

Acids, bases and salts

Question Paper 1

Level	IGCSE
Subject	Chemistry
ExamBoard	CIE
Topic	Acids, bases and salts
Sub-Topic	
Paper	(Extended) Theory
Booklet	Question Paper 1

TimeAllowed: 78 minutes

Score: / 65

Percentage: /100

1 Soluble salts can be made using a base and an acid.

(a) Complete this method of preparing dry crystals of the soluble salt cobalt(II) chloride-6-water from the insoluble base cobalt(II) carbonate.

step 1

Add an excess of cobalt(II) carbonate to hot dilute hydrochloric acid.

step 2

.....
.....

step 3

.....
.....

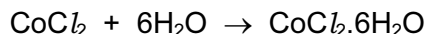
step 4

.....
.....

[4]

- (b) (i) 5.95 g of cobalt(II) carbonate were added to 40 cm³ of hydrochloric acid, concentration 2.0 mol/dm³.

Calculate the maximum yield of cobalt(II) chloride-6-water and show that the cobalt(II) carbonate was in excess.



maximum yield:

number of moles of HCl used =

number of moles of CoCl₂ formed =

number of moles of CoCl₂·6H₂O formed =

mass of one mole of CoCl₂·6H₂O = 238 g

maximum yield of CoCl₂·6H₂O = g

to show that cobalt(II) carbonate is in excess:

number of moles of HCl used = (use your value from above)

mass of one mole of CoCO₃ = 119 g

number of moles of CoCO₃ in 5.95 g of cobalt(II) carbonate = [5]

- (ii) Explain how these calculations show that cobalt(II) carbonate is in excess.

..... [1]

[Total: 10]

2 Sulfuric acid is a strong acid. In aqueous solution, it ionises as shown below.



(a) (i) What is meant by the term *acid*?

.....

[1]

(ii) Sulfurous acid, H_2SO_3 , is a weak acid.

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

.....

.....

[2]

(b) Sulfurous acid forms salts called sulfites, which contain the ion SO_3^{2-} .

When barium nitrate solution is added to aqueous sulfurous acid, a white precipitate, **A**, forms. Bromine water changes from brown to colourless when added to aqueous sulfurous acid.

Bromine oxidises sulfurous acid. When this solution is tested with acidified barium nitrate solution, a different white precipitate, **B**, is formed.

(i) Identify the white precipitate, **A**.

.....[1].

(ii) Identify the white precipitate, **B**.

.....[1]

(iii) Write an ionic equation for the reduction of the bromine molecule.

.....[1]

(iv) Name the product formed by the oxidation of sulfurous acid.

.....
[1]

(c) Complete the following word equations.

(i) magnesium hydroxide + dilute sulfuric acid

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

(ii) zinc + dilute sulfuric acid

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

(iii) copper carbonate + dilute sulfuric acid

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

(d) Write equations for the reaction of dilute sulfuric acid with each of the following.

(i) ammonia

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

(ii) sodium hydroxide

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

(iii) iron

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

[Total: 16]

3 Acid-base reactions are examples of proton transfer.

(a) Ethylamine is a weak base and sodium hydroxide is a strong base.

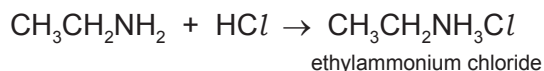
(i) In terms of proton transfer, explain what is meant by the term *weak base*.

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

(ii) Given aqueous solutions of both bases, describe how you could show that sodium hydroxide is the stronger base. How could you ensure a 'fair' comparison between the two solutions?

.....
.....
.....
..... [3]

(b) Ethylamine reacts with acids to form salts.



(i) Complete the equation for the reaction between sulfuric acid and ethylamine. Name the salt formed.



name of salt [3]

(ii) Amines and their salts have similar chemical properties to ammonia and ammonium salts.

Suggest a reagent that could be used to displace the weak base, ethylamine, from its salt ethylammonium chloride.

..... [1]

(c) Gases diffuse, which means that they move to occupy the total available volume.

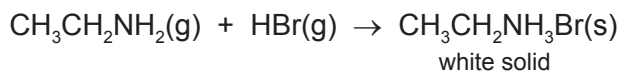
(i) Explain, using kinetic particle theory, why gases diffuse.

.....

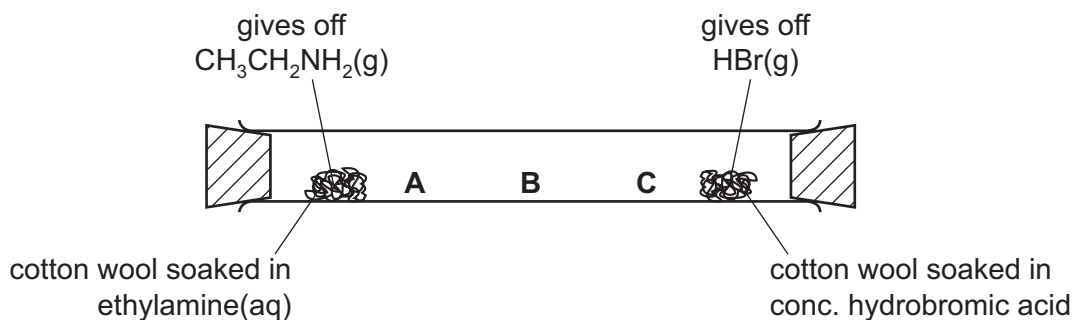
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..... [2]

(ii) When the colourless gases hydrogen bromide and ethylamine come into contact, a white solid is formed.



The following apparatus can be used to compare the rates of diffusion of the two gases ethylamine and hydrogen bromide.



Predict at which position, **A**, **B** or **C**, the white solid will form. Explain your choice.

.....

.....

..... [3]

[Total: 14]

4 Three common methods of preparing salts are shown below.

method **A** adding an excess of an insoluble base or carbonate or metal to a dilute acid and removing excess by filtration

method **B** using a burette and indicator

method **C** mixing two solutions to obtain the salt by precipitation

For each of the following salt preparations, choose a method, **A**, **B** or **C**. Name any additional reagent which is needed and complete the equation.

(a) the soluble salt, nickel chloride, from the insoluble compound nickel carbonate

method

reagent

word equation

[3]

(b) the insoluble salt, lead(II) bromide, from aqueous lead(II) nitrate

method

reagent

ionic equation + \rightarrow PbBr_2

[3]

(c) the soluble salt, lithium sulfate, from the soluble base lithium hydroxide

method

reagent

equation

[4]

[Total: 10]

5 This question is concerned with the following oxides.

- aluminium oxide
- carbon monoxide
- copper(II) oxide
- silicon(IV) oxide
- sodium oxide
- sulfur dioxide
- zinc oxide

Choose **one** oxide from the above list to match each of the following descriptions. An oxide may be used once, more than once or not at all.

- (a) This oxide does not react with acid or alkali.
[1]
- (b) This oxide reacts with water to give a strong alkali solution.
[1]
- (c) This oxide is used as a bleach.
[1]
- (d) This oxide is amphoteric.
[1]
- (e) This oxide has a giant covalent structure.
[1]
- (f) This oxide is soluble in water and it is acidic.
[1]

[Total: 6]

6 (a) Match the following pH values to the solutions given

1 3 7 10 below

The solutions all have the same concentration.

solution	pH
aqueous ammonia, a weak base
dilute hydrochloric acid, a strong acid
aqueous sodium hydroxide, a strong base
aqueous sodium chloride, a salt
dilute ethanoic acid, a weak acid

[5]

(b) Explain why solutions of hydrochloric acid and ethanoic acid with the same concentration, in mol/dm³, have a different pH.

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

(c) Measuring pH is one way of distinguishing between a strong acid and a weak acid. Describe another method.

method

.....

results

..... [2]

[Total: 9]