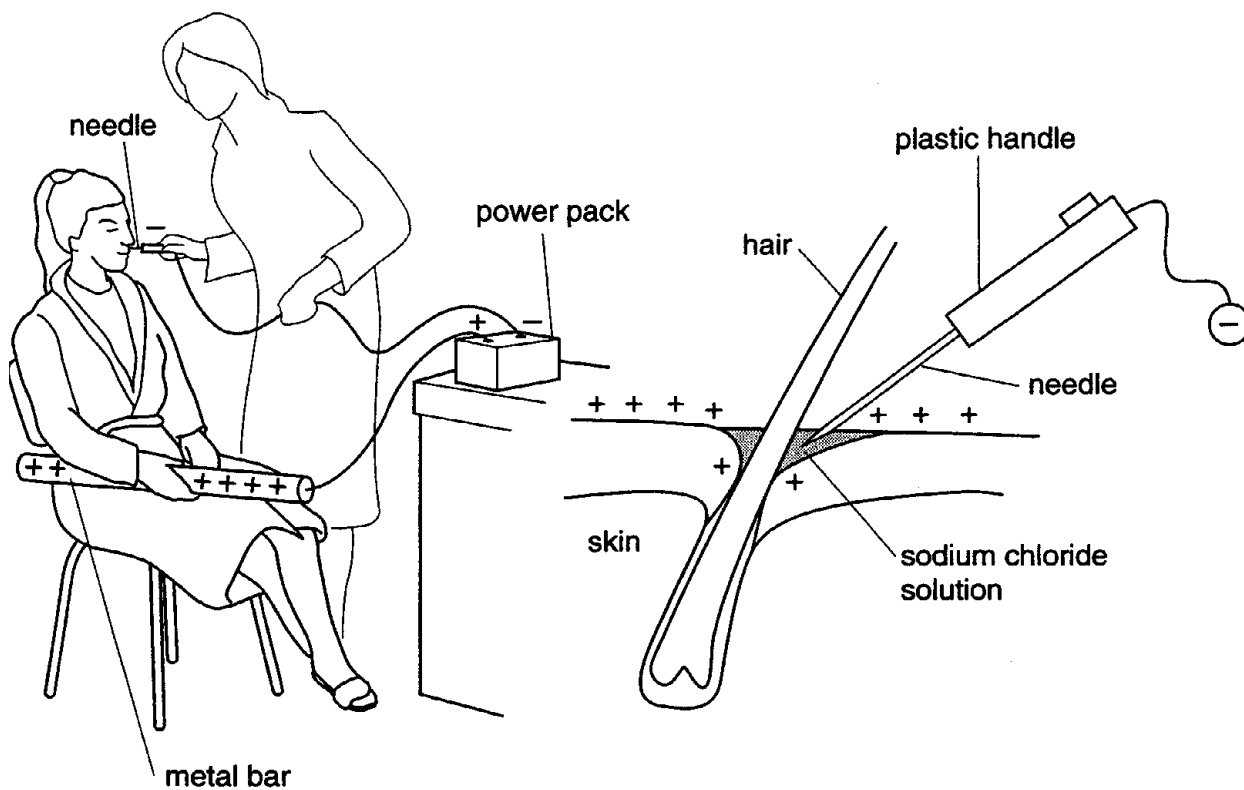


**Core 1**

Unwanted hair on a person's face can be removed by electrolysis.

The skin is given a small positive charge when the person holds on to a metal bar. The metal bar acts as a positive electrode. A needle is the negative electrode.



**(a)** What is the name given to

**(i)** a positive electrode,

.....[1]

**(ii)** a negative electrode?

.....[1]

**(b)** What property must an electrode have if electrolysis is to work?

.....[1]

**(c)** The needle, which is the negative electrode, is held by the operator.

Suggest why the needle has a plastic handle, rather than a metal handle.

.....[1]

**Core 1**

**(d)** The liquid on the skin around the tip of the needle is mainly a solution of sodium chloride.

**(i)** Give the chemical formula for sodium chloride.

.....[1]

**(ii)** Explain the meaning of the word *solution*.

.....[1]

**(iii)** Sodium chloride can be made by adding an acid to an alkali.

Name an acid and alkali you can use to make sodium chloride.

acid .....

alkali .....[2]

**(iv)** Starting with this acid and alkali, describe how you can obtain sodium chloride crystals.

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

**(e)** When the electrolysis is carried out on the surface of the skin, a gas forms around the tip of the needle.

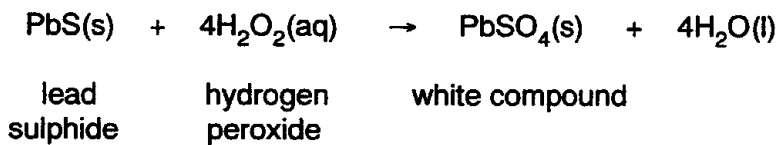
Name this gas.

.....[1]

**Core 2**

Black lead sulphide is formed when oil paints containing lead compounds react with pollutants in the atmosphere.

When hydrogen peroxide is used to clean dirty oil paintings, the following reaction occurs.



**(i)** Name the white compound of lead formed in this reaction.

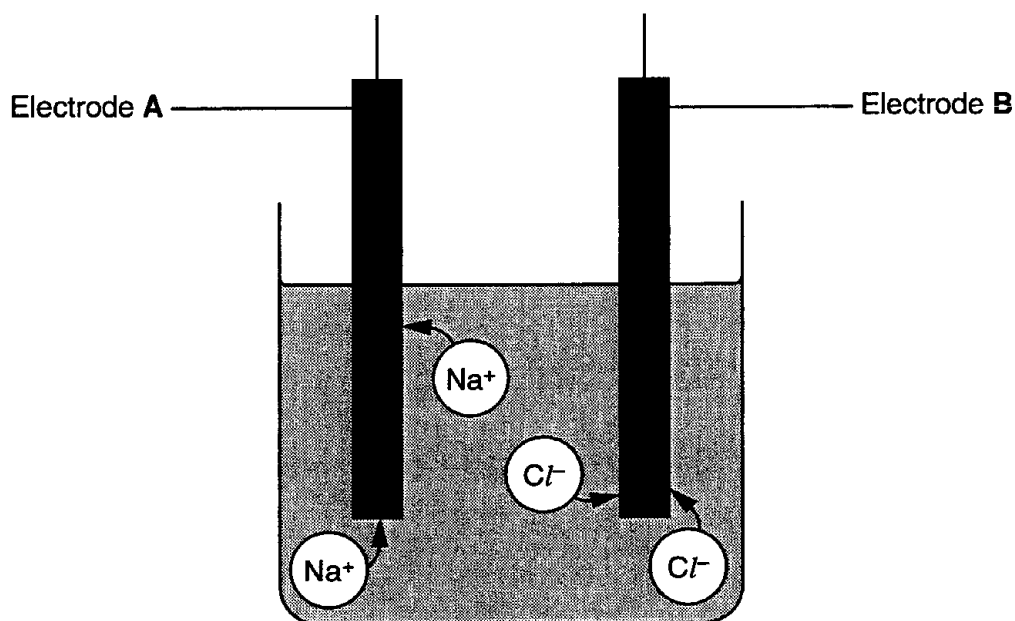
.....[1]

**(ii)** Use the information in the equation to explain how you know the lead sulphide has been oxidised.

.....[1]

### Alternative to Practical 1

The diagram shows the movement of the ions  $\text{Na}^+$  and  $\text{Cl}^-$  during the electrolysis of molten sodium chloride.



(a) Which electrode, A or B, is the positive electrode? Explain your choice.

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

(b) Which ion is attracted to the cathode?

.....[1]

(c) Name the two elements formed by the electrolysis of molten sodium chloride.

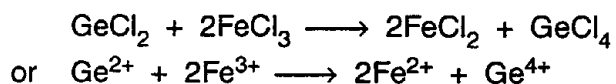
1. ....
2. ....[2]

(d) Give **one** expected observation during this electrolysis.

.....[1]

## Extension 1

When aqueous solutions of germanium(II) chloride and of iron(III) chloride are mixed, the following reaction occurs.



- (i) Is the germanium(II) chloride acting as an oxidising agent or reducing agent? Explain your choice using the idea of electron transfer.

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

- (ii) Describe a test to show that an iron(III) salt had been changed into an iron(II) salt.

test .....

result for iron(III)salt .....

result for iron(II) salt .....

[3]

Extension 2

(a) Copper is refined by electrolysis.

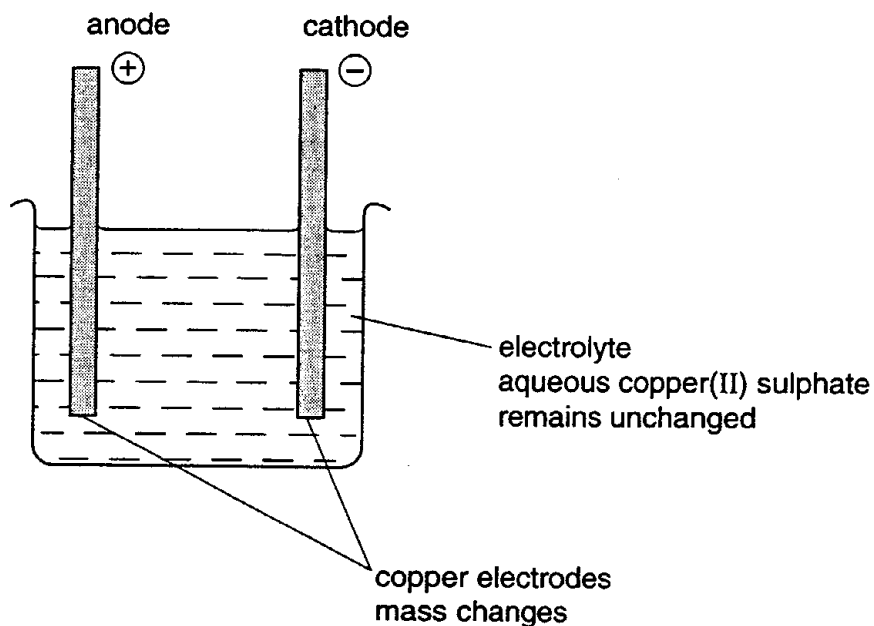


Fig. 4.1

Explain with equations why the electrodes change in mass and why the concentration of aqueous copper(II) sulphate remains unchanged.

Fig. 1

.....  
.....  
.....  
.....[4]

(b) An alloy contains zinc and copper. A small sample of this alloy was dissolved in acid to give a solution containing zinc and copper ions. Explain what would happen when an **excess** of each of the following reagents is separately added to this solution.

(i) iron filings

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

(ii) sodium hydroxide

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

Extension 2

(c) The following diagram shows a simple cell.

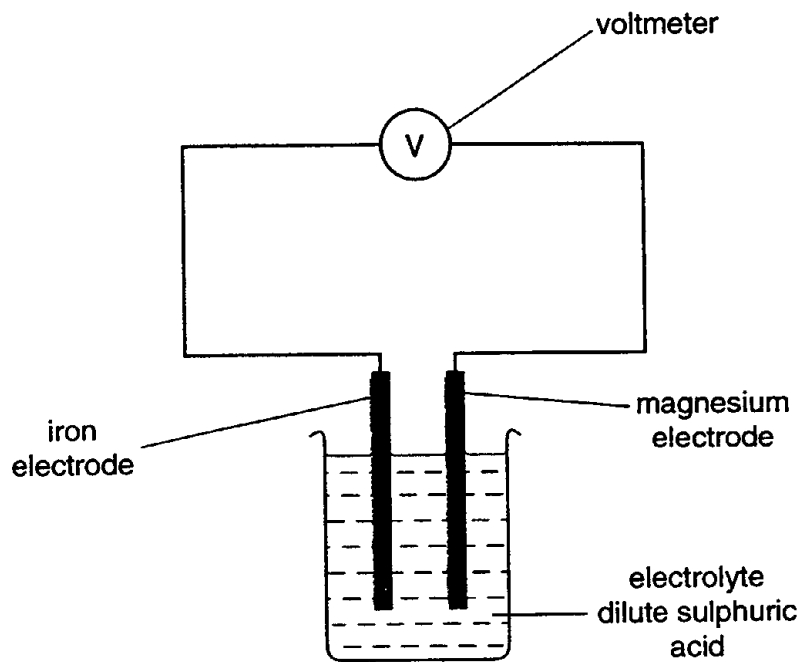


Fig. 2

(i) What is a *cell*?

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

(ii) Mark on the diagram the direction of the electron flow.

[1]

## Core 1

- a(i) anode
- (ii) cathode
- b conducts electricity
- c does not conduct electricity (to operator) / plastic is an insulator / so operator does not get an electric shock
- d(i) NaCl
- (ii) substance dissolved in liquid / contains dissolved substance
- (iii) hydrochloric acid  
sodium hydroxide / sodium carbonate / sodium bicarbonate
- (iv) add acid to the alkali until neutral / use titration  
evaporate off water / boil off water / leave to crystallise
- e hydrogen / H<sub>2</sub>



## Core 2

- (i) lead sulphate
- (ii) oxygen has been added to it

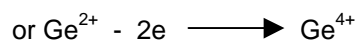
## Alternative to Practical 1

- a B – Cl<sup>-</sup> attracted
- b Na<sup>+</sup> / cation / positive ion
- c sodium chlorine
- d bubbles / silvery metal / green yellow gas

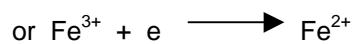
## Extension 1

i reducing

germanium or  $\text{Ge}^{2+}$  loses / donates electrons



iron or  $\text{Fe}^{3+}$  gains electrons



ii sodium hydroxide or aqueous ammonia

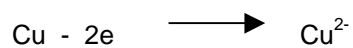
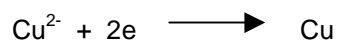
iron (III) salt    brown precipitate

iron (II) salt    green precipitate

(other possible reagents include iodide, thiocyanate, hexacyanoferrates, bromine, zinc, potassium manganate (VII))

## Extension 2

a three of these points



ions removed at cathode

ions formed at anode

b(i) copper formed or iron dissolves

zinc not displaced or iron does not react with zinc ions

(i) blue precipitate of copper hydroxide

white precipitate of zinc hydroxide

c(i) produces electrical energy or voltage or current

from chemical energy or chemical reactions

or

two different electrodes

in electrolyte

(ii) from magnesium to iron through external circuit