

1 Insoluble salts are made by precipitation.

(a) A preparation of the insoluble salt calcium fluoride is described below.

To 15 cm³ of aqueous calcium chloride, 30 cm³ of aqueous sodium fluoride is added. The concentration of both solutions is 1.00 mol / dm³. The mixture is filtered and the precipitate washed with distilled water. Finally, the precipitate is heated in an oven.

(i) Complete the equation.



(ii) Why is the volume of sodium fluoride solution double that of the calcium chloride solution?

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

(iii) Why is the mixture washed with distilled water?

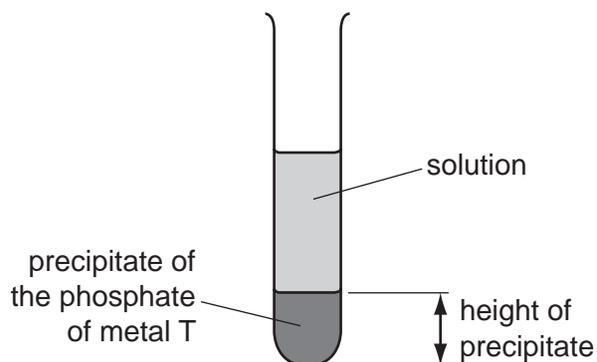
.....
..... [1]

(iv) Why is the solid heated?

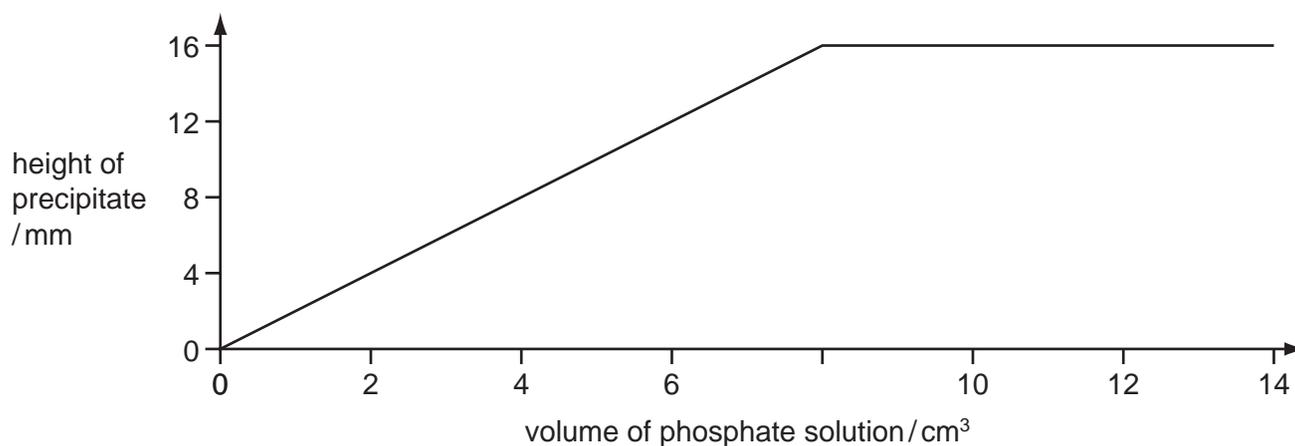
.....
..... [1]

(b) The formulae of insoluble compounds can be found by precipitation reactions.

To 12.0 cm^3 of an aqueous solution of the nitrate of metal T was added 2.0 cm^3 of aqueous sodium phosphate, Na_3PO_4 . The concentration of both solutions was 1.00 mol/dm^3 . When the precipitate had settled, its height was measured.



The experiment was repeated using different volumes of the phosphate solution. The results are shown on the following graph.



What is the formula of the phosphate of metal T? Give your reasoning.

.....

.....

.....

..... [3]

[Total: 8]

2 Oxides are classified as acidic, basic, neutral and amphoteric.

(a) Complete the table.

type of oxide	pH of solution of oxide	example
acidic		
basic		
neutral		

[6]

(b) (i) Explain the term *amphoteric*.

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

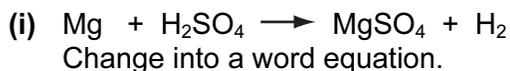
(ii) Name two reagents that are needed to show that an oxide is amphoteric.

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

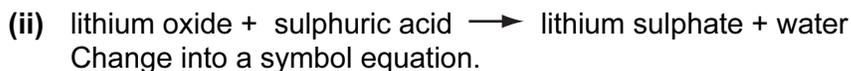
[Total: 9]

3 Sulphuric acid is a typical strong acid.

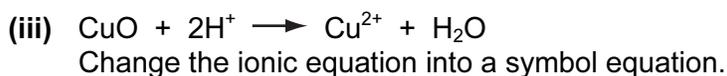
(a) Change the equations given into a different format.



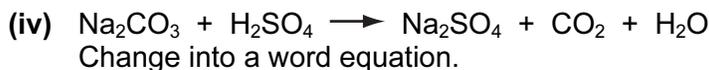
..... [1]



..... [2]

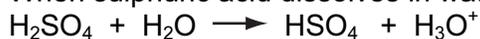


..... [2]



..... [1]

(b) When sulphuric acid dissolves in water, the following reaction occurs.



Explain why water is behaving as a base in this reaction.

..... [2]

(c) Sulphuric acid is a strong acid, ethanoic acid is a weak acid.

Explain the difference between a strong acid and a weak acid.

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

[Total: 10]

4 There are three methods of preparing salts.

Method **A** – use a burette and an indicator.

Method **B** – mix two solutions and obtain the salt by precipitation.

Method **C** – add an excess of base or a metal to a dilute acid and remove the excess by filtration.

For each of the following salt preparations, choose one of the methods **A**, **B** or **C**, name any additional reagent needed and then write or complete the equation.

(i) the soluble salt, zinc sulphate, from the insoluble base, zinc oxide

method
reagent
word equation [3]

(ii) the soluble salt, potassium chloride, from the soluble base, potassium hydroxide

method
reagent
equation + → $KCl + H_2O$ [3]

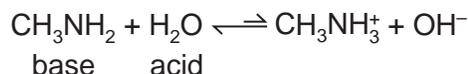
(iii) the insoluble salt, lead(II) iodide, from the soluble salt, lead(II) nitrate

method
reagent
equation $Pb^{2+} +$ → [4]

[Total: 10]

5 Methylamine, CH₃NH₂, is a weak base. Its properties are similar to those of ammonia.

(a) When methylamine is dissolved in water, the following equilibrium is set up.



(i) Suggest why the arrows are not the same length.

..... [1]

(ii) Explain why water is stated to behave as an acid and methylamine as a base.

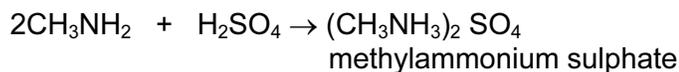
.....
..... [2]

(b) An aqueous solution of the strong base, sodium hydroxide, is pH 12. Predict the pH of an aqueous solution of methylamine which has the same concentration. Give a reason for your choice of pH.

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

(c) Methylamine is a weak base like ammonia.

(i) Methylamine can neutralise acids.



Write the equation for the reaction between methylamine and hydrochloric acid.
Name the salt formed.

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

(ii) When aqueous methylamine is added to aqueous iron(II) sulphate, a green precipitate is formed. What would you see if iron(III) chloride solution had been used instead of iron(II) sulphate?

..... [1]

(iii) Suggest the name of a reagent that will displace methylamine from one of its salts, for example methylammonium sulphate.

..... [1]

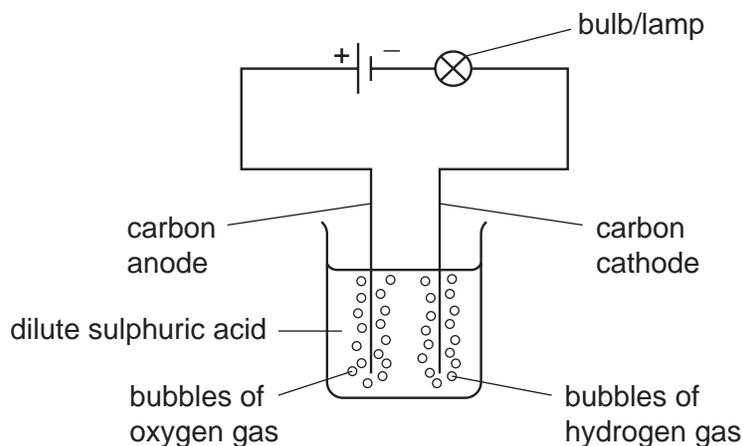
- 6 (a) Four bottles were known to contain aqueous ammonia, dilute hydrochloric acid, sodium hydroxide solution and vinegar, which is dilute ethanoic acid. The bottles had lost their labels. The pH values of the four solutions were 1, 4, 10 and 13.

Complete the table.

solution	
aqueous ammonia	
dilute hydrochloric acid	
sodium hydroxide solution	
vinegar	

[2]

- (b) The following apparatus was set up to investigate the electrical conductivity of dilute acids.

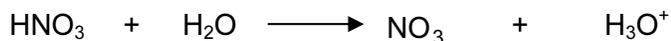


Dilute sulphuric acid is a strong acid. If it was replaced by a weak acid, what **two** differences in the observations would you expect to make?

.....

 [2]

- (c) When nitric acid is added to water the following reaction occurs.



Give the name and the formula of the particle which is transferred from nitric acid to water.

name

[2]

(d) This question is concerned with the following oxides.

aluminium oxide Al_2O_3

calcium oxide CaO

carbon dioxide CO_2

carbon monoxide CO

magnesium oxide MgO

sulphur dioxide SO_2

(i) Which of the above oxides will react with hydrochloric acid but not with aqueous sodium hydroxide?

..... [1]

(ii) Which of the above oxides will react with aqueous sodium hydroxide but not with hydrochloric acid?

..... [1]

(iii) Which of the above oxides will react both with hydrochloric acid and with aqueous sodium hydroxide?

..... [1]

(iv) Which of the above oxides will react neither with hydrochloric acid nor with aqueous sodium hydroxide?

..... [1]