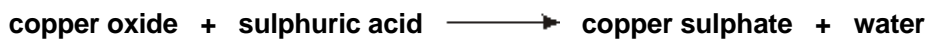


**Q1.** Here is a word equation for a chemical reaction.



Write down everything that the word equation tells you about the reaction.

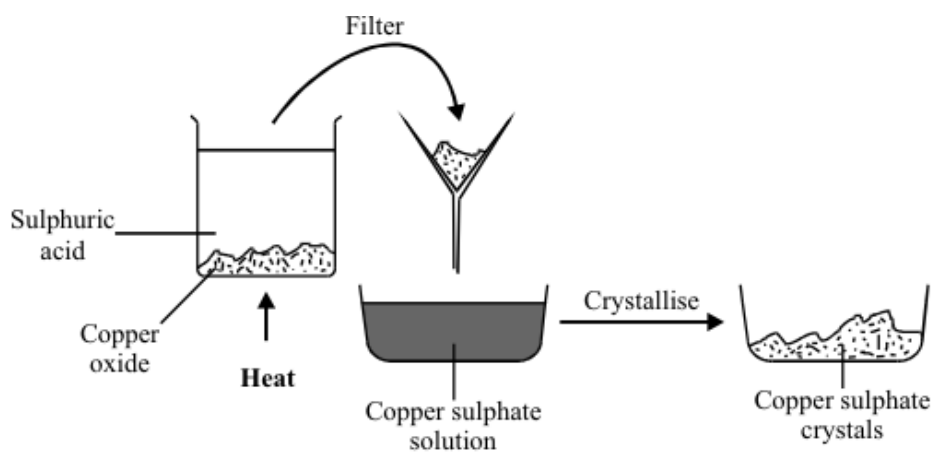
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.....

.....

**(Total 4 marks)**

**Q2.** (a) The diagram shows one way of making crystals of copper sulphate.



(i) Why was the solution filtered?

.....

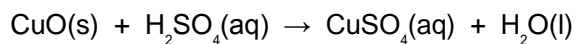
**(1)**

(ii) How could you make the crystals form faster from the copper sulphate solution?

.....

**(1)**

(iii) The chemical equation is shown for this reaction.



In the chemical equation what does (aq) mean?

.....

**(1)**

- (b) Blue copper sulphate crystals go white when warmed. How could you use the white copper sulphate as a test for water?



.....

.....

.....

(2)  
(Total 5 marks)

**Q3.** Salts can be prepared by the reaction of acids with alkalis.

- (a) (i) The reactions of acids with alkalis can be represented by the equation below. Choose a substance from the box to complete the equation.

carbon dioxide	hydrogen	oxygen	water
----------------	----------	--------	-------

acid + alkali → salt + .....

(1)

- (ii) Draw a ring around the word which best describes the reaction.

**displacement      neutralisation      oxidation      reduction**

(1)

- (b) Sodium sulphate is an important salt.

The table gives a list of some substances.

Put a tick (✓) next to the names of the acid **and** the alkali that would react to make sodium sulphate.

Substances	(✓)
Hydrochloric acid	
Nitric acid	
Potassium sulphate	
Sodium hydroxide	
Sodium nitrate	
Sulphuric acid	

(2)  
(Total 4 marks)

- Q4.** Ammonium nitrate and potassium chloride are both salts. They can be made by neutralisation reactions.

Choose substances from the box to complete the word equations for the formation of these two salts.

ammonia	hydrochloric acid	nitric acid
potassium nitrate	water	potassium hydroxide

ammonia + ..... → ammonium nitrate + water

..... + hydrochloric acid → potassium chloride + .....

(Total 3 marks)

**Q5.** Nitric acid can be neutralised by alkalis to make salts.

- (i) The salt called potassium nitrate can be made from nitric acid.

Complete the word equation for this neutralisation reaction.  
Choose the correct substances from the box.

hydrogen	oxygen	potassium chloride
potassium hydroxide	water	

nitric acid + ..... → potassium nitrate + .....

(2)

- (ii) Ammonium nitrate is another salt made from nitric acid.

Which **one** of the following is the main use of ammonium nitrate? Draw a ring around your answer.

dye

fertiliser

plastic

fuel

(1)

- (iii) Complete this sentence by choosing the correct ion from the box.

$\text{H}^+$	$\text{NH}_4^+$	$\text{NO}_3^-$	$\text{O}^{2-}$	$\text{OH}^-$
--------------	-----------------	-----------------	-----------------	---------------

The ion that makes solutions acidic is .....

(1)

(Total 4 marks)

**Q6.** This label was taken from a cola drink.



The pH of this drink is 2.5.

- (a) (i) Which **one** of the ingredients in the cola drink causes the low pH?

.....

(1)

- (ii) Draw a ring around the name of the ion that gives the cola drink its low pH.

**chloride      hydrogen      hydroxide      sodium**

(1)

- (b) The preservative used in the cola drink is sodium benzoate.  
Sodium benzoate is made using two chemical reactions.

**Reaction 1**

Methylbenzene is reacted with oxygen, with the help of a catalyst, to form benzoic acid.

**Reaction 2**

Benzoic acid is neutralised by sodium hydroxide solution to form sodium benzoate and water.

- (i) How does the catalyst help **reaction 1**?

.....  
.....

(1)

- (ii) **Reaction 1** has a high atom economy.

The table lists several statements. Put a tick (✓) next to the **one** statement which best describes a high atom economy.

Statement	(✓)
All the atoms used are cheap.	
Most of the starting materials end up as useful products.	
Only a small number of atoms are used in the reaction.	

(1)

- (iii) **Reaction 2** is a neutralisation reaction.

Complete the equation by writing the formula of the product.



(1)

**(Total 5 marks)**

**Q7.** Distress flares are used to attract attention in an emergency.



Flares often contain magnesium. Magnesium burns to form magnesium oxide.

- (a) The distress flare burns with a bright flame because the reaction is very *exothermic*.

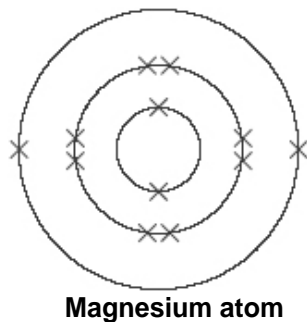
Complete the following sentence using the correct words from the box.

<b>gives out heat</b>	<b>stores heat</b>	<b>takes in heat</b>
-----------------------	--------------------	----------------------

An *exothermic* reaction is one which .....

(1)

- (b) The diagram shows the electronic structure of a magnesium atom.  
The atomic (proton) number of magnesium is 12.



The atomic (proton) number of oxygen is 8.

Which diagram, **A**, **B**, **C** or **D**, shows the electronic structure of an oxygen atom?

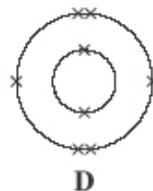
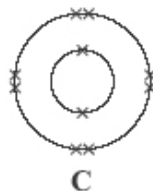
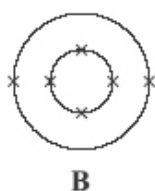
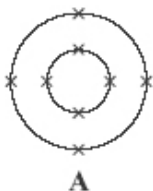
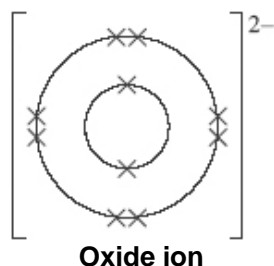


Diagram .....

(1)

- (c) Magnesium ions and oxide ions are formed when magnesium reacts with oxygen. The diagram shows the electronic structure of an oxide ion.



Which diagram, **J**, **K**, **L** or **M**, shows the electronic structure of a magnesium ion?

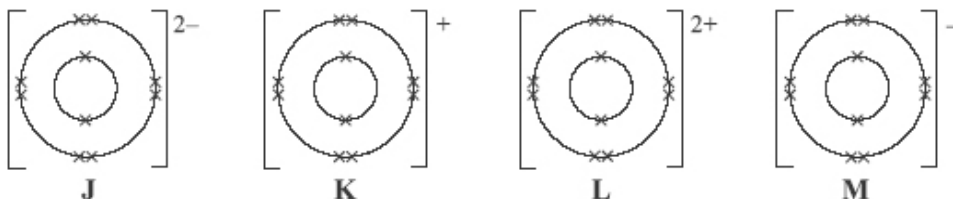


Diagram .....

(1)

- (d) Indigestion tablets can be made from magnesium oxide. The magnesium oxide neutralises some of the hydrochloric acid in the stomach.

Draw a ring around the name of the salt formed when magnesium oxide reacts with hydrochloric acid.

**magnesium chloride**

**magnesium hydroxide**

**magnesium sulfate**

(1)

(Total 4 marks)

- Q8.** (a) Citric acid produces hydrogen ions in aqueous solution.

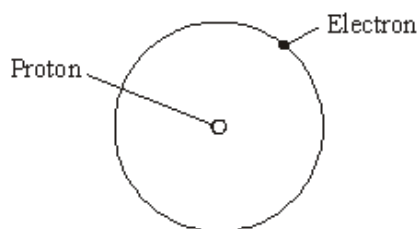
These ions can be represented as  $H^+(aq)$ .

Complete this sentence.

The (aq) means that the acid has been dissolved in .....

(1)

- (b) The diagram represents a hydrogen atom, H.



Use the diagram to explain why a hydrogen ion,  $H^+$ , is a proton.

.....  
 .....

(1)

- (c) Citric acid is a *weak* acid.

Draw a ring around the correct answer to complete the sentence.

	has a low boiling point.
The word <i>weak</i> means that the acid	is dilute.
	is partially ionised in water.

(1)

- (d) A student measured the pH of four acids, **A**, **B**, **C** and **D**.

The acids were the same concentration. The same quantity of magnesium ribbon was added to each of the acids. The volume of gas produced after 5 minutes was recorded.

The results are shown in the table.

Acid	pH	Volume of gas in $cm^3$
<b>A</b>	2	18
<b>B</b>	5	6
<b>C</b>	1	24
<b>D</b>	4	12

- (i) State **one** way in which the student made sure that the experiment was fair.

.....

(1)

- (ii) Use the results to arrange the acids, **A**, **B**, **C** and **D** in order of **decreasing** acid strength.

Most acidic ..... Least acidic.

(1)

- (e) When acids react with alkalis, the hydrogen ions from the acid react with the hydroxide ions from the alkali.

- (i) Which **one** of the following represents the formula of a hydroxide ion?

Draw a ring around your answer.

$H^-$

$O^-$

$OH^-$

(1)



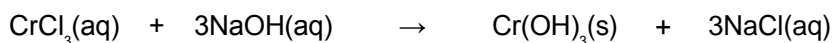
- (ii) Draw a ring around the correct answer to complete the sentence.

	acidic.
A solution with more hydrogen ions than hydroxide ions is	alkaline.
	neutral.

(1)  
(Total 7 marks)

- Q9.** Waste water from some industrial processes contains harmful metal ions, such as chromium ions. These ions must be removed from the water before the water is returned to a river.

The equation shows a method of removing chromium ions from water.



- (a) This type of reaction is called a precipitation reaction.

Describe what happens in a precipitation reaction

.....  
.....

(1)

- (b) Complete the name of the substance with the formula NaOH.

**Sodium** .....

(1)

- (c) Draw a ring around the method that could be used to separate the  $\text{Cr}(\text{OH})_3(\text{s})$  from the water.

**electrolysis**

**filtration**

**neutralisation**

**oxidation**

(1)

- (d) It is important to remove chromium ions from water before it is returned to a river.

Suggest why.

.....  
.....

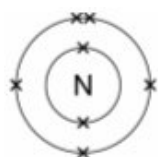
(1)  
(Total 4 marks)

**Q10.** (a) Ammonia has the formula  $\text{NH}_3$ . It is made from nitrogen and hydrogen.

How many atoms are in an ammonia molecule? .....

(1)

(b) The diagrams show the electron arrangement in nitrogen and hydrogen.

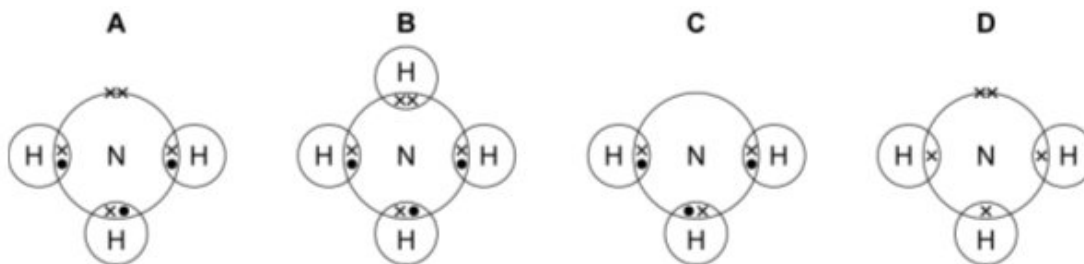


Nitrogen



Hydrogen

Which diagram below, **A**, **B**, **C** or **D**, represents an ammonia molecule?



Write your answer in the box.

Diagram

(1)

(c) Ammonia dissolves in water to form a solution with a pH of 10.

What does this pH value tell you about ammonia solution?

.....

(1)

(d) In industry a large amount of ammonia is neutralised by an acid to make ammonium nitrate.

(i) What type of substance is ammonium nitrate?

Tick (✓) **one** box.

acid

☐

alkali

☐

base

☐

salt

☐

(1)

(ii) Which acid is added to ammonia to make ammonium nitrate?

Tick (✓) **one** box.

hydrochloric

☐

citric

☐

nitric

☐

sulfuric

☐

(1)

(iii) Draw a ring around the main use of ammonium nitrate.

**fertiliser**

**lubricating oil**

**medicine**

**plastic**

(1)

- (e) Instant cold packs are used to treat sports injuries.



One type of cold pack has a plastic bag containing water. Inside the bag is a smaller bag containing ammonium nitrate.

The outer bag is squeezed so that the inner bag bursts. The ammonium nitrate dissolves in the water. This process is endothermic.

Explain why the bag becomes cold.

.....

.....

.....

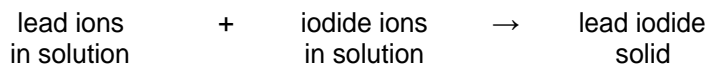
.....

(2)  
(Total 8 marks)

**Q11.** This question is about lead iodide and magnesium iodide.

- (a) Lead iodide can be made by mixing a solution containing lead ions with a solution containing iodide ions.

Lead iodide is formed as a solid.



- (i) Draw a ring around the name given to this type of reaction.

**electrolysis**

**neutralisation**

**precipitation**

(1)

- (ii) Tick (✓) the method used to separate solid lead iodide from the solution.

Method	Tick (✓)
distillation	
evaporation	
filtration	

(1)

- (iii) The table below gives information about the solubility of some compounds.

Soluble compounds	Insoluble compounds
all sodium and potassium salts	
all nitrates	
most chlorides, bromides and iodides	silver and lead chlorides, bromides and iodides

Use the table to help you to:

draw a ring around a soluble compound which contains lead ions

**lead bromide**

**lead chloride**

**lead nitrate**

draw a ring around a soluble compound which contains iodide ions.

**lead iodide**

**silver iodide**

**sodium iodide**

(2)

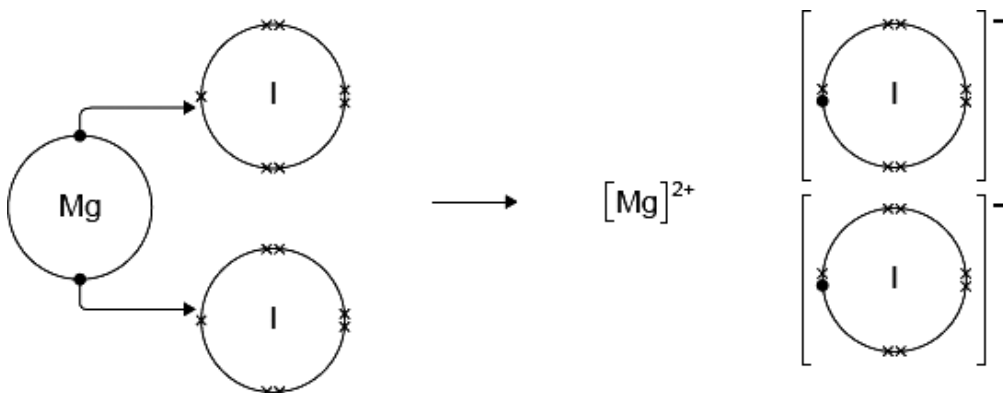
- (b) Magnesium iodide can be made by reacting magnesium with iodine.



The diagram shows how this takes place.

Only the outer electrons are shown.

The dots (•) and crosses (×) are used to represent electrons.



**Use the diagram** to help you to answer this question.

Describe, as fully as you can, what happens when magnesium reacts with iodine to make magnesium iodide.

To gain full marks you should use the words atom, electron and ion in your answer.

.....

.....

.....

.....

.....

.....

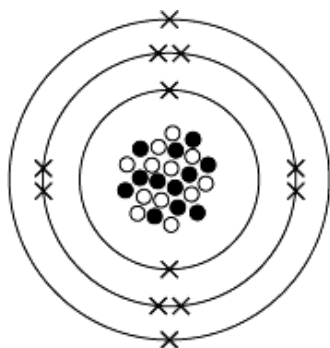
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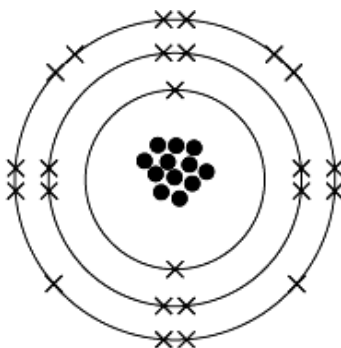
(4)  
(Total 8 marks)

**Q12.** (a) A magnesium atom contains 12 protons (●), 12 neutrons (○) and 12 electrons (x).

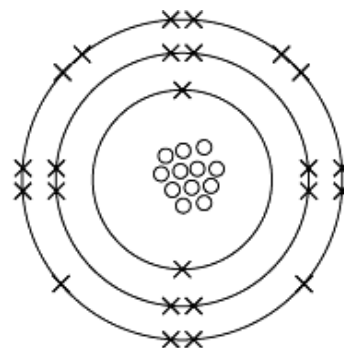
Which diagram, **A**, **B** or **C**, represents this magnesium atom?



**Diagram A**



**Diagram B**

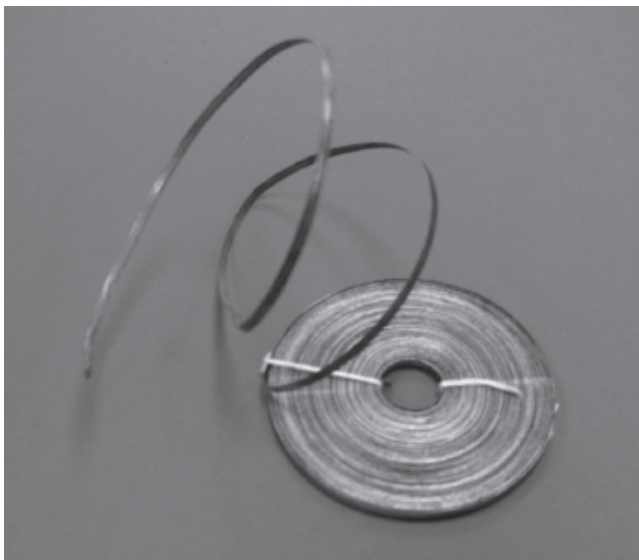


**Diagram C**

This magnesium atom is **Diagram**

(1)

(b) Magnesium metal is shaped to make magnesium ribbon.



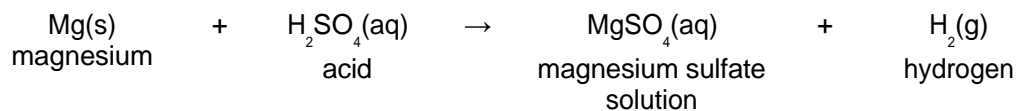
Tick (✓) **two** reasons which explain why metals can be shaped.

Reason why	Tick (✓)
The atoms are all joined by covalent bonds.	
The atoms can slide over each other.	
The atoms are large.	
The atoms are in layers.	

(2)

- (c) Magnesium sulfate is a salt of magnesium.

It can be prepared by the reaction of magnesium metal with an acid. The equation for the reaction of magnesium with this acid is:



- (i) Draw a ring around the name of the acid used in this reaction.

**hydrochloric**

**nitric**

**sulfuric**

(1)

- (ii) Use the equation to help you to answer this question.

Tick (✓) **two** things that happen when this reaction takes place.

	Tick (✓)
Bubbles are produced.	
The magnesium disappears.	
A solid is formed.	
Water is formed.	

(2)

- (iii) Draw a ring around a method to get solid magnesium sulfate from magnesium sulfate solution.

**crystallisation**

**electrolysis**

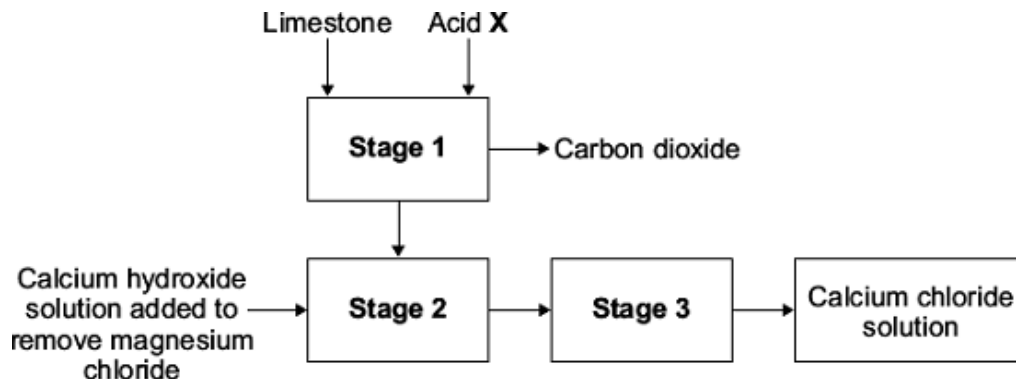
**oxidation**

(1)

(Total 7 marks)



- Q13.** (a) Calcium chloride is made from limestone. Limestone contains mainly calcium carbonate and a small amount of magnesium carbonate.



- (i) In **stage 1** calcium carbonate reacts with acid **X** to form calcium chloride.

Draw a ring around the name of acid **X**.

**hydrochloric**

**nitric**

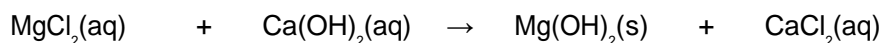
**sulfuric**

(1)

- (ii) **Stage 1** produces a concentrated solution of calcium chloride. The solution also contains magnesium chloride.

Calcium hydroxide solution is added in **stage 2** to remove the magnesium chloride.

The equation for this reaction is:



Draw a ring around the correct answer to complete each sentence.

In **stage 2** a precipitate is made because magnesium hydroxide is

dissolved

insoluble

in water.

soluble

In **stage 3** the solid magnesium hydroxide can be separated from the calcium chloride

chromatography.

solution using

electrolysis.

filtration.

(2)

- (iii) What method can be used to change the calcium chloride solution into solid calcium chloride?

Draw a ring around your answer.

**crystallisation**

**electrolysis**

**reduction**

(1)

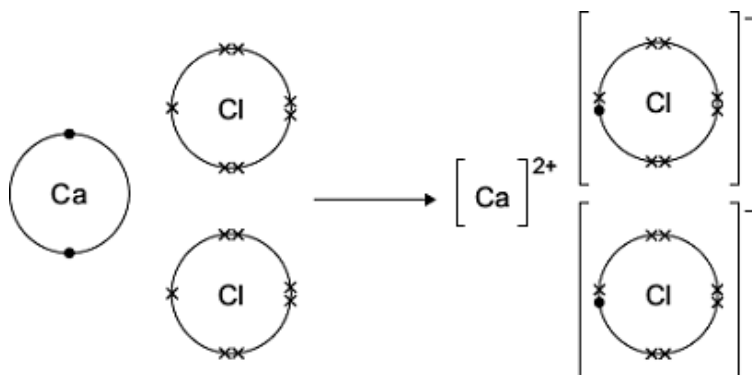
- (b) Calcium chloride can also be made by reacting calcium with chlorine:



The diagram shows what happens to atoms of calcium and chlorine in this reaction.

The dots (•) and crosses (x) are used to represent electrons.

Only the outer electrons are shown.



Use the diagram to help you to answer this question.

Describe, as fully as you can, what happens when calcium reacts with chlorine to make calcium chloride.

.....

.....

.....

.....

.....

.....

.....

(4)

(Total 8 marks)

**Q14.** The table shows some information about acids and alkalis.

Name of acid or alkali	Type	Ions produced in solution		pH	Effect on Universal Indicator
Hydrochloric acid	Strong acid	$\text{H}^+$	$\text{Cl}^-$	1	Goes red
Sodium hydroxide	Strong alkali	$\text{Na}^+$	$\text{OH}^-$	13	Goes purple

Use the information in the table to help you answer parts (a) and (b).

(a) Draw a ring around the correct answer to complete the sentences.

(i) Hydrochloric acid is acidic.

This is because it contains

$\text{Cl}^-$
$\text{H}^+$
$\text{OH}^-$

ions.

(1)

(ii) Sodium hydroxide solution is alkaline.

This is because it contains

$\text{H}^+$
$\text{Na}^+$
$\text{OH}^-$

ions.

(1)

(b) Hydrochloric acid is a stronger acid than ethanoic acid.

When Universal Indicator is added to solutions of these acids at the same concentration the results are different.

Describe how the results would show that ethanoic acid is a weaker acid than hydrochloric acid.

.....

.....

.....

.....

(2)

- (c) Draw a ring around the correct answer to complete this sentence.

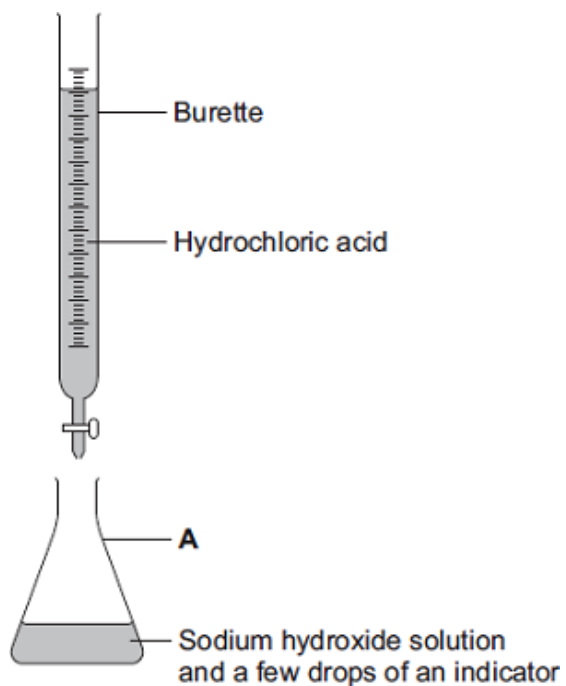
Strong acids and strong alkalis are

completely  
not  
partially

ionised in water.

(1)

- (d) The diagram shows the apparatus used to find the volume of hydrochloric acid that reacts with 25.0 cm<sup>3</sup> of sodium hydroxide solution.



- (i) Which **one** of the following is the correct name for A?

Draw a ring around your answer.

**beaker**

**conical flask**

**pipette**

(1)

- (ii) Use the correct word from the box to complete the sentence.

**distillation**

**filtration**

**titration**

(1)

The method used to find the volume of acid that reacts with a known volume of alkali is called.....

(1)

- (iii) Suggest **one** way to make the results more reliable.

.....  
.....

(1)  
(Total 8 marks)

- Q15.** Read the information below and then answer the questions that follow.

It was once thought that organic compounds could only be made in living organisms.  
The living organisms were assumed to have a special life force.  
This life force allowed them to make organic compounds.

Urea is an organic compound produced in animals. It is found in urine. In 1828, Friedrich Wöhler made urea from chemicals which were not obtained from living things.

Other famous scientists still believed in the idea of a life force. Wöhler made another organic compound in 1845. Most scientists then stopped believing that a life force was needed to make organic compounds.

- (a) How did Wöhler prove that a life force is **not** needed to make organic compounds?

.....  
.....

(1)

- (b) In 1828 most scientists continued to believe that a life force was needed to produce an organic compound.

Suggest why.

.....  
.....

(1)

- (c) In 1845 most scientists stopped believing that a life force was needed to make an organic compound.

Suggest why.

.....  
.....

(1)

- (d) Some scientists repeated Wöhler's experiment.  
These scientists used lead nitrate as one of their starting materials.

Lead nitrate solution can be made by reacting lead with an acid.

- (i) Give the name of this acid .....

(1)

(ii) State how solid lead nitrate can be obtained from lead nitrate solution.

.....  
.....

(1)  
(Total 5 marks)

**Q16.** Ammonium salts, such as ammonium sulfate, are used to help farmers grow crops.



© Artur Synenko/iStock

(a) Use the correct word from the box to complete the sentence.

<b>fertilisers</b>	<b>insecticides</b>	<b>pesticides</b>
--------------------	---------------------	-------------------

Ammonium salts contain nitrogen and are used by farmers as .....to replace the nitrogen lost from the soil.

(1)

(b) Ammonia is made by reacting nitrogen with hydrogen.

Which raw material provides nitrogen?

Draw a ring around your answer.

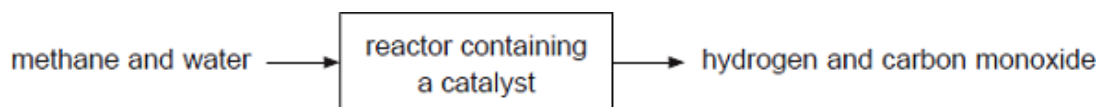
**air**

**crude oil**

**water**

(1)

(c) Methane and water react together to form hydrogen.

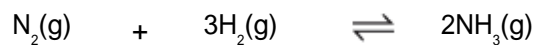


How does the catalyst help this reaction?

.....

(1)

- (d) The reaction between nitrogen and hydrogen to make ammonia can be represented by this equation.



What is the meaning of this symbol  $\rightleftharpoons$  ?

Draw a ring around your answer.

**endothermic reaction      precipitation reaction      reversible reaction**

(1)

- (e) A solution of ammonia in water is alkaline.

- (i) Which **one** of these values could be the pH of a solution of ammonia?

Draw a ring around your answer.

**4**

**7**

**10**

(1)

- (ii) Ammonium sulfate can be made by reacting ammonia solution with sulfuric acid.

Use the correct answer from the box to complete the sentence.

<b>ammonium sulfate</b>	<b>hydrogen</b>	<b>sulfuric</b>	<b>water</b>
-------------------------	-----------------	-----------------	--------------

During the reaction the hydrogen ions ( $\text{H}^+$ ) from the acid react with hydroxide ions

( $\text{OH}^-$ ) from the alkali to make .....

(1)

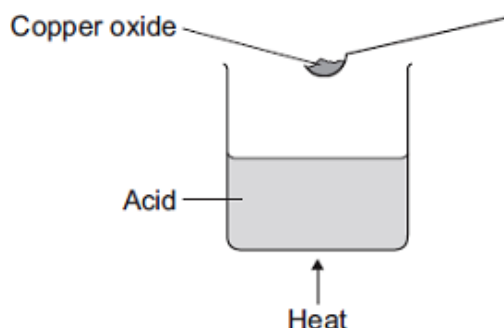
**(Total 6 marks)**

**Q17.** A student added copper oxide to an acid to make copper sulfate.

The student heated the acid.

The student added copper oxide until no more reacted.

(a) The diagram shows the first stage in the experiment.



(i) Complete the word equation.

Copper oxide + ..... acid → copper sulfate + water

(1)

(ii) Which **one** of these values could be the pH of the acid?

Draw a ring around the correct answer.

1

7

11

(1)

(iii) Why is the acid heated?

.....  
.....

(1)

(b) After the reaction is complete, some solid copper oxide remains.  
Why?

.....  
.....

(1)

(c) The student removed the solid copper oxide from the solution.

Suggest what the student should do to the solution to form copper sulfate crystals.

.....  
.....

(1)



- (d) The mass of copper sulfate crystals was less than the student expected.

Tick (✓) the **one** statement that explains why the mass of copper sulfate crystals was less than expected.

Statement	Tick (✓)
Some copper sulfate may have been lost during the experiment.	
The student added too much copper oxide.	
The copper sulfate crystals were wet when they were weighed.	

(1)  
(Total 6 marks)

**Q18.** Kelp is a seaweed.

Kelp can be burned to give out energy.



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- (a) Draw a ring around the correct answer to complete each sentence.

Reactions which give out energy are

endothermic.
exothermic.
reversible.

(1)

- (b) Which **two** of the following questions **cannot** be answered by scientific experiments alone?

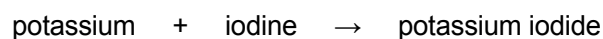
Tick ( ✓ ) **two** boxes.

Question	Tick ( ✓ )
How much carbon dioxide is produced when 100 g of kelp is burned?	
Does kelp give out more heat energy than coal when burned?	
Should people use kelp instead of oil as an energy source?	
Will kelp be more popular than coal in the next 10 years?	

(2)

(c) Potassium iodide can be produced from kelp.

(i) Potassium can be reacted with iodine to produce potassium iodide.



The diagram shows how this happens.

Only the outer electrons are shown.

The dots (●) and crosses (×) are used to represent electrons



Use the diagram to help you answer this question.

Describe, as fully as you can, what happens when potassium reacts with iodine to produce potassium iodide.

To get full marks you should use the words atom, electron and ion in your answer.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(4)

(ii) Potassium iodide reacts with lead nitrate.



Why is this reaction a precipitation?

.....

.....

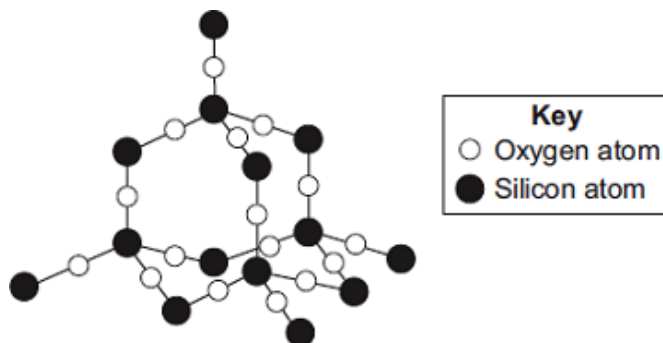
(1)

(iii) How can the precipitate be removed from the reaction mixture?

.....  
.....

(1)  
(Total 9 marks)

**Q19.** The diagram shows a small part of the structure of silicon dioxide.



(a) Use the diagram above to answer the question.

Draw a ring around the correct answer to complete each sentence.

In silicon dioxide, each silicon atom is bonded with

two  
three  
four

oxygen atoms.

The bonds in silicon dioxide are

ionic.  
covalent.  
metallic.

(2)

(b)



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Silicon dioxide is used as the inside layer of furnaces.

Suggest why.

.....  
.....

(1)

(c) Nanowires can be made from silicon dioxide.

Draw a ring around the correct answer to complete the sentence.

The word 'nano' means the wires are very

brittle.  
thick.  
thin.

(1)

(Total 4 marks)

**Q20.** This question is about salts of ammonia and salts of lead.

(a) Ammonia dissolves in water to make an alkaline solution.

Draw a ring around the correct answer to complete each sentence.

The pH of a solution of ammonia is

2.  
7.  
11.

(1)

(b) Ammonia can be reacted with an acid to produce the salt ammonium nitrate.

(i) Name the acid used to produce ammonium nitrate.

.....

(1)

- (ii) Draw a ring around the correct answer to complete each sentence.

The reaction of ammonia with an acid is a

neutralisation
polymerisation
reduction

reaction.

(1)

- (c) Why do farmers use ammonium nitrate on their fields?

.....  
.....

(1)

- (d) Lead iodide is a salt that can be produced without using an acid.

- (i) Lead iodide is produced by mixing two solutions.

Complete the word equation.

lead ..... + potassium .....  $\longrightarrow$  lead iodide + potassium nitrate

(2)

- (ii) The lead iodide is produced as a solid.

Complete the sentence.

A solid that is produced when two solutions are mixed is called a.....

(1)

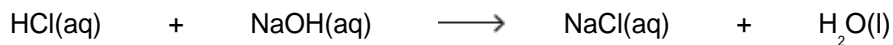
- (iii) How could the solid lead iodide be separated from the solution?

.....

(1)

- (iv) A student mixed two solutions to make sodium chloride.

The equation for the reaction the student used is:



How could the student obtain solid sodium chloride from the solution?

.....

(1)

(Total 9 marks)

