

1 (a) Chlorine reacts with potassium bromide in solution to form bromine and potassium chloride.

(i) What type of reaction is taking place?

Put a cross (☒) in the box next to your answer.

(1)

- A** displacement
- B** distillation
- C** neutralisation
- D** precipitation

(ii) State the colour of the mixture at the end of the reaction.

(1)

(b) Chlorine reacts with an element X to form a solid chloride.

The solid chloride is dark red.

Which is the most likely position of the element X in the periodic table?

| | 1 | 2 | | | | | | | | 3 | 4 | | | 0 |
|----------|----------|---|--|--|--|----------|--|--|--|---|---|--|--|---|
| | | | | | | | | | | | | | | |
| A | | | | | | | | | | | | | | |
| | B | | | | | C | | | | | | | | |
| D | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |

Put a cross (☒) in the box next to your answer.

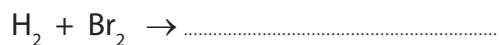
(1)

- A**
- B**
- C**
- D**

(c) The halogens react with hydrogen to form hydrogen halides.

Complete the balanced equation for the reaction between hydrogen and bromine forming hydrogen bromide.

(2)



(d) Calculate the relative formula mass of magnesium chloride, MgCl_2 .
(relative atomic masses: Mg = 24.0; Cl = 35.5)

(1)

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relative formula mass =

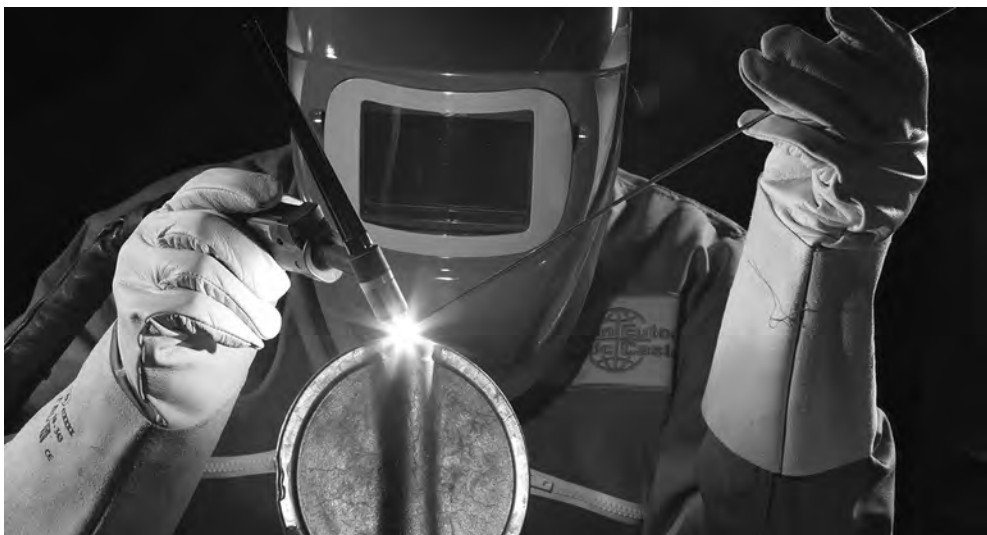
(e) Calculate the percentage by mass of fluorine in sodium fluoride, NaF.
(relative atomic masses: F = 19; Na = 23)

(2)

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percentage by mass of fluorine = %

(Total for Question 1 = 8 marks)

2 (a) Two pieces of metal can be joined by welding them together.



(i) Complete the sentence by putting a cross (☒) in the box next to your answer.

The structure of a metal is a lattice of

(1)

- A anions
- B anions and cations
- C cations in a sea of electrons
- D molecules in a sea of electrons

(ii) To join two pieces of metal by welding, they must be melted together.

State why a high temperature has to be used.

(1)

(iii) The pieces of metal are welded together in an atmosphere of argon.

Explain why an atmosphere of argon is used.

(2)

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(b) Some metals react with halogens.

Iron reacts with bromine, Br_2 , to form iron(III) bromide, FeBr_3 .

Write the balanced equation for this reaction.

(2)

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(c) Complete the sentence by putting a cross (☒) in the box next to your answer.

At room temperature, iodine is a

(1)

- A** brown gas
- B** brown liquid
- C** grey solid
- D** purple gas

(d) When a halogen is added to a solution containing halide ions a displacement reaction may occur.

In the table

✓ shows a displacement reaction occurs

✗ shows a displacement reaction does not occur

| halogen added | halide ion in solution | | |
|---------------|------------------------|-------------|------------|
| | chloride ion | bromide ion | iodide ion |
| chlorine | | ✓ | ✓ |
| bromine | ✗ | | ✓ |
| iodine | ✗ | ✗ | |

Use the information in the table to explain the order of reactivity of the three halogens.

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(Total for Question 2 = 9 marks)

(c) When iron wool is heated in bromine vapour, it reacts to form iron bromide.

(i) In an experiment, 5.60 g of iron reacted exactly with 24.0 g of bromine, Br₂.

[relative atomic masses: Fe = 56.0, Br = 80.0]

Determine, using this information, the balanced equation for the reaction between iron and bromine.

You must show your working.

(4)

(ii) When iron reacts with bromine, bromide ions are formed.

Explain the type of reaction bromine atoms undergo when they are converted to bromide ions.

(2)

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(Total for Question 3 = 13 marks)

- 4 (a) A compound of iron and chlorine was formed by reacting 2.80 g of iron with 3.55 g of chlorine.

Calculate the empirical formula of the compound.
(relative atomic masses: Cl = 35.5, Fe = 56.0)

(3)

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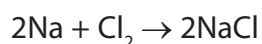
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empirical formula

- (b) Sodium reacts with chlorine to form sodium chloride.



Calculate the maximum mass of sodium chloride that could be formed by reacting 9.20 g of sodium with excess chlorine.
(relative atomic masses: Na = 23.0, Cl = 35.5)

(3)

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mass of sodium chloride g

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(Total for Question 4 = 12 marks)

5 Electrolysis occurs when solutions of some compounds are decomposed by passing direct electric current through them.

(a) Sodium chloride solution was electrolysed.
The reaction produced chlorine and hydrogen.
The remaining solution contained sodium hydroxide, NaOH.

(i) State a hazard associated with chlorine gas. (1)

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(ii) Describe a test that can be used to identify a sample of gas as chlorine. (2)

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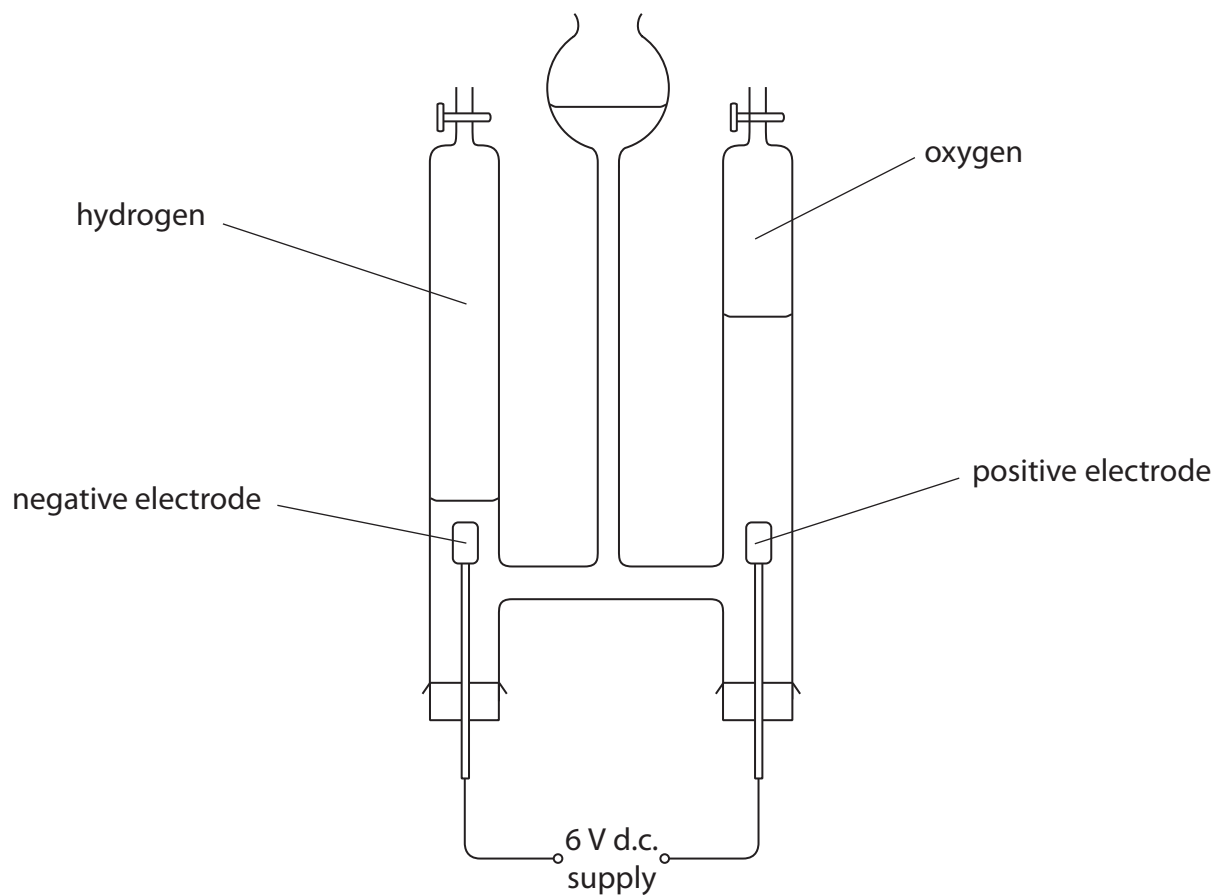
(iii) State a use of chlorine. (1)

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(iv) Complete and balance the equation for the overall reaction taking place when sodium chloride solution is electrolysed. (2)



*(b) Water was decomposed by electrolysis in the apparatus shown.



The water decomposed into hydrogen and oxygen.

After five minutes, the volumes of hydrogen and oxygen in the tubes were measured.

Two further experiments were carried out changing only one factor in each experiment. All other factors were kept the same.

The table shows the conditions and results of all three experiments.

| experiment | time / minutes | current / amps | volume of hydrogen / cm ³ | volume of oxygen / cm ³ |
|------------|----------------|----------------|--------------------------------------|------------------------------------|
| 1 | 5 | 0.50 | 20.0 | 10.0 |
| 2 | 10 | 0.50 | 40.0 | 20.0 |
| 3 | 5 | 0.75 | 30.0 | 15.0 |

Use these results of electrolysis to compare the volumes of hydrogen and oxygen formed and to show the effect of changing the time and the current on the volumes of these gases.

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(Total for Question 5 = 12 marks)