1 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)

2 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

Efforts are being made to solve this problem and more water is being treated.

Describe how water in the United Kingdom is treated.

Explain how this makes it safe to drink.

.....

.....

.....

.....

.....

.....

.....

.....

(Total 3 marks)

3 Read the following information and then answer the questions.

Chlorine – for better, for worse?

Chlorine is used to make bleaches, plastics and medicines. Swimming pool water is often treated with chlorine.

Chlorine is used to make water safe to drink. It is relatively cheap and easy to use. People who drink untreated water risk dying from typhoid and cholera.

However, chlorine is a poisonous chemical. It causes breathing difficulties and can kill people. Some people are also allergic to chlorine.

(a) How does chlorine make water safe to drink?

.....

.....

(1)

(b) The amount of chlorine in swimming pool water should be carefully monitored and controlled.

Explain why.

.....

.....

.....

.....

(2)

(c) Developing countries are likely to choose chlorination as their method of making water safe to drink.

Suggest why.

.....

.....

.....

(1)

(d) A government is setting up an enquiry into the safety of using chlorine.

(i) Suggest why people from all political parties should be represented.

.....

.....

.....

(1)

(ii) Suggest why the opinion of a well-respected scientist might change the outcome of any discussion.

.....

.....

.....

(1)

(iii) The decision taken about the safety of using chlorine should be based on evidence and data rather than on hearsay and opinion.

Suggest why.

.....

.....

.....

(1)

(Total 7 marks)

4 Most water contains dissolved compounds.

The concentrations of these dissolved compounds are higher in sea water than in drinking water.

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

Pure water can be obtained from sea water by

distillation.
filtration.
neutralisation.

(1)

(ii) What is the boiling point of pure water? ..... °C

(1)

(b) A student wanted to find out how much solid was dissolved in sea water.

This is the method the student used:

- measure the mass of an empty evaporating basin
- measure 25 cm^3 of sea water and pour it into the evaporating basin
- heat the evaporating basin gently until all of the water has evaporated
- measure the mass of the evaporating basin containing the solid residue.

(i) What piece of apparatus would be suitable for measuring 25 cm^3 of sea water?

.....

(1)

(ii) How could the student check that all of the water had evaporated?

.....

.....

.....

.....

(2)

(iii) The results the student obtained using 25 cm^3 of sea water are:

mass of empty evaporating basin = 23.21 g
mass of evaporating basin and dry solid residue = 24.04 g

Calculate the mass of solid dissolved in 1000 cm^3 of the sea water.

.....

.....

.....

Mass dissolved in 1000 cm^3 = ... g

(2)

(c) In many countries chlorine is added to drinking water supplies.

Why is chlorine added to drinking water?

.....

.....

(1)

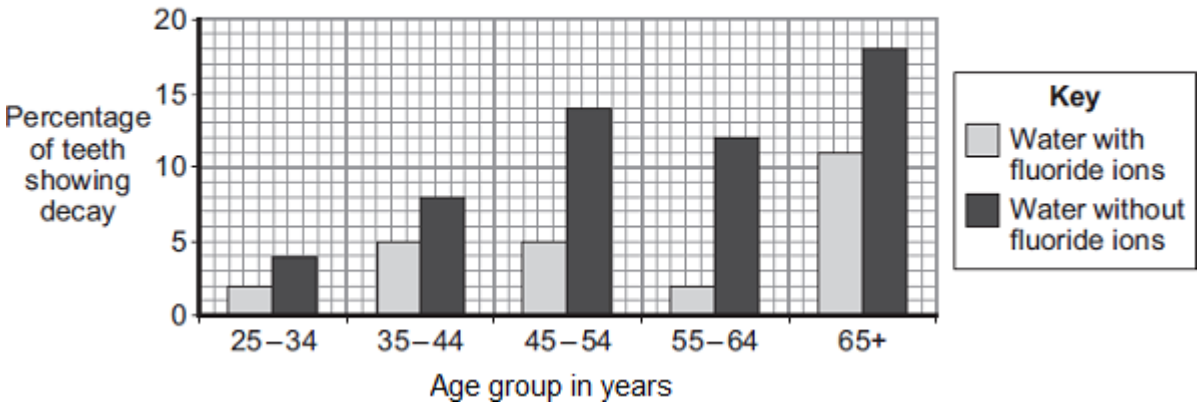
(d) *In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.*

Compounds containing fluoride ions are added to some drinking water supplies.

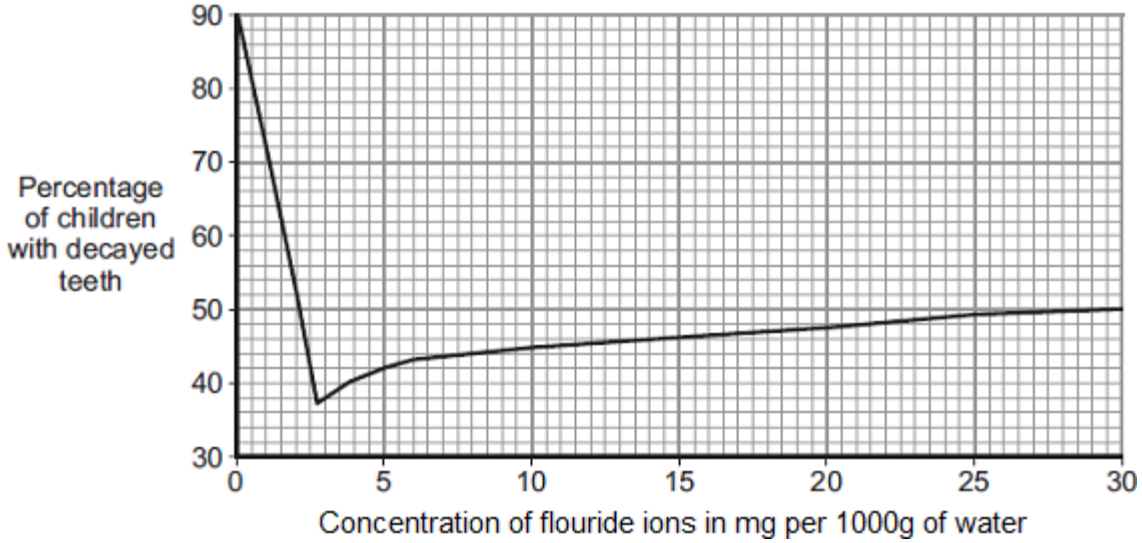
Many scientists have done research into the effects of fluoride ions in drinking water.

Graphs 1, **2** and **3** show some of the results obtained.

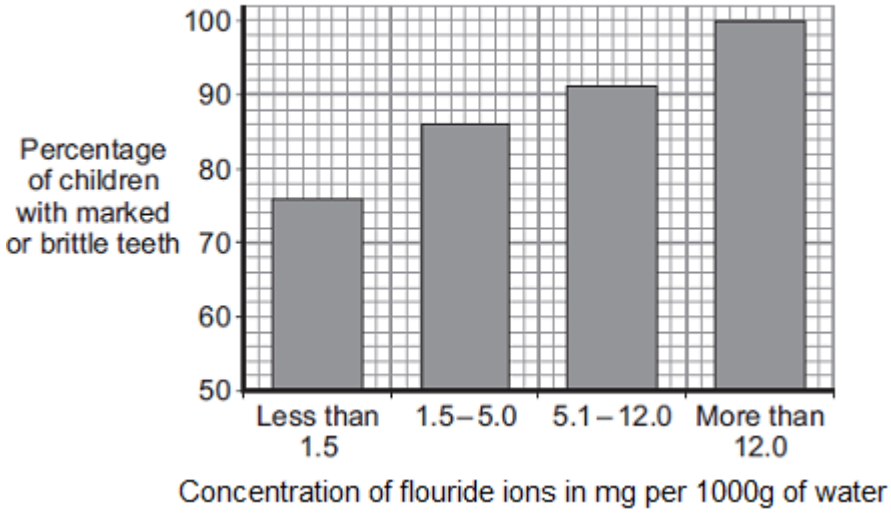
Graph 1



Graph 2



Graph 3



Evaluate the advantages and disadvantages of adding fluoride ions to drinking water.

You should support your answer with evidence from **all three** graphs.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(6)

(Total 14 marks)

5 Water from a lake in the UK is used to produce drinking water.

(a) What are the two main steps used to treat water from lakes?

Give a reason for each step.

Step 1 .....

Reason .....

Step 2 .....

Reason .....

(2)

(b) Explain why it is more difficult to produce drinking water from waste water than from water in lakes.

.....

.....

.....

.....

.....

.....

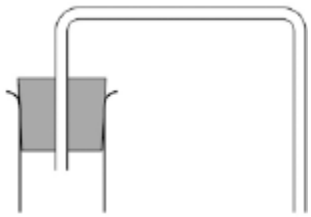
(3)

(c) Some countries make drinking water from sea water.

Complete the figure below to show how you can distil salt solution to produce and collect pure water.

Label the following:

- pure water
- salt solution



(3)

(d) How could the water be tested to show it is pure?

Give the expected result of the test for pure water.

.....

.....

.....

.....

.....

(2)

(e) Why is producing drinking water from sea water expensive?

.....

.....

(1)

(Total 11 marks)

6 Good quality water is essential for life.

(a) In the United Kingdom, water is filtered and treated with chlorine to make it safe to drink.

Explain why the water is:

filtered .....

.....

treated with chlorine. .....

.....

(2)

(b) Millions of people in Bangladesh drink water from wells that contain high levels of arsenic. Arsenic is poisonous.

The World Health Organisation recommends that there should be no more than 0.01 mg of arsenic per litre in drinking water.

The table gives some information about two instrumental methods of testing for arsenic.

Factor to consider	**Laboratory Instrumental Method**	**Portable Instrumental Method**
Cost of equipment	£10 000	£50
Skill level of technician	Highly skilled	where test is done
Little training needed	Laboratory only	Anywhere
Time to prepare the instrument for the test	5 minutes	10 seconds
Sensitivity of the instrument	0.000001 mg of arsenic per litre of water	0.1 mg of arsenic per litre of water

(i) Use the information in the table to give **two** advantages and **one** disadvantage of using the Portable Instrumental Method compared with the Laboratory Instrumental Method.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(3)

(ii) The information about these two instrumental methods was provided by the Professional Institute of Water Engineers (PIWE). The Institute has no connection with the companies that make these instruments.

Suggest why many people would accept the views of PIWE rather than the views of the companies that make the instruments.

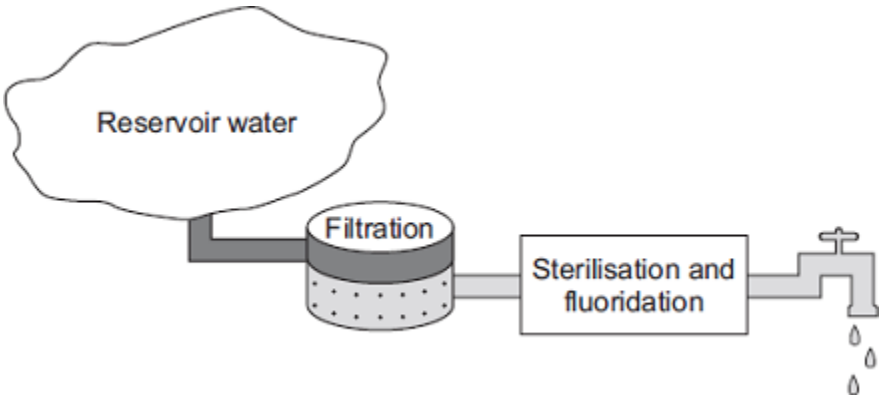
.....

.....

(1)

(Total 6 marks)

7 The diagram shows three stages in the treatment of reservoir water.



(a) (i) What is separated from the reservoir water during filtration?

Tick (✓) **one** box.

Bacteria ☐

Dissolved nitrates ☐

Solids ☐

(1)

(ii) What is added to sterilise the water?

Tick (✓) **one** box.

Calcium ☐

Chlorine ☐

Magnesium ☐

(1)

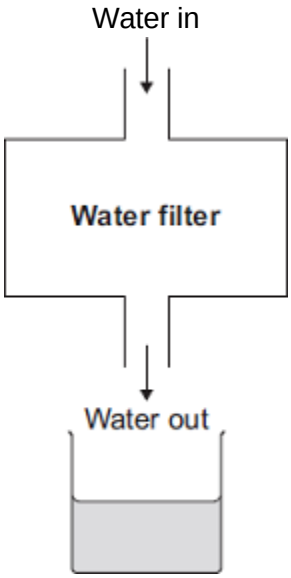
(iii) State **one** advantage of adding fluoride to drinking water.

.....

.....

(1)

(b) The diagram shows a water filter used in the home.



A student collected a sample of water from the filter.

The student could show that the filtered water contains dissolved salts without using a chemical test.

Describe how.

.....

.....

.....

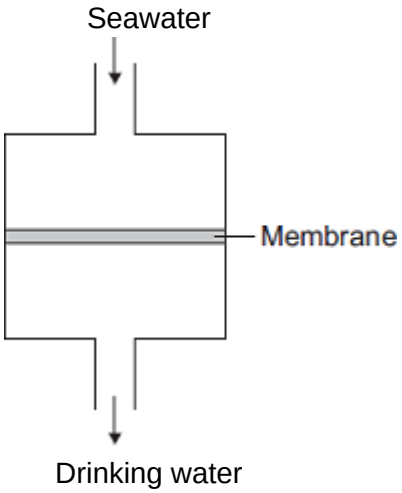
.....

.....

.....

(2)

(c) Seawater is forced through a membrane to make drinking water.



Suggest why water molecules can pass through the membrane, but sodium ions and chloride ions cannot.

.....

.....

(1)

(Total 6 marks)

8 Water in Britain is taken from reservoirs to use as drinking water.

(a) What are the **two** main steps used to treat water from reservoirs?

Give **one** reason for each step.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(4)

(b) Some people use water filters to treat water before drinking it.

(i) Water filters remove hardness from hard water.

What is in water filters that removes hardness from water?

.....

.....

(1)

(ii) Suggest why water filters used in the home contain particles of silver.

.....

.....

(1)

(c) Pure water can be produced by distillation.

Why is distillation **not** usually an economic method of treating water for drinking?

.....

.....

(1)

(d) Drinking hard water has health benefits.

State **one** health benefit of drinking hard water.

.....

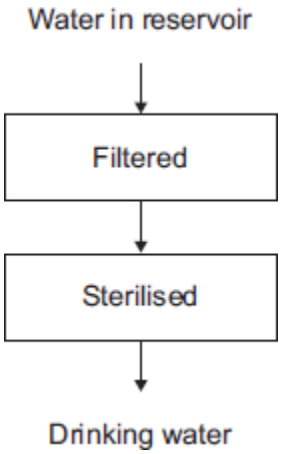
.....

(1)

(Total 8 marks)

9 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?

.....

.....

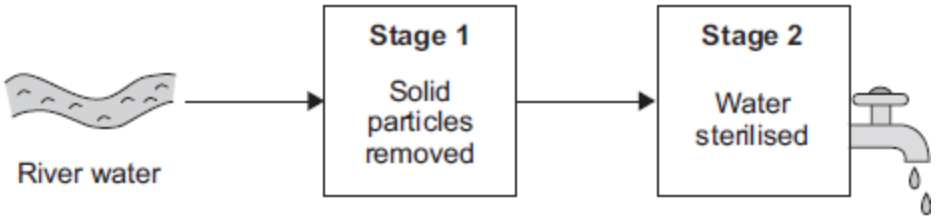
(1)

(Total 5 marks)

10 This question is about water.

River water needs to be treated before it is safe to drink.

(a) The diagram shows two stages of the treatment of river water.



(i) What is the name of the process used to remove solid particles in **Stage 1**?

Tick (✓) **one** box.

Crystallisation ☐

Fermentation ☐

Filtration ☐

(1)

(ii) What is added in **Stage 2** to sterilise the water?

Tick (✓) **one** box.

Chlorine ☐

Fluoride ☐

Potassium ☐

(1)

(b) Toxic substances in river water are removed by adding very small amounts of iron oxide nanoparticles.

(i) How is the size of nanoparticles different from normal-sized particles?

.....

.....

(1)

(ii) Nanoparticles are needed in only very small amounts.

Suggest why.

.....

.....

(1)

(c) In certain areas of the UK, tap water contains aluminium ions.

What would you **see** when sodium hydroxide solution is added drop by drop to tap water containing aluminium ions?

.....

.....

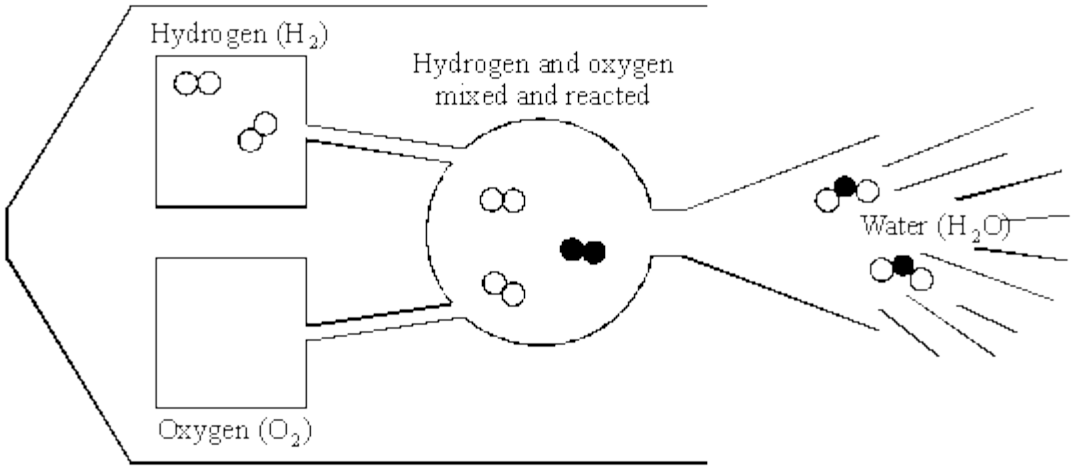
.....

.....

(2)

(Total 6 marks)

11 The diagram shows the reaction of hydrogen molecules with oxygen molecules to form water molecules.



(i) In the empty box draw **one** oxygen molecule.

(1)

(ii) Why are hydrogen and oxygen called elements?

.....

.....

(1)

(iii) Why is water called a compound?

.....

.....

(2)

(Total 4 marks)

1

(a) contains (large amounts of) dissolved solids / difficult to remove dissolved solids

allow salty / too much salt

allow sea water makes you thirsty / vomit

allow polluted / untreated / contaminated

1

(b) filtered: removes solids / removes insoluble material / dirt

ignore large objects

1

chlorine: kills/destroy bacteria/microbes/ germs etc

*allow disinfect / sterilise **or** gets rid of bacteria*

ignore purify / clean

1

[3]

2

two methods and **1 linked** explanation **or 1** method and **two** explanations, **1** linked = **3** marks

no linking of method and explanation then max **2** marks

ignore references to removal of hardness

method 1:

filter

ignore screening / sedimentation

explanation 1:

remove insoluble substances / remove solids / small bits / dirt / mud/ soil / sand / silt

method 2:

precipitate / flocculate / add eg. alum

allow other named substances

explanation 2:

removes (some) soluble material as solids / removes (some) metal ions

method 3:

add chlorine / chlorine dioxide / ozone

explanation 3:

sterilise / kill bacteria / microorganisms / microbes

ignore 'remove bacteria'

ignore disinfect

[3]

3

(a) sterilise / disinfect (water)

ignore removes bacteria / impurities / disease

or

kill bacteria / micro-organisms / microbes / germs / pathogens

ignore cleans the water / makes (water) safe

*allow destroy bacteria **or** gets rid of bacteria*

1

(b) any **two** from:

ignore reference to safe / unsafe

- chlorine is toxic / poisonous
- so (too much) will be dangerous / harmful / kill people / cause illness / health problems

  allow causes damage
- cause breathing difficulties **or** cause (more) allergic reactions / skin **or** eye irritation
- too little will not kill bacteria

  allow bacteria still there

2

(c) cheap / easy / quick to use (process)

accept prevents typhoid / cholera

ignore reference to specialists or equipment

1

(d) (i) fair / more ideas / views / opinions **or** less chance of bias **or** more democratic

allow idea of different points of view / balanced view

allow avoids undue influence owtte

1

(ii) (more likely) to have support / influence / convince people

ignore well respected

allow ideas about trust eg people will have more confidence in their views / more likely to be believed

allow ideas about expertise eg more likely to know what they are talking about / have done experiments / tests

allow have knowledge / understanding

allow (more) reliable

1

(iii) (more likely) to be correct / less likely to be incorrect

owtte

or

reliable / factual / accurate / based on proof / based on experiments or tests / based on validation

ignore based on evidence unqualified

allow hearsay / opinion can be biased

1

[7]

4

(a) (i) distillation

1

(ii) 100 / one hundred

1

(b) (i) measuring cylinder **or** pipette **or** burette

allow phonetic spelling

*do **not** accept teat pipette*

ignore any additional words or volumes

1

(ii) (re)heat the evaporating basin

*accept heat to constant mass for **2** marks*

1

weigh (again) **or** mass will not change

*if no other mark awarded allow **1** mark for a chemical test for water*

1

(iii) 33.2 (g)

*correct answer with or without working scores **2** marks*

*allow mass of residue = (24.04 g − 23.21 g) = 0.83 for **1** mark*

*allow ecf (mass of residue × 40) for **1** mark*

2

(c) to kill microbes / bacteria **or** to sterilise / disinfect water

allow to prevent disease

ignore 'to make it safe to drink'

1

(d) Marks awarded for this answer will be determined by the Quality of Communication (QoC) as well as the standard of the scientific response. Examiners should also refer to the information on page 4, and apply a 'best−fit' approach to the marking.

0 marks
No relevant content

Level 1 (1 − 2 marks)
A simple relevant comment has been made on the data from at least one of the graphs.

Level 2 (3 − 4 marks)
At least two of the graphs have been considered with a relevant comment made.

Level 3 (5 − 6 marks)
All the graphs have been considered and relevant comments made about each.
A justified conclusion may be given.

examples of chemistry points made in the response:

extra information

- (graph 1 shows) fluoride ions reduce the amount of tooth decay
- (graph 1 shows) the effect in reducing tooth decay is greatest for 55−64 year olds

  accept any in range 55 − 64
- (graph 2 shows) the fluoride ions reduce percentage with decayed teeth
- (graph 2 shows) effect is greatest at 2.5 to 3 mg per 1000 g of water then decay increases if more than 2.5 to 3 mg of fluoride ions per 1000 g water

  accept any in range 2.5 − 3
- (graph 2 shows percentage) decay decreases from 0 to 2.5 / 3 mg per 1000 g
- (graph 3 shows) more marked / brittle teeth as fluoride level increases
- above points linked together to draw a justified conclusion

6

[14]

5

(a) filtration
or
by passing through filter beds to remove solids

1

sterilisation to kill microbes

allow chlorine / ozone allow ultraviolet light

1

(b) water needs more / different processes

1

because it contains any **two** from:

- more organic matter
- more microbes
- toxic chemicals or detergents

2

(c) *(as part of glassware attached to bung)*
salt solution in (conical) flask

allow suitable alternative equipment, eg boiling tube

1

(at end of delivery tube)
pure water in test tube which must not be sealed

allow suitable alternative equipment, eg, beaker, condenser

1

heat source (to heat container holding salt solution)

1

*if no other mark obtained allow for **1** mark suitable equipment drawn as part of glassware attached to bung **and** at end of delivery tube*

(d) determine boiling point

1

should be at a fixed temperature 100°C

allow should be 100°C

allow if impure will boil at a temperature over 100°C

1

(e) high energy requirement

1

[11]

6

(a) filtered: removes insoluble / solid

Ignore named substances / minerals

*do **not** accept ions*

1

chlorine: kills microorganisms / microbes / bacteria / disinfects (water)

*allow kills germs / pathogens **or** sterilises*

allow chlorine is a disinfectant

ignore cleans water or removes impurities / bacteria

1

(b) (i) advantages of portable:

accept converse throughout

any **two** from :

- costs less
- little training needed
- water can be tested within 10 seconds / immediately / quicker
- can be used anywhere

2

disadvantage of portable

less precise / sensitive

allow only detect down to 0.1 mg

ignore less accurate

1

(ii) (PIWE) is unbiased

it / they = PIWE

allow honest / trusted / respected / reliable

ignore professional / scientific / skilled

or

company may be biased

allow company trying to sell products

1

[6]

7

(a) (i) Solids

1

(ii) Chlorine

1

(iii) improves dental health **or** reduces tooth decay

1

(b) put a sample of the filtered water in an evaporating basin **or** leave to evaporate

accept any description of evaporation (using a Bunsen or leaving on the windowsill)

1

there will be crystals of salt left

1

(c) sodium and / or chloride ions are bigger than water (molecules) **or** ions are charged **or** molecules are not charged

*do **not** accept sodium chloride molecules as ions is given in the question*

1

[6]

8 (a) filter

1

to remove *solids* ***or*** *insoluble particles*

OR

add coagulant (1)

flocculation / settling / remove solids (1)

1

(add) chlorine

accept ozone / UV

1

to reduce the number of microbes

accept to kill microbes / bacteria / germs

accept sterilise

allow disinfect

ignore remove microbes

1

(b) (i) ion exchange resin

allow ion exchange column

allow sodium ions / Na^+

allow hydrogen ions / H^+

1

(ii) prevent growth of microbes

accept sterilise

accept to kill microbes / bacteria / germs

accept to reduce the number of microbes

ignore remove microbes

1

(c) high cost of energy / *heating*

allow uses a lot of energy

1

(d) any **one** from:

- helps to develop / maintain bones

  allow any suitable positive effect on bones
- helps to develop / maintain teeth

  allow any suitable positive effect on teeth
- reduces heart disease

1

[8]

9

(a) (i) Solids

1

(ii) Chlorine

1

(iii) kill microbes / bacteria

allow to make the water safe to drink

ignore disinfect

ignore remove / get rid of microbes

1

(b) energy

allow heat

1

(c) improve dental health

allow reduce tooth decay

allow (local) government requirement

allow help teeth

1

[5]

10

(a) (i) Filtration

1

(ii) Chlorine

1

(b) (i) nanoparticles are small / smaller / much smaller / tiny

allow any in range 1−100 nm or 1 × 10^{-9} m − 1 × 10^{-7} m ***or*** *a few hundred atoms in size*

ignore numbers if stated smaller

1

(ii) they have a high surface area to volume ratio

reference to surface area without volume ratio is insufficient

allow nanoparticles are very reactive ***or*** *nanoparticles are more reactive than normal particles.*

1

(c) (sodium hydroxide) produces a white precipitate

accept solid / suspension or ppt or ppte for precipitate.

ignore cloudy / milky

1

which (then) dissolves / disappears (in excess sodium hydroxide)

M2 cannot be awarded unless a solid of some sort has been made

ignore names or formulae of compounds

1

[6]

11 (i) two circles together **and** shaded
i.e. one molecule

1

(ii) made up of one type of atom

accept made up of atoms which contain the same number of protons

*accept a substance that cannot be split up into simpler substances **by chemical means***

*do **not** accept they are in the Periodic Table*

1

(iii) no marks can be awarded if there is any reference to mixture **or** mix

made up of two **or** more types of atoms

*accept made up of two **or** more elements*

1

(chemically) bonded

*accept joined **or** combined for bonded*

*do **not** accept fused*

1

[4]

Examiner reports

1

The majority of the candidates were able to gain full marks.

Quite a few candidates were unable to gain the filter mark for part (b) as they were talking in terms of filtering large objects. Some even thought that it removes the salt. There were some candidates who gave the correct answers but did not mention which answer referred to which process.

2

A generally well-answered question and the sympathetic mark scheme allowed candidates the opportunity to gain full credit, by discussing filtration and chlorination. Candidates needed to say that chlorine kills bacteria rather than just removes bacteria. Filtration and screening were frequently confused. Flocculation or precipitation in the correct context were seldom seen, although the use of aluminium compounds was sometimes mentioned. Common non-creditworthy responses included screening, incorrect ideas about flocculation or aluminium sulfate aggregating insoluble solid particles like dirt, rather than soluble material, boiling and/or distilling the water, the use of ion-exchange columns in water treatment plant and a number of ways of treating water in the home using jug kettles with silver filters, ion exchange and washing soda for removing hardness. The question was not about sewage treatment.

3

Generally, this question was quite well attempted

(a) The majority of the candidates gained this mark. Some candidates gave vague answers such as cleans the water or makes it safe.

(b) Nearly all of the candidates gained some credit for explaining why the amount of chlorine in swimming pool water should be monitored and controlled, and almost two thirds of them gained full credit. Quite a few candidates lost marks here by giving answers such as too little would not clean the water properly or it would be unsafe.

(c) This was very well attempted and majority of the candidates gained the mark here as they were able to pick out 'cheap and easy to use' from the passage.

(d) (i) A large number of candidates wrote because the party wants to win the election or everyone needs to be aware of the dangers of chlorine.

(ii) This was another very well answered question. Most candidates were able to make valid suggestions as to why a well respected scientist might change the outcome of any discussion.

(iii) Not quite so well answered as (d)(ii) but still over two thirds of the candidates gained credit for suggesting that evidence is reliable, factual or accurate, while hearsay is none of these.

4

(a) (i) The majority of students could state how water is obtained from sea water.

(ii) The vast majority of students could state the boiling point of water.

(b) (i) Most students gained the mark here, but a common error was the use of a 'measuring tube'.

(ii) Very few students seemed to have come across the idea of heating to constant mass, although this technique should also come up in experiments to find empirical formulae. Hence a very small minority gained both marks. Almost half of the students decided to conduct a chemical test for water but some used an incorrect test reagent (such as universal indicator or litmus); some decided that they could simply look at the crystals to see if they were dry.

(iii) Most students gained both marks for this question, but there were a surprising number of arithmetical errors in the subtraction to find the mass of solid and errors in scaling up from 25 cm^3 to 1000 cm^3.

(c) Although over three-quarters of the answers given were correct, it should be noted that adding chlorine to water does not purify it; it must, in fact, make it less pure. Chlorine does not remove things from water; it is added to kill bacteria, such as the ones that cause cholera.

(d) Some excellent answers were seen to this question, with the vast majority of students considering all three graphs and able to make a correct interpretation of each one. Interpretation of Graph 2 produced the most errors, with students incorrectly reading the scale on the *x*-axis or making statements that increasing fluoride increased decay (without any reference to the fact that decay is decreased greatly by the addition of low levels of fluoride). Units were often incorrectly stated. Students need to plan their answers; many gave long interpretations of Graph 1 and then either gave scant regard to Graphs 2 and 3 (as they had run out of space) or went onto additional answer sheets. Some students clearly did not check what they had written, or changed their mind half way through a sentence and so wrote something that was either contradictory or made little sense.

6

(a) Very few candidates gained two marks. Many did not gain the mark for 'filtration' as they did not mention 'insoluble' or 'solid'. Quite a few candidates wrote in terms of removal of ions such as calcium and magnesium. Some candidates did not gain the mark for treatment with chlorine as they wrote 'it gets rid of/removes bacteria' instead of 'kills bacteria'.

(b) (i) A lot of candidates did not gain a mark here for the 'disadvantage'. Many said that the portable method was less accurate while others thought that the instruments help to remove the arsenic, so gave answers such as 'the portable method removes less arsenic'.

(ii) About one third of candidates did not gain this mark because they answered in terms of 'PIWE being experts/more knowledgeable/scientific/professional or skilled' rather than in terms of bias.

8

(a) The question produced a wide range of marks, with one or two the marks most commonly awarded. The most frequent mark was for filtration. A large number of students missed out on the second marking point by confusing filtration with screening and suggesting that it was to remove large, usually specified, objects such as trees and fish. Coagulation was hardly seen. Many students knew that chlorine was added but lost the fourth marking point by making vague statements such as 'to make it safe to drink' or referred to the removal of microbes. A significant number of students wrote in terms of removing hardness, for example by passing the water through an ion exchange column.

(b) (i) This question was very poorly attempted. Not many students indicated ion exchange resins or columns. A more popular answer was that of sodium ions although many answered simply sodium. Silver, carbon and magnesium and calcium (and their compounds) also appeared. Sodium carbonate and sodium hydroxide were also suggested.

(ii) Only a few students knew the correct answer. Many incorrect reasons were given, including softening water, catalysis, removing chlorine and improving taste.

(c) This question also proved difficult. A majority of students added nothing to the information given in the question, answering simply that distillation is expensive with no reason suggested as to why this might be the case.

(d) Students fared much better with this question, about two thirds being awarded the mark. The most common correct answers referred to teeth or bones. Some stated that hard water contains calcium but did not link that to a health benefit as required by the question. A few missed the point of the question, disregarding hardness and merely stating that drinking water prevents dehydration.

9

(a) (i) Nearly all students knew that solids are removed by filtration.

(ii) The vast majority can identify chlorine as a water sterilising agent.

(iii) Only about half the students obtained this mark. Many wrote 'remove bacteria' or 'get rid of the bacteria' which were not acceptable. Other responses which did not gain marks were 'kills diseases', 'to make it drinkable', 'healthy to drink'.

(b) There were a large number of incorrect responses. Students included answers such as 'money', 'time', 'steps', 'chemicals' and 'equipment'.

(c) This was quite poorly attempted. The vast majority of students who did not score negated their correct answers by including statements such as 'good for heart disease' or 'good for bones'. There were other answers including 'cheaper than sterilisation', 'improves taste', 'kills bacteria' and 'softens water'.

10

(a) (i) This was answered correctly by the majority of students.

(ii) This was answered correctly by the majority of students although fluoride was a powerful distractor.

(b) (i) Almost all students were able to state that nanoparticles were much smaller than normal sized particles. A small minority did not read the question correctly and gave an answer concerning some other aspect of nanoparticles, such as safety concerns.

(ii) While many good answers were seen, it was a common misconception that because they were small they had a large surface area − missing the crucial aspect of the ratio to the volume. A few students tried to explain the use of a small amount due to there being only a small amount of toxic substances in the water, or the toxic nature of nanoparticles themselves which were not accepted.

(c) Many students were able to recall the test for aluminium ions and apply their knowledge to work out what would be seen. However, some answers were only partial, stating either that the white precipitate would form but not that it would redissolve in excess, or failing to state the colour of the precipitate. Some answers just said there would be a colour change, which in a question requiring observations is insufficient to gain marks. It was surprisingly common for students to suggest a gas would be formed − possibly some confusion with the reaction of elemental aluminium with sodium hydroxide.

11

Double and Single Award

One oxygen molecule was often drawn as an atom, left unshaded, or more than one molecule was drawn. As in previous examinations, the understanding of ‘element’ and compound’ was weak. Many candidates stated that an element was ‘one atom’ instead of’one type of atom’. Candidates, when describing a compound, used the words ‘mixed’ or ‘mixture’ inappropriately.