are gases at room temperature and pressure **D** is not correct as iodine is a solid at room temperature and pressure	**(1)** **AO1**

Question number	Answer	Mark
(iv)	**D** iodine **A** is not correct as fluorine is pale yellow at room temperature and pressure **B** is not correct as chlorine is green at room temperature and pressure **C** is not correct as bromine is red-brown liquid at room temperature and pressure	**(1)** **AO1**

Q25.

Question number	Answer	Additional guidance	Mark
	hydrobromic acid (1)	Ignore hydrogen bromide solution Ignore HBr(aq)	**(1)**

Q26.

Question number	Answer	Additional guidance	Mark
	$Cl_2 + H_2 \rightarrow 2HCl$ (3) $Cl_2 + H_2 \rightarrow$ (1) $\rightarrow$ HCl (1) balancing of correct formulae (1)	do not penalise incorrect small/ capital letters for left hand side formulae, do not allow Cl^2 or Cl2, but allow MP3 if correctly balanced allow reactants in either order allow ClH for HCl allow = for → allow multiples ignore state symbols if molecules have a + or – charge do not allow mark for formulae but allow MP3 for correct balancing	**(3)**

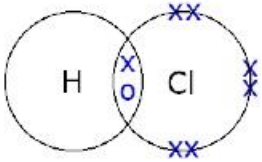
Q27.

Question number	Answer	Additional guidance	Mark
	$2Fe + 3F_2 \rightarrow 2FeF_3$ (2) correct formulae only (1) balancing of correct formulae (1)	allow multiples reject Fe(III) on LHS reject incorrect capitals and subscripts reject charges on LHS but ignore charges on RHS. allow = for →	**(2)**

Q28.

Question number	Answer	Additional guidance	Mark
(i)	hydrogen + chlorine → hydrogen chloride	answer must contain a "+" between reactants allow reactants on LHS in either order allow $H_2 + Cl_2 \rightarrow 2HCl$ allow multiples on balanced equation ignore state symbols	**(1)**

Question number	Answer	Mark
(ii)	(turns) red /pink	**(1)**

Question number	Answer	Additional guidance	Mark
(iii)		6 electrons drawn in outer shell of Cl (1) ignore inner shells of electrons even if incorrect	**(1)**

Question number	Answer	Additional guidance	Mark
(iv)	covalent	ignore other words reject ionic / metallic	**(1)**