

# Cambridge University Examinations

General Certificate of Education Ordinary Level  
O – LEVEL 5070. Notes, P1, P2 and P4

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Chapter

## Acids, bases and alkalis

### Work Sheet Paper 1

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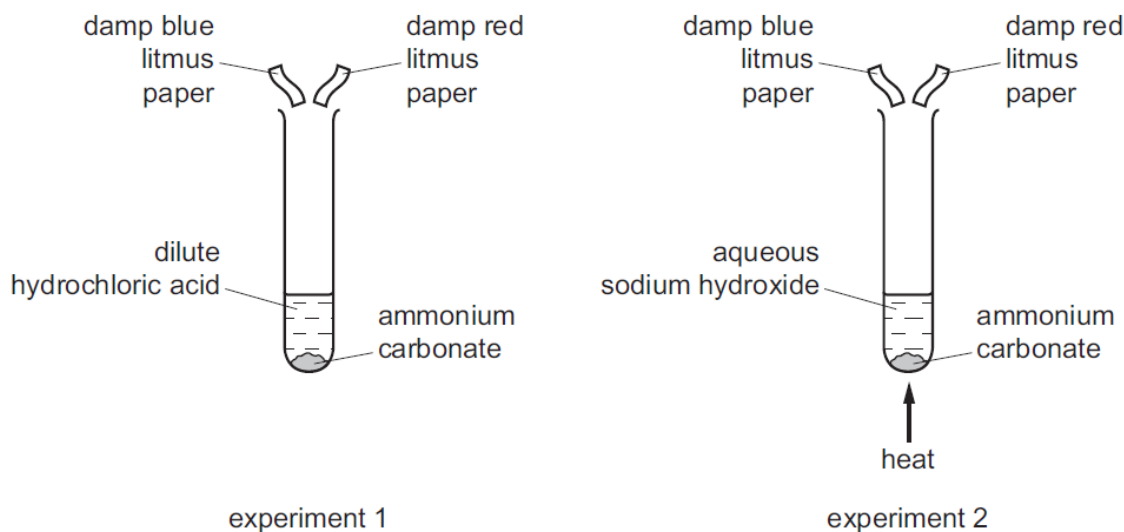
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1 Two experiments were carried out.

In experiment 1, ammonium carbonate was reacted with dilute hydrochloric acid.

In experiment 2, ammonium carbonate was heated with aqueous sodium hydroxide.

In each experiment, the gas evolved was tested with damp blue litmus paper and damp red litmus paper.



Which row correctly shows the colour of both the pieces of litmus paper at the end of each experiment?

	experiment 1	experiment 2
<b>A</b>	blue	blue
<b>B</b>	blue	red
<b>C</b>	red	blue
<b>D</b>	red	red

2 Which reaction does **not** involve neutralisation?

- A**  $\text{H}_2\text{SO}_4(\text{aq}) + 2\text{NH}_3(\text{aq}) \rightarrow (\text{NH}_4)_2\text{SO}_4(\text{aq})$
- B**  $\text{H}_2\text{SO}_4(\text{aq}) + \text{BaCl}_2(\text{aq}) \rightarrow \text{BaSO}_4(\text{s}) + 2\text{HCl}(\text{aq})$
- C**  $\text{H}_2\text{SO}_4(\text{aq}) + \text{CuO}(\text{s}) \rightarrow \text{CuSO}_4(\text{aq}) + \text{H}_2\text{O}(\text{l})$
- D**  $\text{H}_2\text{SO}_4(\text{aq}) + 2\text{NaOH}(\text{aq}) \rightarrow \text{Na}_2\text{SO}_4(\text{aq}) + 2\text{H}_2\text{O}(\text{l})$

3 When the product of a reaction between two gases is added to water, a solution of pH7 is formed.

Which could be these gases?

- A** hydrogen and chlorine
- B** hydrogen and nitrogen
- C** hydrogen and oxygen
- D** oxygen and carbon monoxide



- 4 Which pair of gases are both non-acidic?
- A** ammonia and methane  
**B** carbon dioxide and ammonia  
**C** methane and nitrogen dioxide  
**D** nitrogen dioxide and carbon dioxide
- 5 Which row shows the pH values for  $0.1 \text{ mol/dm}^3$  solutions of ammonia, hydrochloric acid, sodium chloride and sodium hydroxide?

	pH values			
	$\text{NH}_3$	$\text{HCl}$	$\text{NaCl}$	$\text{NaOH}$
<b>A</b>	1	7	13	11
<b>B</b>	7	1	11	13
<b>C</b>	11	1	7	13
<b>D</b>	13	11	7	1

- 6 Solution **X** has a pH value of 12. It is added to aqueous ammonium chloride and the mixture is warmed.

Which information is correct?

	solution <b>X</b> is	when the mixture is warmed
<b>A</b>	acidic	ammonia gas is given off
<b>B</b>	acidic	no gas is given off
<b>C</b>	alkaline	ammonia gas is given off
<b>D</b>	alkaline	no gas is given off

- 7 In a titration between an acid (in the burette) and an alkali, you may need to re-use the same titration flask.

Which is the best procedure for rinsing the flask?

- A** Rinse with distilled water and then with the alkali.  
**B** Rinse with tap water and then with distilled water.  
**C** Rinse with tap water and then with the acid.  
**D** Rinse with the alkali.
- 8 Which row correctly classifies the oxides in the table?

	carbon dioxide	copper(II) oxide	zinc oxide
<b>A</b>	acidic	amphoteric	basic
<b>B</b>	acidic	basic	amphoteric
<b>C</b>	acidic	neutral	amphoteric
<b>D</b>	basic	neutral	neutral



9 Which pair of substances reacts to form a salt and water only?

- A aqueous sodium chloride and aqueous silver nitrate
- B aqueous sodium hydroxide and dilute ethanoic acid
- C aqueous sodium carbonate and dilute sulfuric acid
- D zinc and dilute hydrochloric acid

10 An excess of calcium hydroxide is added to an acidic soil.

What happens to the pH of the soil?

	change in pH	final pH
A	decrease	5
B	decrease	7
C	increase	7
D	increase	10

11 Which substance in the table could be an amphoteric oxide?

	reaction with dilute hydrochloric acid	reaction with water	reaction with sodium hydroxide
A	dissolves	insoluble	dissolves
B	dissolves	insoluble	insoluble
C	insoluble	dissolves	insoluble
D	insoluble	insoluble	dissolves

12 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

13 In a titration between an acid (in the burette) and an alkali, you may need to re-use the same titration flask.

Which is the best procedure for rinsing the flask?

- A Rinse with distilled water and then with the alkali.
- B Rinse with tap water and then with distilled water.
- C Rinse with tap water and then with the acid.
- D Rinse with the alkali.



- 14 Which statement about amphoteric oxides is **not** correct?
- A They dissolve in water.
  - B They are formed only by metals.
  - C They react with aqueous sodium hydroxide to give salts.
  - D They react with aqueous acids to give salts.
- 15 The pH of an aqueous solution of hydrochloric acid is 2.
- What will be the pH of the acid after the addition of 10 g of sodium chloride?
- A 1
  - B 2
  - C 7
  - D 9
- 16 Concentrated aqueous sodium chloride is electrolysed using inert electrodes until no more chlorine gas is evolved.
- What could be the pH of the resulting solution?
- A 1
  - B 4
  - C 7
  - D 11
- 17 Which mixture would react with dilute sulfuric acid to form two **different** gases?
- A copper and magnesium carbonate
  - B copper(II) carbonate and magnesium
  - C copper(II) carbonate and magnesium oxide
  - D copper(II) oxide and magnesium
- 18 Which compound in a  $1 \text{ mol/dm}^3$  solution has the lowest pH value?
- A ethanoic acid
  - B hydrogen chloride
  - C sodium chloride
  - D sodium hydroxide
- 19 In which reaction do the products formed **not** include a salt?
- A calcium(II) carbonate with hydrochloric acid
  - B copper(II) oxide with hydrogen
  - C copper(II) oxide with sulfuric acid
  - D copper(II) sulfate with sodium hydroxide
- 20 Which type of compound will liberate ammonia when heated with ammonium sulfate?
- A an acid
  - B an alkali
  - C a reducing agent
  - D a salt



- 21 The pH of an aqueous solution of hydrochloric acid is 2.

What will be the pH of the acid after the addition of 10 g of sodium chloride?

- A** 1                      **B** 2                      **C** 7                      **D** 9

- 22 A colourless solution reacts with magnesium to form a salt and hydrogen gas.

How is this solution acting?

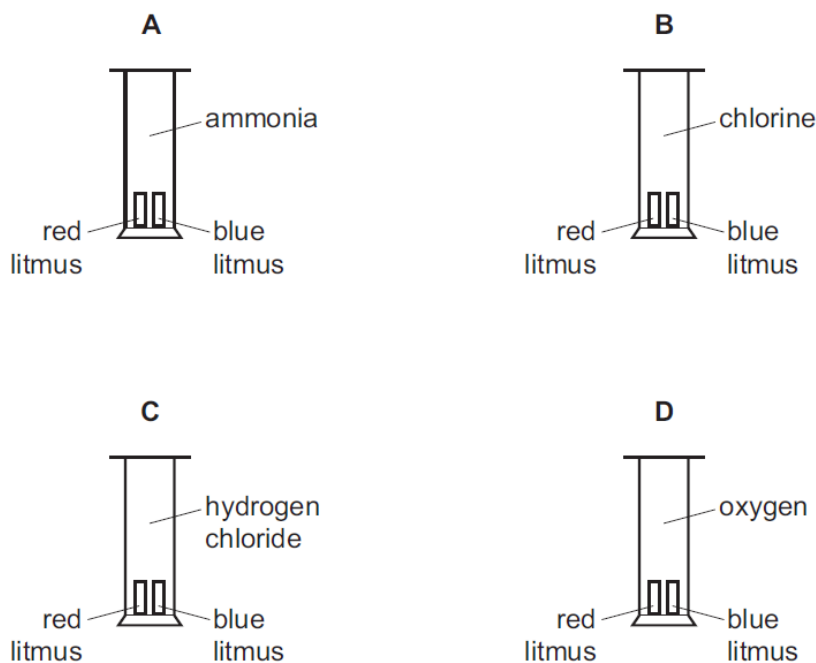
- A** as a base  
**B** as a reducing agent  
**C** as a solvent  
**D** as an acid

- 23 Which oxide is amphoteric?

- A**  $Al_2O_3$               **B**  $CO_2$               **C**  $Na_2O$               **D**  $SO_2$

- 24 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?



- 25 The concentration of aqueous sodium carbonate can be found by reaction with hydrochloric acid of known concentration using the indicator methyl orange.

Which items of equipment are needed?

- A** burette, measuring cylinder, gas syringe  
**B** burette, measuring cylinder, thermometer  
**C** burette, pipette, conical flask  
**D** burette, pipette, stopwatch



- 26 Samples of three oxides, **X**, **Y** and **Z**, were added separately to dilute hydrochloric acid and to dilute sodium hydroxide.

**X** and **Y** react with dilute hydrochloric acid but **Z** does not react.

**Y** and **Z** react with aqueous sodium hydroxide but **X** does not react.

Which type of oxide are each of **X**, **Y** and **Z**?

	type of oxide		
	acidic	amphoteric	basic
<b>A</b>	<b>X</b>	<b>Y</b>	<b>Z</b>
<b>B</b>	<b>Y</b>	<b>X</b>	<b>Z</b>
<b>C</b>	<b>Z</b>	<b>X</b>	<b>Y</b>
<b>D</b>	<b>Z</b>	<b>Y</b>	<b>X</b>

- 27 Which substance does **not** react with hydrochloric acid?

- A** zinc carbonate
- B** zinc hydroxide
- C** zinc metal
- D** zinc nitrate

- 28 The following statements about dilute sulfuric acid are **all** correct.

- 1 Addition of Universal Indicator shows that the solution has a pH value of less than 7.0.
- 2 A white precipitate is formed when aqueous barium nitrate is added.
- 3 The solution reacts with copper(II) oxide, forming a blue solution.
- 4 The solution turns anhydrous copper(II) sulfate from white to blue.

Which two statements confirm the acidic nature of the solution?

- A** 1 and 2      **B** 1 and 3      **C** 2 and 4      **D** 3 and 4

- 29 Four oxides are added separately to aqueous sodium hydroxide.

- 1 aluminium oxide
- 2 carbon dioxide
- 3 copper(II) oxide
- 4 magnesium oxide

Which oxides react with aqueous sodium hydroxide?

- A** 1 and 2 only
- B** 1, 3 and 4 only
- C** 2 only
- D** 3 and 4 only



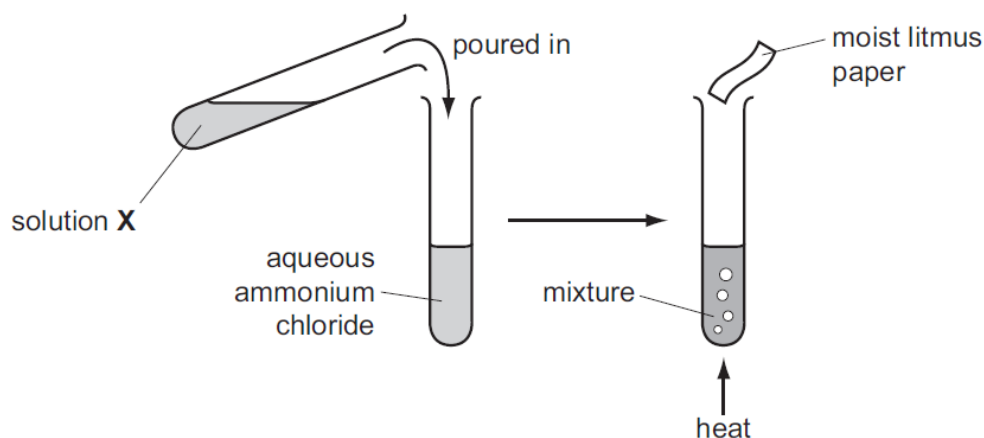


30 A sample of air was bubbled into water. The pH of the water slowly changed from 7 to 6.

Which gas in the sample caused this change?

- A carbon dioxide
- B carbon monoxide
- C nitrogen
- D oxygen

31 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

32 The oxide **Q** dissolves in water to form a colourless solution. This solution reacts with sodium carbonate to produce carbon dioxide.

What is **Q**?

- A copper(II) oxide
- B sodium oxide
- C sulfur dioxide
- D zinc oxide

33 What is a characteristic of a weak acid?

- A It does not react with sodium carbonate.
- B It forms an aqueous solution with a pH of 8.
- C It is only partially ionised when added to water.
- D It turns litmus solution blue.





- 34 Three separate mixtures of a solution and a solid are made, as shown in the table.

The mixtures are warmed.

In which mixtures does gas form?

	NaOH(aq) and NH <sub>4</sub> Cl(s)	H <sub>2</sub> SO <sub>4</sub> (aq) and NH <sub>4</sub> Cl(s)	H <sub>2</sub> SO <sub>4</sub> (aq) and Mg(s)	
<b>A</b>	✓	✓	x	key ✓ = gas forms x = no gas forms
<b>B</b>	✓	x	✓	
<b>C</b>	x	✓	x	
<b>D</b>	x	x	✓	

- 35 Potassium hydroxide is a base.

Which statement describes a reaction of potassium hydroxide?

- A** Chlorine is formed when it is heated with ammonium chloride.  
**B** It turns Universal Indicator green.  
**C** It reacts with an acid to produce a salt and water.  
**D** It turns methyl orange red.
- 36 Solution Q is warmed with ammonium chloride.

In a separate experiment, solution Q is added to methyl orange.

Which observations show that solution Q is basic?

	warmed with ammonium chloride	added to methyl orange
<b>A</b>	gas is produced	turns red
<b>B</b>	gas is produced	turns yellow
<b>C</b>	no reaction	turns red
<b>D</b>	no reaction	turns yellow

- 37 Potassium hydroxide is a base.

Which statement describes a reaction of potassium hydroxide?

- A** Chlorine is formed when it is heated with ammonium chloride.  
**B** It turns Universal Indicator green.  
**C** It reacts with an acid to produce a salt and water.  
**D** It turns methyl orange red.



- 38 When dilute sulfuric acid is added to solid X, a colourless solution is formed and a gas is produced.

What is X?

- A copper(II) oxide
- B sodium oxide
- C copper(II) carbonate
- D sodium carbonate

- 39 Aqueous sodium hydroxide is added to solid Q in a test-tube.

A gas is produced which turns damp red litmus blue.

What is Q?

- A aluminium
- B ammonia
- C ammonium chloride
- D sodium nitrate

- 40 The table gives information about three indicators.

indicator	colour at pH 1	pH at which colour changes	colour at pH 12
thymol blue	red	3	yellow
congo red	blue	5	red
phenolphthalein	colourless	10	red

Which colours would be obtained when each indicator was added separately to pure water?

	thymol blue	congo red	phenolphthalein
<b>A</b>	red	blue	red
<b>B</b>	yellow	blue	colourless
<b>C</b>	yellow	blue	red
<b>D</b>	yellow	red	colourless

- 41 When dilute sulfuric acid is added to solid X, a colourless solution is formed and a gas is produced.

What is X?

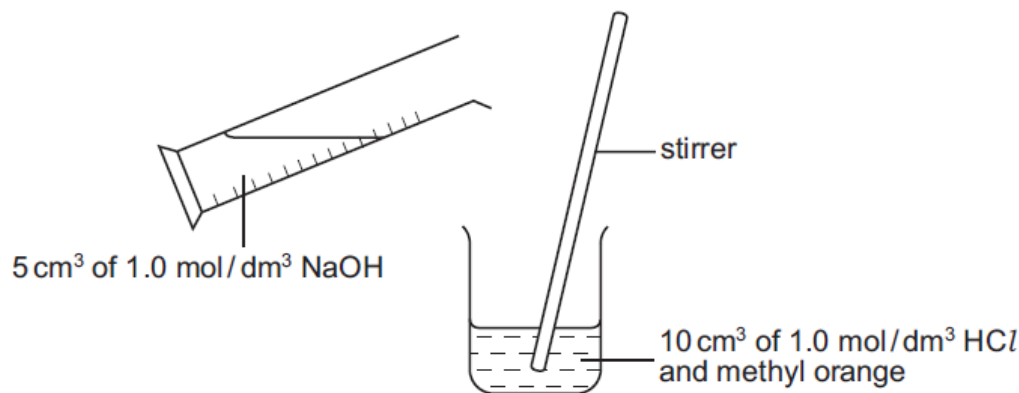
- A copper(II) oxide
- B sodium oxide
- C copper(II) carbonate
- D sodium carbonate



- 42 A few drops of methyl orange are added to a reaction mixture.  
During the reaction, a gas is produced and the methyl orange turns from red to orange.

What are the reactants?

- A** aqueous sodium hydroxide and ammonium chloride  
**B** aqueous sodium hydroxide and calcium carbonate  
**C** dilute hydrochloric acid and magnesium  
**D** dilute hydrochloric acid and aqueous sodium hydroxide
- 43 In an experiment  $5\text{ cm}^3$  of  $1.0\text{ mol/dm}^3$  sodium hydroxide are gradually added to  $10\text{ cm}^3$  of  $1.0\text{ mol/dm}^3$  hydrochloric acid containing methyl orange.



Which change occurs in the mixture?

- A** The concentration of the  $\text{H}^+$  ions increases.  
**B** The methyl orange changes colour.  
**C** More water molecules are formed.  
**D** A precipitate is formed.
- 44 The diagram shows the colours of the indicators, methyl orange and methyl red, at different pH values.

pH	2	3	4	5	6
colour of methyl orange	red		yellow		
colour of methyl red	red				yellow

The table shows the pH of four solutions.

solution	W	X	Y	Z
pH	2	3	5	6

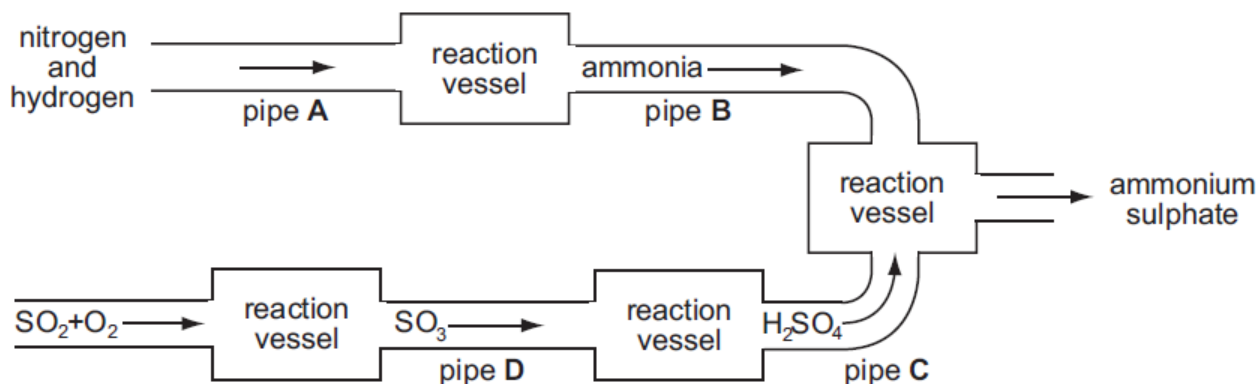
In which solutions will both indicators be yellow?

- A** W and X      **B** X and Y      **C** Y and Z      **D** Z only

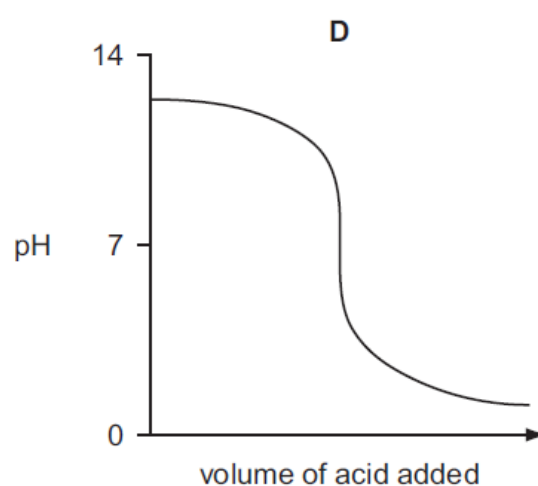
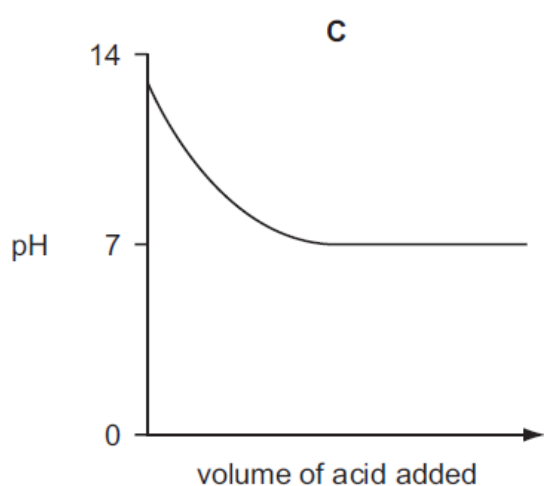
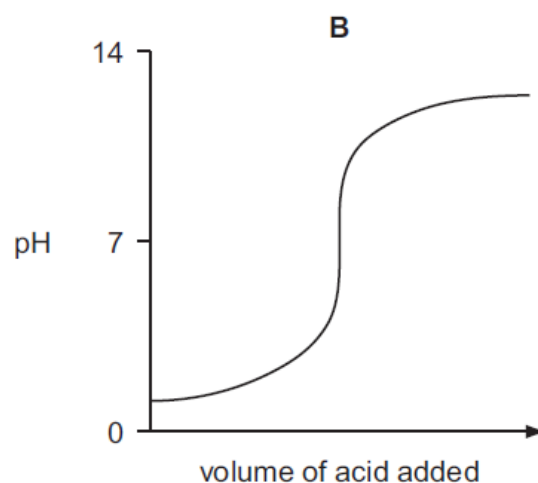
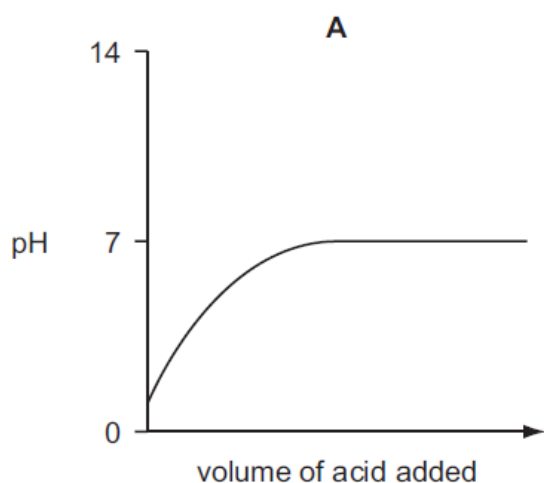


- 45 The diagram shows some of the stages in the manufacture of ammonium sulphate.

From which connecting pipe would a major leak most **increase** the pH value of rain?



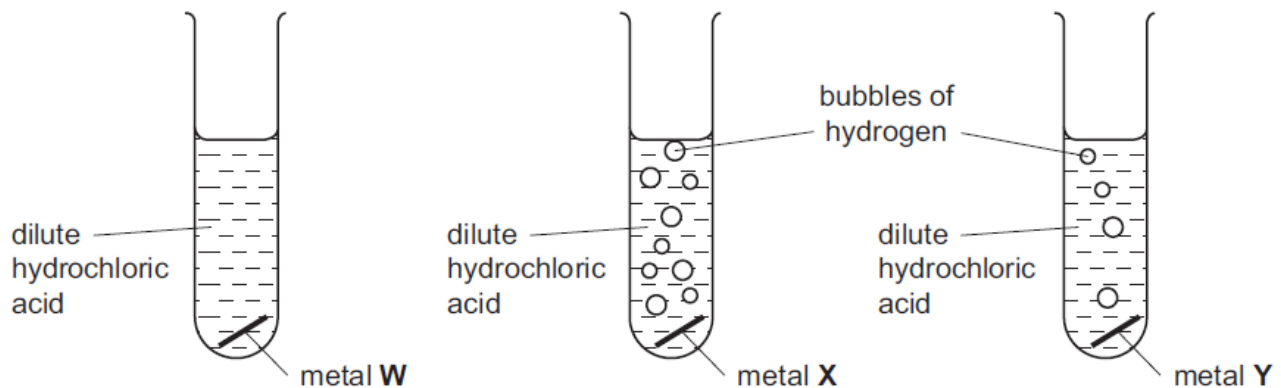
- 46 Which graph shows the changes in pH as an excess of hydrochloric acid is added to aqueous sodium hydroxide?



- 47 Which statement does **not** describe a property of a weak acid in solution?
- A It forms a salt with sodium hydroxide.  
 B It has a pH of between 8 and 9.  
 C It is only partly dissociated into ions.  
 D It reacts with sodium carbonate to give off carbon dioxide.
- 48 Which products are formed when dilute hydrochloric acid reacts with the substances shown in the table?

	substance	products
A	iron	iron(II) chloride + hydrogen only
B	iron(II) carbonate	iron(II) chloride + carbon dioxide gas only
C	iron(II) oxide	iron(II) chloride + oxygen gas only
D	iron(II) sulphate	iron(II) chloride + sulphur dioxide only

- 49 The diagrams show the reactions of three different metals with dilute hydrochloric acid.



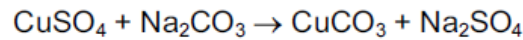
What are metals **W**, **X** and **Y**?

	W	X	Y
A	copper	magnesium	zinc
B	copper	zinc	magnesium
C	magnesium	zinc	copper
D	zinc	magnesium	copper

- 50 Which of the following is a reaction of dilute sodium hydroxide?
- A It reacts with ammonium chloride to produce ammonia.  
 B It reacts with calcium carbonate to produce carbon dioxide.  
 C It reacts with copper(II) oxide to produce water.  
 D It reacts with Universal Indicator solution turning it red.



- 51 The equation for one method of making copper carbonate is shown below.



The reaction is an example of

- A neutralisation.
  - B oxidation and reduction.
  - C precipitation.
  - D synthesis.
- 52 An excess of calcium hydroxide is added to an acidic soil.

What happens to the pH of the soil?

	change in pH	final pH
A	increase	7
B	increase	10
C	decrease	7
D	decrease	5

- 53 Which substance does **not** produce copper(II) sulphate when added to dilute sulphuric acid?
- A copper
  - B copper(II) carbonate
  - C copper(II) hydroxide
  - D copper(II) oxide
- 54 Which ionic equation represents the neutralisation of aqueous sodium hydroxide with dilute nitric acid?
- A  $\text{H}^+ + \text{OH}^- \rightarrow \text{H}_2\text{O}$
  - B  $\text{Na}^+ + \text{NO}_3^- \rightarrow \text{NaNO}_3$
  - C  $\text{Na}^+ + \text{HNO}_3 \rightarrow \text{NaNO}_3 + \text{H}^+$
  - D  $\text{NaOH} + \text{H}^+ \rightarrow \text{Na}^+ + \text{H}_2\text{O}$
- 55 Which substance reacts with water to form a soluble compound and an insoluble gas?
- A ammonium sulphate
  - B caesium
  - C calcium carbonate
  - D copper



56 The table gives information about three indicators.

indicator	colour at pH 1	pH at which colour changes	colour at pH 12
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phenolphthalein	colourless	10	red

Which colours would be obtained when each indicator was added separately to pure water?

	thymol blue	congo red	phenolphthalein
<b>A</b>	red	blue	red
<b>B</b>	yellow	blue	colourless
<b>C</b>	yellow	blue	red
<b>D</b>	yellow	red	colourless

57

