

Water

Question Paper

Level	GCSE
Subject	Chemistry
Exam Board	AQA
Unit	C3
Topic	Water
Difficulty Level	Bronze Level
Booklet	Question Paper

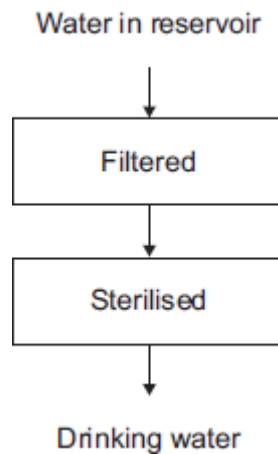
Time Allowed: 71 minutes

Score: /71

Percentage: /100

Q1. This question is about drinking water.

(a) The flow diagram below shows how water is made suitable for drinking.



(i) What is removed when the water is filtered?

Tick (✓) **one** box.

Gases

Liquids

Solids

(1)

(ii) What is used to sterilise the water?

Tick (✓) **one** box.

Carbon

Chlorine

Sodium chloride

(1)

(iii) Why is the water sterilised?

.....
.....

(1)

(b) Water can be purified by distillation.

Drinking water is **not** usually purified by distillation because distillation is expensive.

Complete the sentence.

Distillation is expensive because it requires a lot of

.....

(1)

(c) Why do some water companies add fluoride to drinking water?

.....
.....

(1)

(Total 5 marks)

Q2. Some pollutants cause acid rain.

A student tested 25.0 cm³ samples of three types of rainwater, **P**, **Q** and **R**. The student titrated the samples with sodium hydroxide solution (an alkali).

The student recorded the volume of sodium hydroxide solution needed to neutralise the rainwater. The student's results are shown in **Table 1**.

Table 1

Volume of sodium hydroxide needed to neutralise the rainwater in cm ³					
Type of	Titration	Titration	Titration	Titration	Mean

rainwater	1	2	3	4	value
P	18.0	15.5	14.5	15.0	15.0
Q	13.0	10.0	11.0	10.5	10.5
R	23.0	19.5	18.5	19.0	19.0

(a) (i) The student calculated the mean value for rainwater R as 19.0 cm³.

Show how the student calculated the mean value for rainwater R.

.....

.....

.....

.....

(2)

(ii) Write down P, Q and R in order of their acidity.

Most acidic

.....

Least acidic

(2)

(b) A second student repeated the experiment and recorded the results in **Table 2**.

Table 2

		Volume of sodium hydroxide needed to neutralise the rainwater in cm ³	
Type of rainwater	Titration 1	Titration 2	
P	17	15	
Q	11	9	
R	20	18	

Use **Table 1** and **Table 2** to suggest **two** improvements the second student could make to obtain more accurate results.

.....

.....

.....

.....

(2)

- (c) The results of the two students show that the experiment is reproducible.
Give the reason why.

.....

.....

(1)

(Total 7 marks)

Q3. Hard water causes scale to form in kettles, as shown in the figure below.



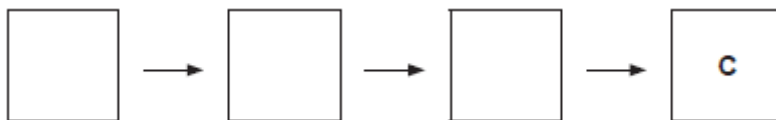
© Steve Gorton/Thinkstock

- (a) The sentences describe how water becomes hard and causes scale.
The sentences are in the wrong order.
- A** Water is heated.
 - B** Water flows over rocks.
 - C** Scale forms.

D Ions causing hardness dissolve in the water.

Complete the boxes to show the correct order of the sentences.

The last box has been done for you.



(2)

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

Hardness in water is caused by dissolved

calcium ions.
chloride ions.
sodium ions.

(1)

(c) Vinegar is used to remove scale in kettles.

Vinegar contains the acid with the formula CH_3COOH

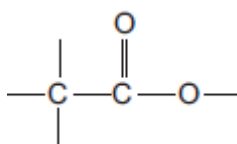
(i) Draw a ring around the correct answer to complete the sentence.

Vinegar contains

ethanoic acid.
nitric acid.
sulfuric acid.

(1)

(ii) Complete the displayed structure of the acid CH_3COOH



(1)

(iii) Scale in kettles contains calcium carbonate.

When vinegar reacts with scale, a gas is produced.

Name the gas.

.....

(1)

(d) Why does removing the scale from a kettle save money?

.....

.....

(1)

(e) Hard water reacts with soap.

Complete the sentence.

When hard water reacts with soap, it forms

(1)

(Total 8 marks)

Q4. Two problems of hard water are scale and scum, as shown in the pictures of a heating element and a wash basin.

Photographs are not reproduced here due to third-party copyright constraints.

(a) Name **one** ion that causes water to be hard.

.....

(1)

(b) Hard water can be softened using an ion-exchange column.

Complete this sentence by choosing the correct word from the box.

aluminium **copper** **sodium**

When hard water passes through the column, the ions that cause hardness are exchanged for ions and soft water is produced.

(1)

- (c) Soap solution can be used to show that the water going into the column is hard **and** the water coming out is soft.

Describe how. Give the results you would expect.

.....
.....
.....
.....
.....
.....

(3)

(Total 5 marks)

Q5. Some people use water filters because they are concerned about the quality of drinking water.

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

(i) One of the active chemicals in many water filters is

carbon.
magnesium.
sulfur.

(1)

(ii) In many areas of the United Kingdom the water is hard.

The hardness in water is caused by

bromide
calcium
hydrogen

ions.

(1)

(b) Describe and give the result of a test to show that some drinking water is hard.

Test

.....

Result of test

.....

(2)

(c) State and explain **one** benefit of drinking hard water.

.....

.....

.....

.....

(2)

(Total 6 marks)

Q6. Water is a natural resource.

(a) Water in some parts of the UK is hard, but in other parts of the UK it is soft.

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

(i) Water becomes hard because ions in rocks condense
dissolve
evaporate into the water

(1)

(ii) Hardness in water is caused by calcium
hydrogen
sodium ions

(1)

(b) There are two types of hard water, permanent hard water and temporary hard water.

Draw a straight line from each statement to the correct type of water.

Statement	Type of water
Easily makes a lather with soap	Permanent hard water
Can be made soft by boiling	Temporary hard water
	Soft water

(2)

(c) Water of the correct quality is essential for life.

In many parts of the world the water used for drinking contains solid particles and harmful bacteria.

Suggest **two** methods that could be used to improve the quality of this water.

1

2

(2)
(Total 6 marks)

Q7. (a) In some parts of the world the water is hard, but in other parts the water is soft.

Draw a ring around the correct answer to complete these sentences.

(i)

	condense	
When water comes into contact with rocks, ions	dissolve	into the water.
	evaporate	

(1)

(ii)

	calcium	
Hardness in water is caused by	hydrogen	ions.
	sodium	

(1)

(iii)

	sodium carbonate.
Hard water can be made soft by adding	sodium chloride.
	sodium sulfate.

(1)

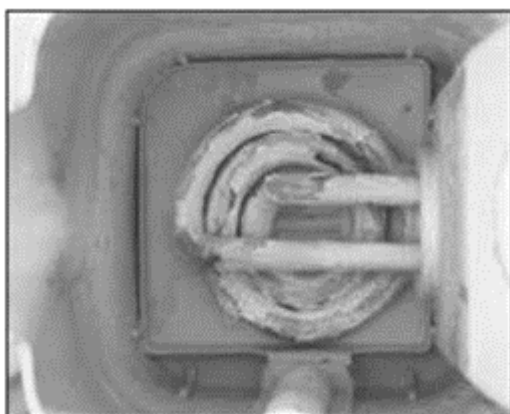
(iv) The ions that cause hardness are removed by adding a substance

	neutralises	
which	oxidises	them.
	precipitates	

(1)

(b) Hard water reduces the efficiency of kettles.

The picture shows a heating element from a kettle.



Explain how hard water reduces the efficiency of kettles.

.....

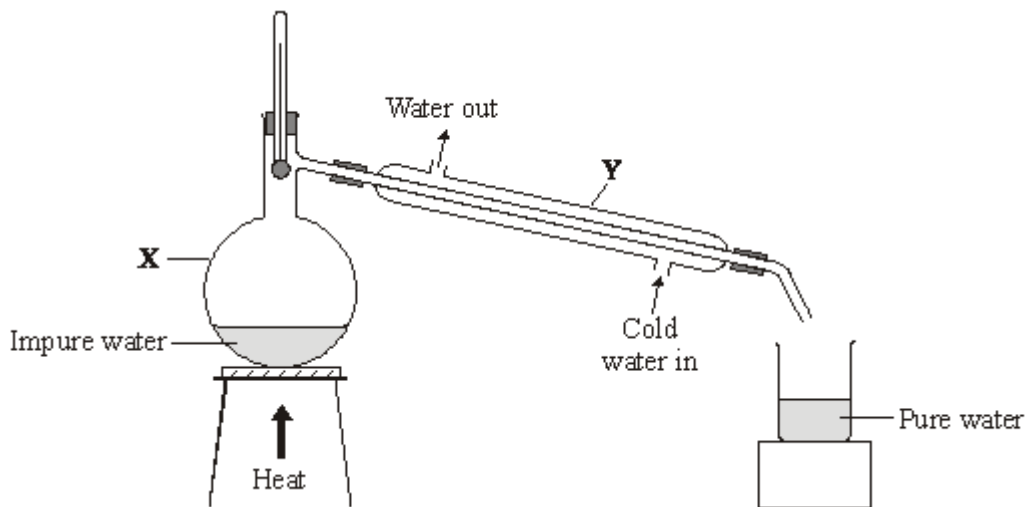
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(2)

(c) The diagram shows how pure water can be made from impure water by distillation.



Choose the correct words from the box to name apparatus **X** and **Y**.

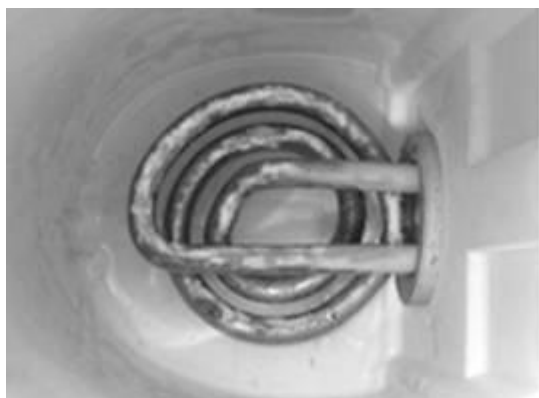
beaker	condenser	flask	thermometer
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(i) Apparatus **X** is a (1)

(ii) Apparatus **Y** is a (1)

(Total 8 marks)

Q8. Two problems of hard water are scale and scum, as shown in the pictures of a heating element and a wash basin.



(a) Name **one** ion that causes water to be hard.

.....

(1)

(b) Hard water can be softened using an ion-exchange column.

Complete this sentence by choosing the correct word from the box.

aluminium	copper	sodium
-----------	--------	--------

When hard water passes through the column, the ions that cause hardness are exchanged for ions, and soft water is produced.

(1)

(c) Describe how soap solution can be used to show that the water going into the column is hard **and** the water coming out is soft.

.....
.....
.....
.....
.....
.....

(3)

(Total 5 marks)

Q9. Good quality water is needed for a healthy life.

In the United Kingdom, obtaining safe water for drinking is as simple as turning on a tap. The water is made safe to drink by water companies.

However, in many parts of Africa and Asia, water used for drinking is contaminated and untreated. It is estimated that 2.2 million people die each year as a result of drinking contaminated water.



DADA DANESHANANDA, Man with filtered water from the Mafi-Zongo water project. www.amurt.net/africa/ghana/2005

(a) Sea water is **not** used as drinking water.

Suggest why.

.....
.....

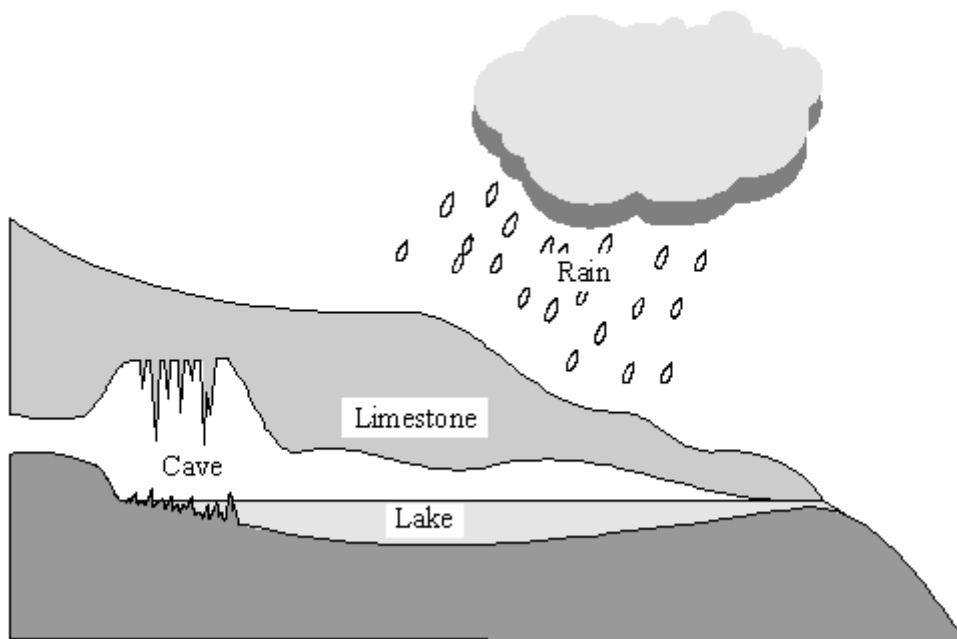
(1)

(b) Explain why water for drinking is filtered and then treated with chlorine.

.....
.....
.....
.....

(2)
(Total 3 marks)

Q10. Rainwater falling on limestone rocks can form caves.



(a) Complete the sentences by choosing the correct words from the box.

acidic	alkaline	dissolves
hard	reacts	soft
		tastes

You may use each word once or not at all.

Rainwater is an solution which with limestone. The solution formed in the lake is known as water. One advantage of drinking the water from the lake is that it better than rainwater.

(4)

- (b) Samples of water were tested by shaking with soap solution. The results are shown in the table.

Water sample (50 cm ³)	Volume of soap solution to form a lather in cm ³
lake	15
boiled lake	3
rain	1

- (i) What is seen when only 10 cm³ of soap solution is shaken with 50 cm³ of water from the lake?

.....

(1)

- (ii) Why did the rainwater need only 1 cm³ of soap solution to form a lather?

.....

(1)

- (iii) Why did the water from the lake need 15 cm³ of soap solution to form a lather?

.....

(1)

- (iv) Explain why boiled water from the lake needed only 3 cm³ of soap solution to form a lather.

.....

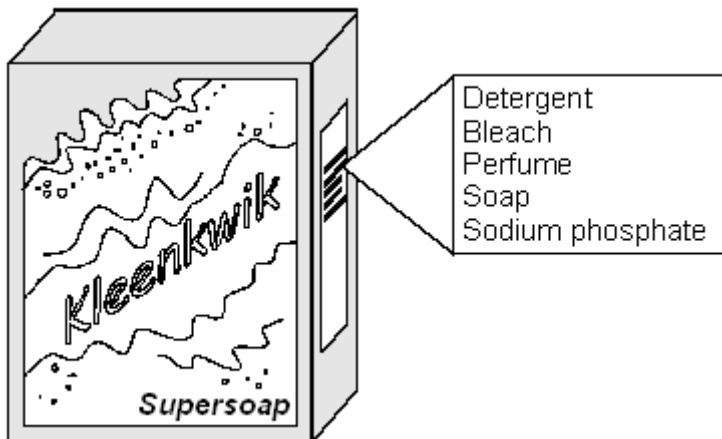
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(2)

(Total 9 marks)

Q11. Washing powders are a mixture of substances. The substances in a box of Kleenkwik washing powder are shown.



(a) Which substance in the washing powder gives clothes a pleasant smell?

.....

(1)

(b) What does a bleach do?

.....

(1)

(c) Sodium phosphate removes the hardness in water.

(i) What is hard water?

.....

.....

(1)

(ii) Why should the hardness be removed?

.....

.....

(1)

(iii) Give another method which removes the hardness in water.

.....

.....

(1)

(d) Circle the chemical which is used to make detergents.

carbonic acid hydrochloric acid sulphuric acid

(1)

(Total 6 marks)

##

A leaflet listed the effects of hard water:

<p style="text-align: center;">HOW HARD WATER COSTS YOU HARD CASH</p> <p>Hard water causes:</p> <ul style="list-style-type: none">• Blocked showers, burnt out immersion heaters• Scale build up inside water pipes• Higher water heating cost• Extra soap required to get a lather

Describe how softening the hard water could save money.

.....

.....

.....

(Total 3 marks)

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