Q1. Rock salt is a mixture of sand and salt.

Salt dissolves in water. Sand does **not** dissolve in water.

Some students separated rock salt.

This is the method used.

1. Place the rock salt in a beaker.
2. Add 100 cm^3 of cold water.
3. Allow the sand to settle to the bottom of the beaker.
4. Carefully pour the salty water into an evaporating dish.
5. Heat the contents of the evaporating dish with a Bunsen burner until salt crystals start to form.

(a) Suggest **one** improvement to step 2 to make sure all the salt is dissolved in the water.

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(1)

(b) The salty water in step 4 still contained very small grains of sand.

Suggest **one** improvement to step 4 to remove all the sand.

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(1)

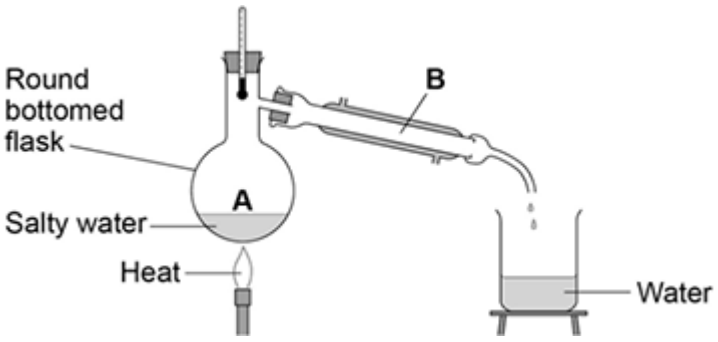
(c) Suggest **one** safety precaution the students should take in step 5.

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(1)

(d) Another student removed water from salty water using the apparatus in the figure below.



Describe how this technique works by referring to the processes at **A** and **B**.

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(2)

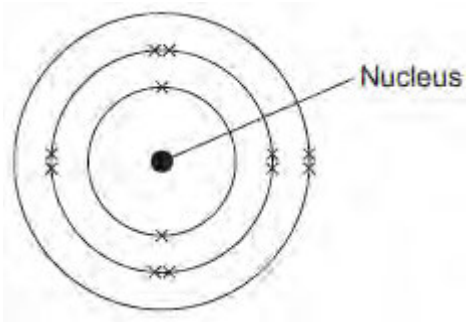
(e) What is the reading on the thermometer during this process?

..... ˚C

(1)
(Total 6 marks)

Q2. This question is about magnesium.

(a) (i) The electronic structure of a magnesium atom is shown below.



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

electrons	**neutrons**	**protons**	**shells**

The nucleus contains protons and .....

The particles with the smallest relative mass that move around the nucleus are called .....

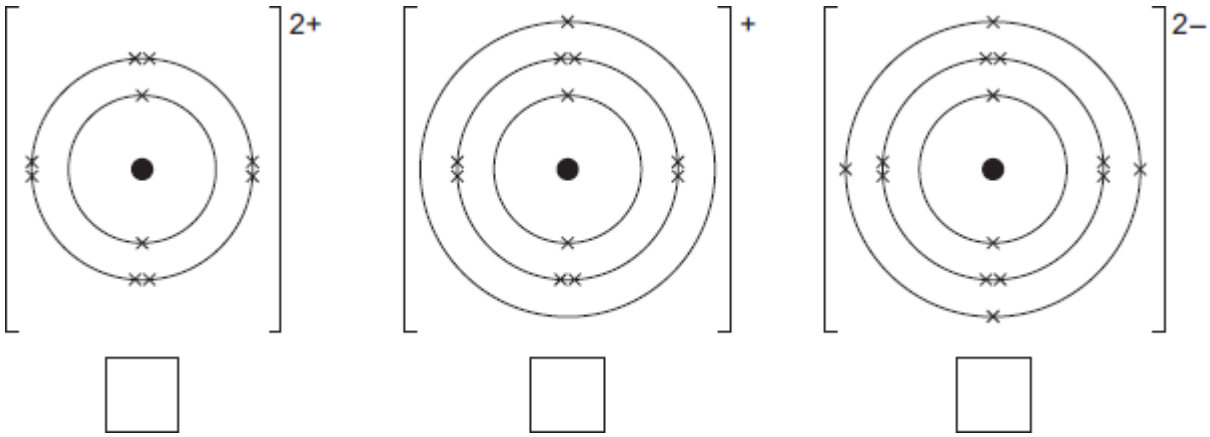
Atoms of magnesium are neutral because they contain the same number of electrons and .....

(3)

(ii) A magnesium atom reacts to produce a magnesium ion.

Which diagram shows a magnesium ion?

Tick (✓) **one** box.



(1)

(b) Magnesium and dilute hydrochloric acid react to produce magnesium chloride solution and hydrogen.

$$Mg(s) + 2\,HCl(aq) \longrightarrow MgCl_2(aq) + H_2(g)$$

(i) State **two** observations that could be made during the reaction.

1 .....

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2 .....

.....

(2)

(ii) **In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.**

Describe a method for making pure crystals of magnesium chloride from magnesium and dilute hydrochloric acid.

In your method you should name the apparatus you will use.

You do **not** need to mention safety.

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(6)
(Total 12 marks)

Q3. Lead nitrate solution reacts with potassium iodide solution.

The reaction produces a solid.

Figure 1 shows the reaction occurring.

Figure 1



Lead Iodide By Der Kreole (own work) (CC-BY-3.0) via Wikimedia Commons

(a) (i) Give the name of this type of reaction.

Tick (✓) **one** box.

Combustion ☐

Neutralisation ☐

Precipitation ☐

(1)

(ii) Write the missing state symbols in the chemical equation.

$Pb(NO_3)_2$(aq) + 2KI(.....) ⟶ PbI_2(.....) + $2KNO_3$(aq)

(2)

(iii) Complete the word equation for the reaction.

lead nitrate + ... ⟶ lead iodide + ...

(2)

(iv) How is solid lead iodide separated from the solution?

Draw a ring around the correct answer.

Distillation **Electrolysis** **Filtration**

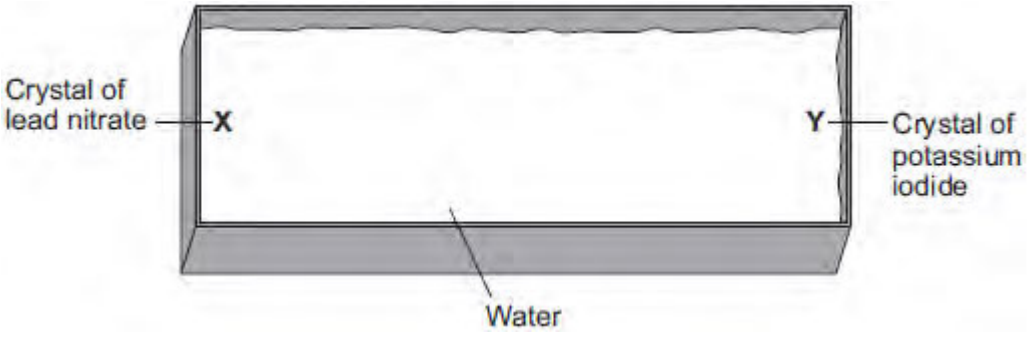
(1)

(b) A group of students investigated the movement of particles.

The students filled a container with water.

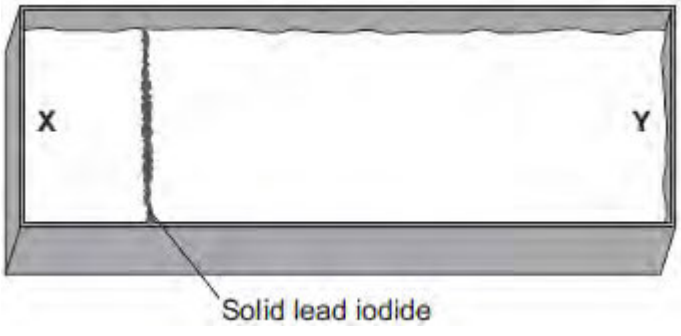
The students added a crystal of lead nitrate at position **X** and a crystal of potassium iodide at position **Y**, as shown in **Figure 2**.

Figure 2 – view from above



After 3 minutes solid lead iodide started to form at the position shown in **Figure 3**.

Figure 3 – view from above



(i) Tick (✓) the correct box to complete the sentence.

Lead ions and iodide ions move through the water by

diffusion. ☐

evaporation. ☐

neutralisation. ☐

(1)

(ii) What conclusion can you make about the speed of movement of lead ions compared with iodide ions?

Give a reason for your answer.

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(2)

(iii) The students repeated the experiment at a higher temperature.

The solid lead iodide formed after a shorter period of time.

Explain why, in terms of particles.

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(2)
(Total 11 marks)

Q4. The label shows the ingredients in a drink called Cola.

Cola
Ingredients: Carbonated water Sugar Colouring Phosphoric acid Flavouring Caffeine

(a) (i) The pH of carbonated water is 4.5.

The pH of Cola is 2.9.

Name the ingredient on the label that lowers the pH of Cola to 2.9.

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(1)

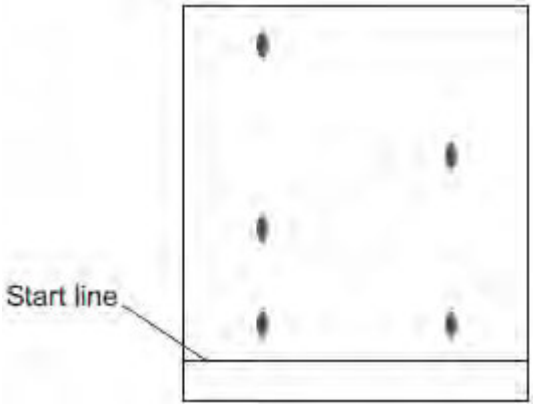
(ii) Which ion causes the pH to be 2.9?

.....

(1)

(b) A student investigated the food colouring in Cola and in a fruit drink using paper chromatography.

The chromatogram in the figure below shows the student's results.



Cola Fruit drink

(i) Complete the sentence.

The start line should be drawn with a ruler and ..... .

Give a reason for your answer.

.....

.....

(2)

(ii) Suggest **three** conclusions you can make from the student's results.

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(3)

(c) Caffeine can be separated from the other compounds in the drink by gas chromatography.

Why do different compounds separate in a gas chromatography column?

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(1)

(d) Caffeine is a stimulant.

Large amounts of caffeine can be harmful.

(i) Only **one** of the questions in the table **can** be answered by science alone.

Tick (✓) **one** question.

Question	Tick (✓)
Should caffeine be an ingredient in drinks?	
Is there caffeine in a certain brand of drink?	
How much caffeine should people drink?	

(1)

(ii) Give **two** reasons why the other questions **cannot** be answered by science alone.

Reason 1 .....

.....

Reason 2 .....

.....

(2)
(Total 11 marks)

Q5. 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?

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(1)

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

Suggest why.

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(1)

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

Suggest why.

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(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.

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(1)
(Total 5 marks)

Q6. (a) *In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.*

The salt called potassium chloride is made when potassium hydroxide solution reacts with hydrochloric acid.

potassium hydroxide solution + hydrochloric acid → potassium chloride solution + water

Describe a method for making **crystals** of potassium chloride from potassium hydroxide solution and hydrochloric acid.

In this method you should:

- describe how you will add the correct amount of the hydrochloric acid to neutralise the potassium hydroxide solution
- describe how you will get crystals of potassium chloride.

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(6)

(b) Ammonium nitrate is another salt.
Ammonium nitrate is made when ammonia solution is neutralised with an acid.

Name the acid to complete the word equation.

ammonia + ... acid → ammonium nitrate

(1)

(c) Read the information.

Ammonium nitrate – good or bad?

Some farmers put a lot of ammonium nitrate on their farmland.

Many people are worried about this use of ammonium nitrate.

Rain water can wash the ammonium nitrate off the farmland and into rivers and lakes. The ammonium nitrate may get into drinking water supplies and could be harmful to health.

(i) Why do some farmers put ammonium nitrate on their farmland?

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(1)

(ii) Which **one** of the questions in the table cannot be answered by science alone?

Tick (✓) **one** question.

Question	Tick (✓)
How much ammonium nitrate is in drinking water?	
Should farmers stop using ammonium nitrate on their farmland?	
Is ammonium nitrate soluble in rain water?	

Give **two** reasons why this question **cannot** be answered by science alone.

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(3)
(Total 11 marks)