

M1.(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]

M2.(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]

- M3.(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]

M4.(a) any **two** from:

- copper / ores are running out / harder to find
- there are no / very small amounts of high-grade copper ores left
- copper metal is in demand
- copper is expensive
- now economical to extract copper from low-grade ores
it = copper
allow new methods of extraction e.g. bioleaching and phytomining
allow high-grade ores are running out for 2 marks

2

- (b) (i) large amounts / 98% of rock to dispose of as waste
accept contains toxic (metal) compounds / bioleacher

orwaste rock takes up a lot of space

1

- (ii) (copper sulfide reacts with oxygen to) produce sulfur dioxide / SO_2
allow (sulfur reacts with oxygen to) produce sulfur dioxide / SO_2

1

that causes acid rain

*allow description of effects of acid rain **or** sulfur dioxide*
*if no other mark awarded allow CO_2 produced which causes global warming **or** CO_2 produced by burning fuel or heating the furnace*
for 1 mark

1

- (iii) any **one** from:

- large amounts of fuels / energy used (for the furnace and electrolysis)
allow large amounts of electricity needed
ignore high temperature / electrolysis unqualified
- (the extraction has) many steps / stages / processes
allow (extraction) is a long process / takes a lot of time

- large amounts of ore / material have to be mined
allow ores contain a low percentage of copper

1

(iv) (copper ions move towards) the negative electrode / *cathode*

1

because copper ions / Cu^{2+} are positively charged **or** are oppositely charged **or**
copper ions need to gain electrons

*allow because metal ions are positive **or** opposites attract*

1

(v) (growing) plants

1

[9]

M5. (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]

- M6.** (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]