

# Identification Of ions And Gases

## Question Paper

Level	O Level
Subject	Chemistry
Exam Board	Cambridge International Examinations
Topic	Experimental Chemistry
Sub-Topic	Identification of ions and gases
Booklet	Question Paper

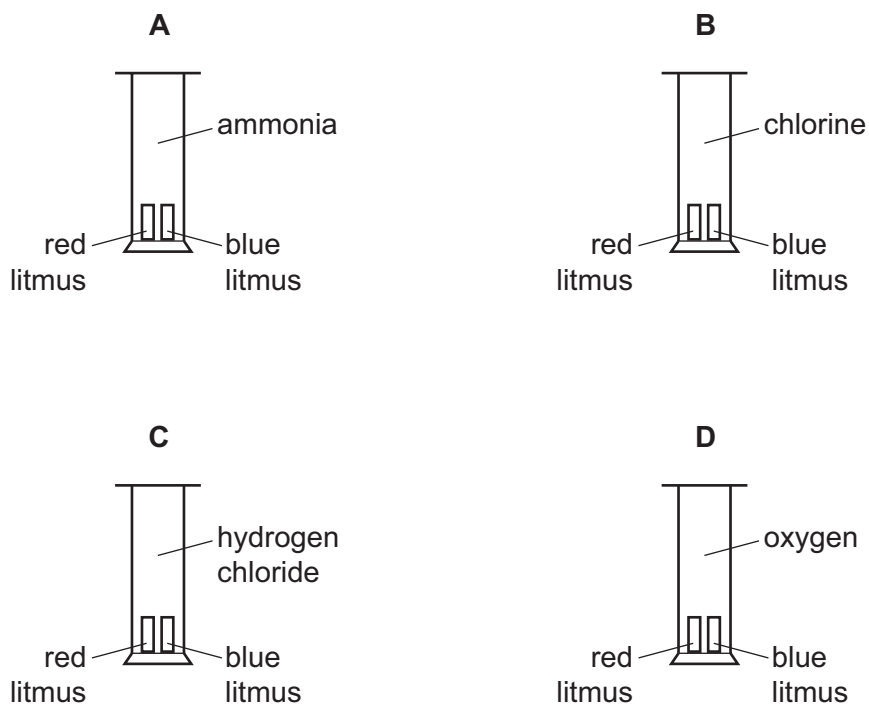
**Time Allowed:** 58 minutes

**Score:** /48

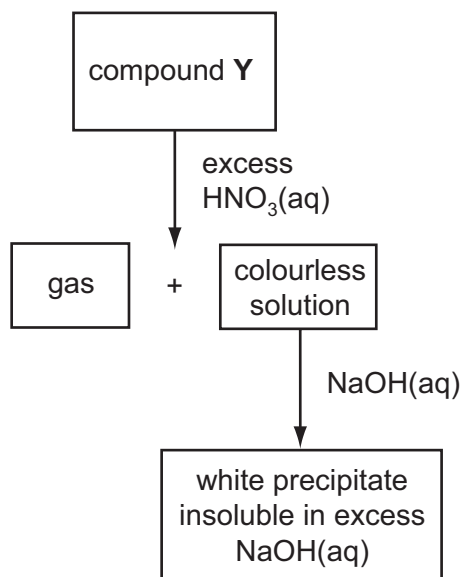
**Percentage:** /100

- 1 Four gas jars each contain one of the gases ammonia, chlorine, hydrogen chloride and oxygen. A strip of damp blue litmus paper and a strip of damp red litmus paper are placed in each jar.

In which gas jar will both the damp blue litmus paper and the damp red litmus paper change colour?



- 2 The scheme shows a sequence of reactions starting from compound **Y**.



What could the compound **Y** be?

- A aluminium sulfate
  - B calcium carbonate
  - C copper(II) carbonate
  - D zinc carbonate
- 3 A student mixed together aqueous solutions of **Y** and **Z**. A white precipitate formed.

Which could **not** be **Y** and **Z**?

	<b>Y</b>	<b>Z</b>
<b>A</b>	hydrochloric acid	silver nitrate
<b>B</b>	hydrochloric acid	sodium nitrate
<b>C</b>	sodium chloride	lead(II) nitrate
<b>D</b>	sodium chloride	silver nitrate

- 4 A liquid reacts with each of sodium carbonate, potassium hydroxide and ethanol.

What is the liquid?

- A aqueous ammonia
  - B ethanoic acid
  - C ethyl ethanoate
  - D sodium hydroxide
- 5 Which compound, on combustion, **never** forms carbon?
- A carbon monoxide
  - B ethanol
  - C ethene
  - D methane
- 6 Which compound when in aqueous solution will produce a red/brown precipitate on the addition of an aqueous solution of  $\text{Fe}^{3+}$  ions?
- A hydrogen chloride
  - B sodium chloride
  - C sodium hydroxide
  - D sulfur trioxide
- 7 Sulfur is burnt in air.
- Which statement about this reaction is correct?
- A The gas formed turns aqueous potassium dichromate(VI) from green to orange.
  - B The product is used as a food preservative.
  - C The reaction is endothermic.
  - D The reaction is reversible.

8 In which pair do neither of the gases change the colour of damp blue litmus paper?

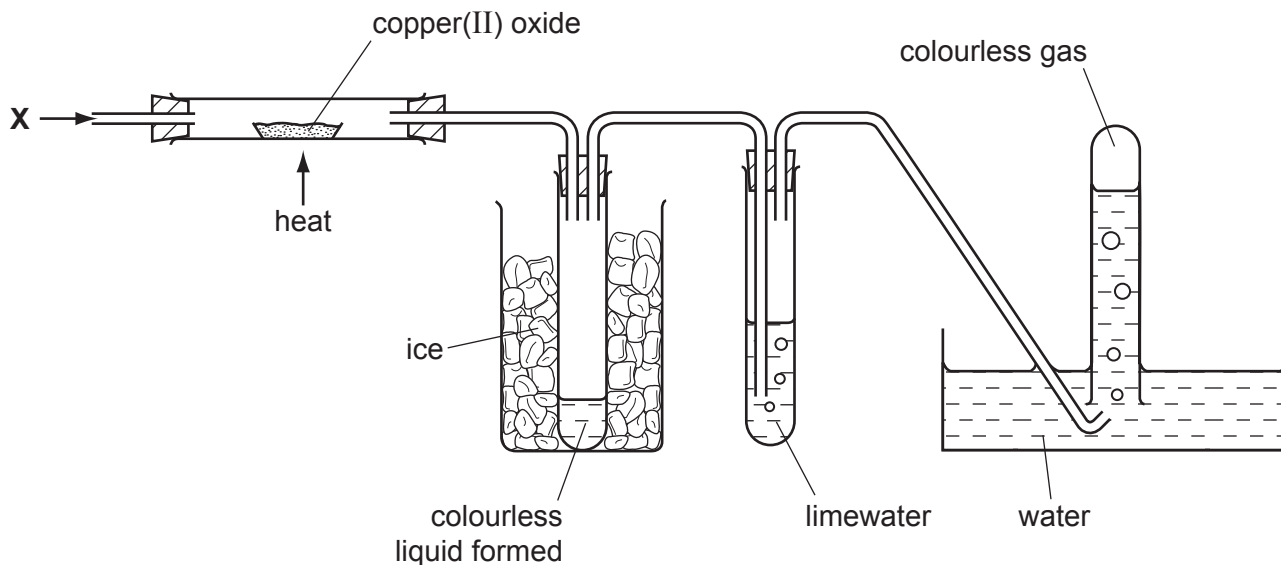
- A ammonia and hydrogen
- B ammonia and hydrogen chloride
- C carbon dioxide and chlorine
- D carbon dioxide and sulfur dioxide

9 Aqueous silver nitrate is added to separate solutions of potassium chloride and sodium iodide.

What are the colours of the precipitates formed?

	colour of precipitate formed with chloride	colour of precipitate formed with iodide
<b>A</b>	white	white
<b>B</b>	white	yellow
<b>C</b>	yellow	white
<b>D</b>	yellow	yellow

- 10 When pure gas **X** was passed through the apparatus shown, the copper(II) oxide turned pink and the limewater stayed colourless.



What is gas **X**?

- A carbon dioxide
  - B carbon monoxide
  - C hydrogen
  - D nitrogen
- 11 The addition of dilute acid to a solution containing the anion Q and the subsequent use of limewater can be used to identify the anion Q.

What is Q?

- A a carbonate
  - B a chloride
  - C an iodide
  - D a sulfate
- 12 Which ion reacts with aqueous ammonia to give a precipitate that dissolves in an excess of ammonia?
- A  $Al^{3+}(aq)$
  - B  $Fe^{2+}(aq)$
  - C  $Fe^{3+}(aq)$
  - D  $Zn^{2+}(aq)$

- 13 Which statement about aqueous sodium chloride is correct?
- A It contains sodium atoms.
  - B It contains two different types of molecules.
  - C It does not conduct electricity.
  - D It forms a white precipitate when added to aqueous silver nitrate.

- 14 Substance Q is a soluble salt.

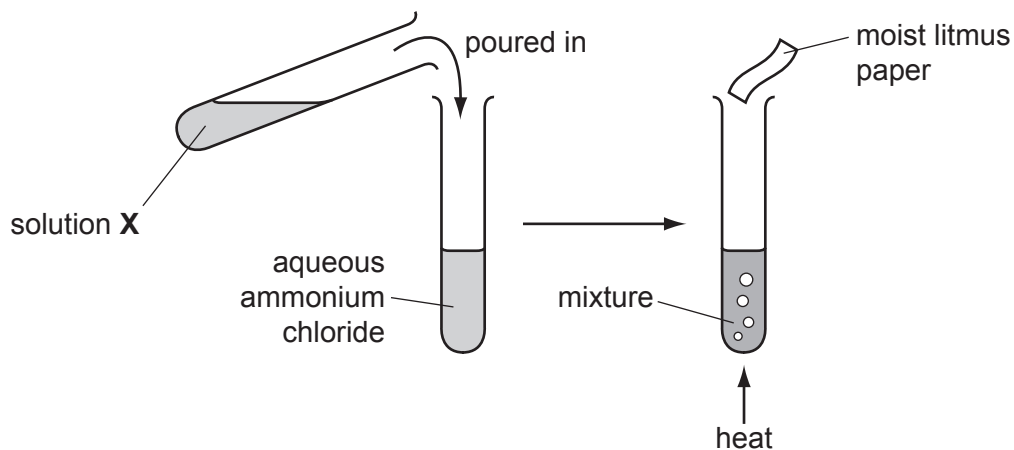
An aqueous solution of Q is tested as shown.

test	observation
warm Q with aqueous sodium hydroxide	alkaline gas given off, no precipitate formed
to Q add dilute nitric acid and barium nitrate solution	white precipitate forms

What is Q?

- A ammonium chloride
  - B ammonium sulfate
  - C zinc chloride
  - D zinc sulfate
- 15 A mixture of two gases has no effect on either damp blue litmus paper or damp red litmus paper.
- Which gases are present in the mixture?
- A ammonia and oxygen
  - B carbon dioxide and sulfur dioxide
  - C chlorine and hydrogen
  - D hydrogen and oxygen

- 16 The diagrams show an experiment with aqueous ammonium chloride.



A gas, **Y**, is produced and the litmus paper changes colour.

What are solution **X** and gas **Y**?

	solution <b>X</b>	gas <b>Y</b>
<b>A</b>	aqueous sodium hydroxide	ammonia
<b>B</b>	aqueous sodium hydroxide	chlorine
<b>C</b>	dilute sulfuric acid	ammonia
<b>D</b>	dilute sulfuric acid	chlorine

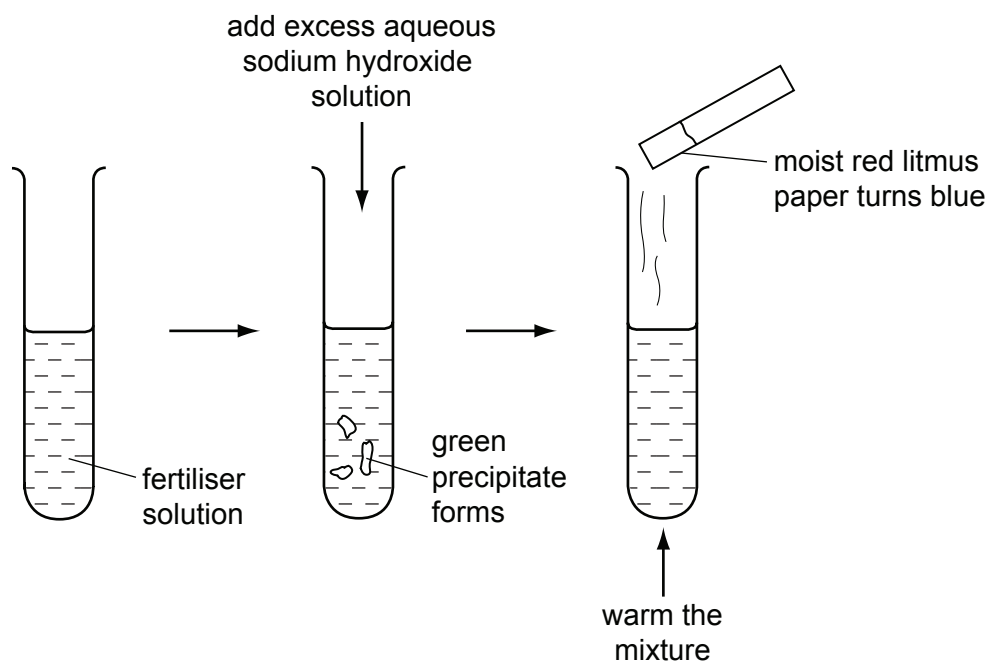
- 17 A student tested a solution by adding aqueous sodium hydroxide. A precipitate was not seen because the reagent was added too quickly.

What could **not** have been present in the solution?

- A**  $Al^{3+}$       **B**  $Ca^{2+}$       **C**  $NH_4^+$       **D**  $Zn^{2+}$



18 A solution of fertiliser was tested as shown.



Which ions must be present in the fertiliser?

- A  $\text{Fe}^{2+}$  and  $\text{SO}_4^{2-}$
  - B  $\text{Fe}^{3+}$  and  $\text{NO}_3^-$
  - C  $\text{NH}_4^+$  and  $\text{Fe}^{2+}$
  - D  $\text{NH}_4^+$  and  $\text{NO}_3^-$
- 19 The labels fell off two bottles each containing a colourless solution, one of which was sodium carbonate solution and the other was sodium chloride solution.

The addition of which solution to a sample from each bottle would **most** readily enable the bottles to be correctly relabelled?

- A ammonia
- B hydrochloric acid
- C lead(II) nitrate
- D sodium hydroxide

- 20 Ammonium sulfate and potassium sulfate are salts which can be found in fertilisers. A sample of a fertiliser is warmed with aqueous sodium hydroxide and a gas with pH10 is given off.

Which salt must be in the fertiliser and which gas is given off?

	salt in fertiliser	name of gas
<b>A</b>	ammonium sulfate	ammonia
<b>B</b>	ammonium sulfate	sulfur dioxide
<b>C</b>	potassium sulfate	ammonia
<b>D</b>	potassium sulfate	sulfur dioxide

- 21 A sample of tap water gave a white precipitate with acidified silver nitrate.

What does this show about the tap water?

- A** It contained chloride.
  - B** It contained harmful microbes.
  - C** It contained nitrates.
  - D** It had not been filtered.
- 22 Which is an anion that is present in the solution formed when an excess of dilute hydrochloric acid is added to calcium carbonate?

- A**  $\text{Ca}^{2+}$       **B**  $\text{Cl}^-$       **C**  $\text{CO}_3^{2-}$       **D**  $\text{H}^+$

- 23 A metal reacts with dilute hydrochloric acid to produce a gas.

What is used to identify this gas?

- A** a glowing splint
- B** a lighted splint
- C** damp blue litmus paper
- D** limewater

24 Titration of an acid against a base is a method often used in the preparation of salts.

Which properties of the acid, the base and the salt are required if this method is to be used?

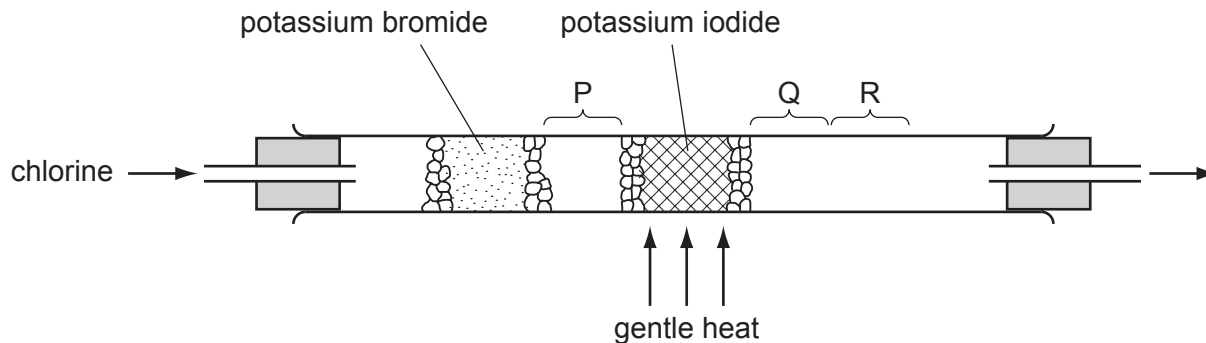
	acid	base	salt
A	insoluble	insoluble	insoluble
B	soluble	insoluble	insoluble
C	soluble	soluble	insoluble
D	soluble	soluble	soluble

25 Substance X dissolves in water to form a colourless solution. This solution reacts with aqueous lead(II) nitrate in the presence of dilute nitric acid to give a yellow precipitate.

What is substance X?

- A calcium iodide
- B copper(II) chloride
- C iron(II) iodide
- D sodium chloride

26 Using the apparatus shown, chlorine is passed through the tube.



After a short time, coloured substances are seen at P, Q and R.

What are these coloured substances?

	at P	at Q	at R
<b>A</b>	green gas	red brown vapour	violet vapour
<b>B</b>	green gas	violet vapour	black solid
<b>C</b>	red brown vapour	violet vapour	black solid
<b>D</b>	violet vapour	red brown vapour	red brown vapour

27 Carbon dioxide and carbon monoxide are both

- A** absorbed by sodium hydroxide.
- B** colourless.
- C** inflammable in air.
- D** lighter than air.

28 Which reagent could be used to distinguish between dilute nitric acid and dilute hydrochloric acid?

- A** aqueous barium chloride
- B** aqueous silver nitrate
- C** aqueous sodium hydroxide
- D** copper(II) carbonate

29 Which is a property of aqueous potassium iodide?

- A It does not conduct electricity.
- B It is a purple solution.
- C It is decolourised by chlorine.
- D It reacts with aqueous bromine to form iodine.

30 Solution X contains a simple salt.

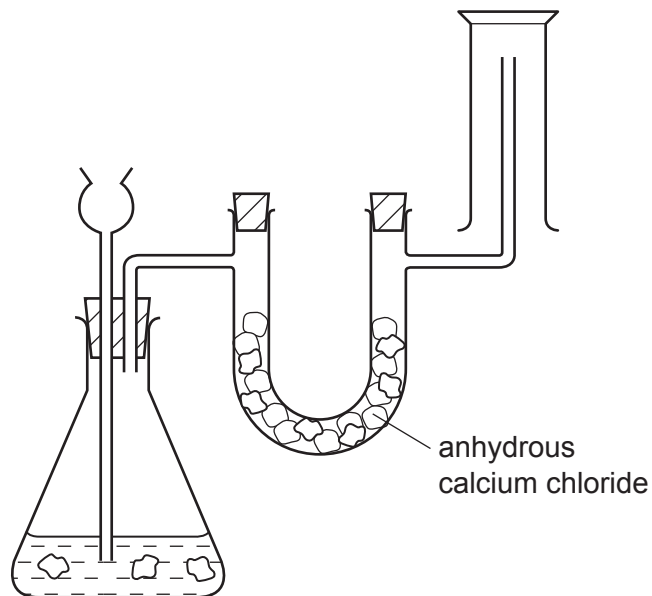
The table shows the results of some tests on solution X.

test	observation
addition of aqueous sodium hydroxide	green precipitate forms
addition of acidified barium nitrate	white precipitate forms

What is the name of the salt in solution X?

- A iron(II) chloride
- B iron(III) chloride
- C iron(II) sulphate
- D iron(III) sulphate

31 The diagram shows a simple laboratory apparatus for the preparation and collection of a dry gas.



What is the gas?

- A carbon dioxide
- B chlorine
- C hydrogen
- D hydrogen chloride

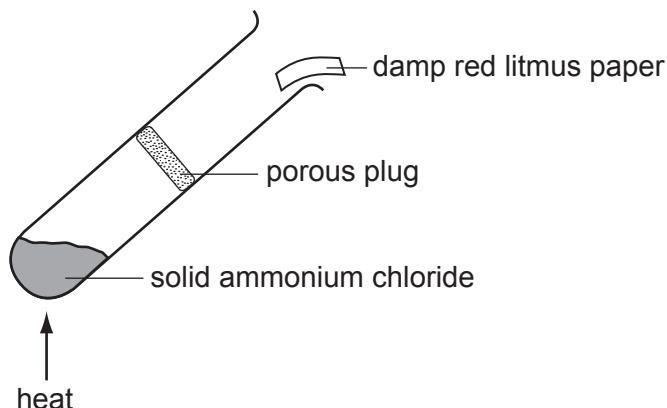
32 Gas X

- has no effect either on damp red litmus paper or on damp blue litmus paper,
- puts out both a glowing splint and a burning splint.

What is gas X?

- A ammonia
- B carbon dioxide
- C chlorine
- D nitrogen

- 33 Solid ammonium chloride decomposes on heating according to the following equation.



Which change occurs to the damp red litmus paper in the experiment above?

- A remains red
  - B turns blue and is then bleached
  - C turns blue and remains blue
  - D turns blue and then turns red
- 34 Compound X reacts with some metals to liberate hydrogen and is used to make fertilisers. It gives a white precipitate when added to aqueous barium nitrate. What is X?
- A ammonium sulphate
  - B hydrochloric acid
  - C potassium nitrate
  - D sulphuric acid
- 35 An aqueous solution of zinc chloride is tested with various reagents. Which observation is correct?
- A Acidified barium nitrate solution gives a white precipitate.
  - B Aqueous ammonia gives a white precipitate soluble in excess of the reagent.
  - C Copper turnings precipitate zinc.
  - D Sodium hydroxide solution gives a white precipitate insoluble in excess of the reagent.

36 Which cation, on reaction with aqueous sodium hydroxide, forms a precipitate that dissolves in excess sodium hydroxide?

- A**  $\text{Ca}^{2+}$             **B**  $\text{Cu}^{2+}$             **C**  $\text{Fe}^{3+}$             **D**  $\text{Zn}^{2+}$

37 Element **R** reacts with oxygen to form a gas, **T**.

**T** changes the colour of damp litmus paper from blue to red.

**T** is used to kill bacteria in the preservation of dried fruit.

What is **R**?

- A** carbon  
**B** chlorine  
**C** nitrogen  
**D** sulphur

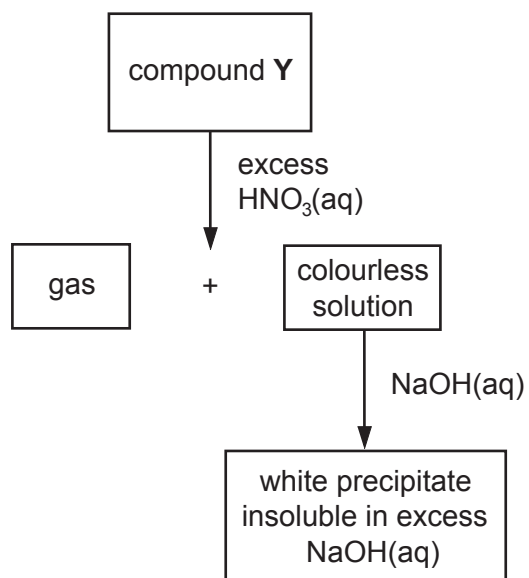
38 An aqueous solution of compound **X** reacts with aqueous sodium hydroxide to form a green precipitate and then aluminium powder is added. The mixture is heated and a gas that turns damp red litmus paper blue is given off.

What is **X**?

- A** ammonium nitrate  
**B** copper(II) chloride  
**C** iron(II) nitrate  
**D** iron(III) chloride



39 The scheme shows some reactions of a compound **Y**.



What could the compound **Y** be?

- A** aluminium sulphate
- B** calcium carbonate
- C** copper(II) carbonate
- D** zinc carbonate

40 A student adds aqueous sodium hydroxide or aqueous ammonia to aqueous solutions of four different metal compounds.

Which solution contains  $Zn^{2+}$  ions?

solution	add a few drops of NaOH(aq)	add excess NaOH(aq)	add a few drops of $NH_3(aq)$	add excess $NH_3(aq)$
<b>A</b>	ppt	ppt dissolves	ppt	ppt dissolves
<b>B</b>	ppt	ppt dissolves	ppt	ppt
<b>C</b>	ppt	ppt	no ppt	no ppt
<b>D</b>	no ppt	no ppt	no ppt	no ppt

41 The results of tests carried out on compound **X** are shown.

test	result
dilute hydrochloric acid added warm with aqueous sodium hydroxide	gas given off which turned limewater cloudy gas evolved which turned red litmus blue

What is compound **X**?

- A** ammonium carbonate
- B** ammonium nitrate
- C** calcium carbonate
- D** calcium nitrate

42 Two tests are carried out on a solution of compound **X**.

test	result
add nitric acid followed by aqueous silver nitrate	white precipitate formed
excess aqueous sodium hydroxide added	white precipitate formed that does not re-dissolve

What is compound **X**?

- A** aluminium chloride
- B** aluminium sulphate
- C** calcium chloride
- D** calcium sulphate

43 When chlorine water is added to a colourless solution of **X**, a dark brown solution is obtained.

What is **X**?

- A**  $KCl$                       **B**  $KI$                       **C**  $NaBr$                       **D**  $NaF$

44 One mole of compound **X** gives three moles of ions in aqueous solution. **X** reacts with ammonium carbonate to give an acidic gas.

What is compound **X**?

- A** calcium hydroxide
- B** ethanoic acid
- C** sodium hydroxide
- D** sulphuric acid

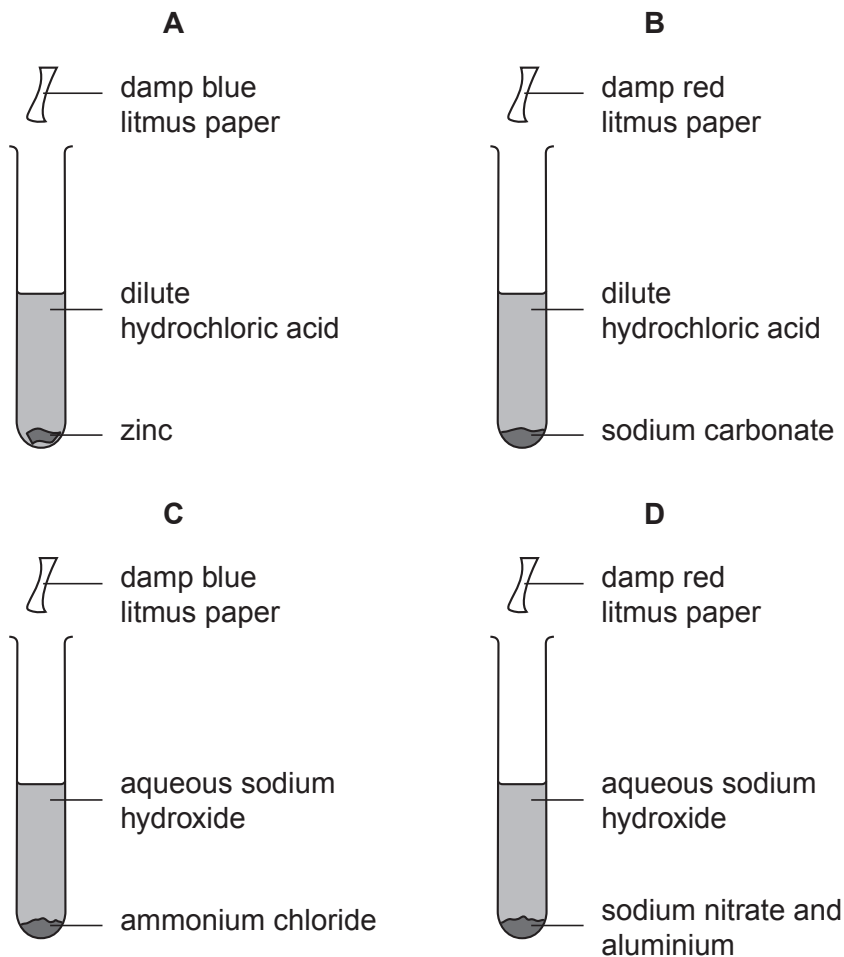
45 A pale green solution **X** gives a green precipitate with excess aqueous sodium hydroxide. An alkaline gas is only given off when the mixture is warmed with powdered aluminium.

Which ions does **X** contain?

- A ammonium and copper(II)
- B ammonium and iron(III)
- C copper(II) and nitrate
- D iron(II) and nitrate

46 The diagrams show mixtures of chemicals that react to produce gases.

In which reaction will the litmus paper change colour?



47 The table shows the results of two tests carried out on separate portions of a solution of salt **X**.

	test	observation
1	acidified aqueous barium nitrate added	white precipitate
2	aqueous sodium hydroxide added	white precipitate soluble in an excess of aqueous sodium hydroxide

What is **X**?

- A calcium chloride
- B iron(II) sulphate
- C lead(II) nitrate
- D zinc sulphate

48 A salt is dissolved in water. The results of two separate tests on it are shown in the table.

	test	result
1	add aqueous ammonia	a white precipitate which dissolves when an excess of aqueous ammonia is added
2	add dilute nitric acid then aqueous barium nitrate	a white precipitate

What is the salt?

- A aluminium chloride
- B aluminium sulphate
- C zinc chloride
- D zinc sulphate

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