AQA GCSE Chemistry | 8462

SPECIFICATION POINT 4.10.1.3

Waste water treatment

Mark schemes and examiner comments

Tier	**Higher**
Question groups	**4**
Available paper years	**2009–2024**

Using this booklet

1. Booklet answer numbers match the question booklet.
2. Use the original question number within marking tables.
3. Examiner comments are included where available.

Name: _____ **Date:** _____

Where a precise marking extract is unavailable, the full source document is included in an appendix. Any missing mark scheme is explicitly identified.

4.10.1.3 Waste water treatment

Answer 01 · Mark scheme June 2009 | CHY2H | Original Q2 | Legacy

Question 2

question	answers	extra information	mark
2(a)	hydrogen / H^+ /$2H^+$ / H_3O^+	allow H / 2H do **not** accept H_2 apply list principle	1
2(b)(i)	143	correct answer with or without working = **2** marks ignore units if answer is not correct 40 + (2 × 35.5) + (2 × 16) gains **1** mark	2
2(b)(ii)	49.7% (49.6 to 50)	correct answer with or without working = **2** marks answer 49 gains **1** mark if answer is not correct: (71 ÷ 143) × 100 gains **1** mark allow error carried forward from part (b)(i) ie. (71 or their (2 × 35.5) ÷ answer to (b)(i)) × 100 gains **2** marks if calculated correctly and **1** mark if not calculated correctly. **Special case** 35.5 ÷ 143 × 100 = 24.8 to 25% **or** 35.5 ÷ answer to (b)(i) x 100 correctly calculated for **1** mark	2
2(b)(iii)	9.9 to 10g	allow ecf from (b)(i) or (b)(ii)	1

Question 2 continues on the next page…

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CHY2H

Question 2 Continued

question	answers	extra information	mark
2(c)(i)	an alkali	apply list principle accept named alkali accept hydroxide accept soluble base ignore base	1
2(c)(ii)	a solid / insoluble substance (owtte)		1
2(c)(iii)	filter / filtration	allow decant / centrifuge accept filtration followed by evaporation **or** filtration and evaporation do **not** accept filtration or evaporation do **not** accept evaporation and filtration	1
Total			**9**

4.10.1.3 Waste water treatment

Answer 01 · Mark scheme

June 2009 | CHY2H | Original Q2 | Legacy

CHY2H

4.10.1.3 Waste water treatment

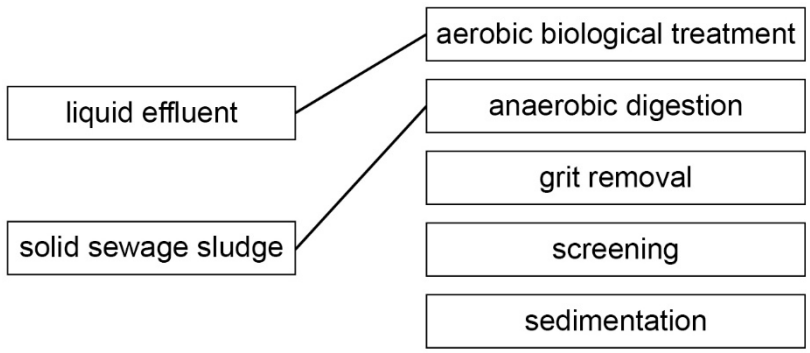
Answer 02 · Mark scheme

November 2020 | 8462/2H | Original Q2

Question 2

Question	Answers	Mark	AO/ Spec. Ref
02.1	**Level 2**: Relevant points (reasons/causes) are identified, given in detail and logically linked to form a clear account.	3–4	AO1 4.10.1.2
	Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.	1–2	
	No relevant content	0	
	Indicative content • choose an appropriate source of fresh water • such as rivers, streams, lakes, boreholes • pass through filter beds • (which) removes undissolved solids • sterilise • using chlorine / ozone / UV light • (which) destroys harmful microbes		

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.2	any **one** from: • distillation • reverse osmosis	allow use of membranes allow desalination	1	AO3 4.10.1.2

02.3	 additional line from a box on the left negates the mark for that box		1 1	AO1 4.10.1.3

Question 2 (continued)

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.4	$\frac{260}{1413}$ x 100 = 18.40056617 (%) = 18.4 (%)	 allow an answer correctly calculated to 3 significant figures from an incorrect percentage calculation which uses values in the question	1 1 1	AO2 4.10.1.3
02.5	any **one** from: • the population increased • more waste water produced • less untreated sewage discharged		1	AO3 4.10.1.3
02.6	any **two** from: • increased demand for food (due to increasing population) • conserves energy / resources • landfill space is running out • increased demand for organic fertiliser	ignore references to cost allow more farming allow more sustainable allow more awareness of the negative environmental impacts of landfill ignore less sent to landfill allow lifestyle choice for organic food	2	AO3 4.10.1.3
Total			**13**	

4.10.1.3 Waste water treatment

Answer 03 · Mark scheme

June 2022 | 8462/2H | Original Q5

Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1		allow a description of each process		AO1 4.10.1.3
	screening **or** grit removal	allow filtering to remove (large) solids	1	
	sedimentation (to produce sewage sludge and effluent)		1	
	anaerobic digestion of (solid sewage) sludge		1	
	aerobic biological treatment of (liquid) effluent	allow aerobic digestion of effluent	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.2	Na^+ : 0.003 mol/dm^3 Cl^- : 0.003 mol/dm^3		1	AO3 4.10.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.3	the ions pass through the filter	allow the ions are not trapped / removed by the filter	1	AO3 4.1.1.2 4.10.1.2
	(because) the ions are in solution	allow (because) the ions are smaller than the filter pores	1	

4.10.1.3 Waste water treatment

Answer 03 · Mark scheme

June 2022 | 8462/2H | Original Q5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.4	(the ground water) contains microbes which are harmful (to health) (so) the water is sterilised **or** (so) the microbes are destroyed		1 1	AO3 AO1 4.10.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.5	(the water is) unadulterated **or** (the water is) in its natural state	allow nothing is added (to the water) allow (the water) contains no microbes	1	AO2 4.8.1.1 4.10.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.6	(use) damp litmus paper (the paper) is bleached **or** (the paper) turns white	MP2 is dependent upon MP1 ignore paper turns red	1 1	AO1 4.8.2.4

Total Question 5		12

4.10.1.3 Waste water treatment

Answer 04 · Mark scheme

June 2024 | 8462/2H | Original Q3

Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	combustion reversible		1 1	AO2 4.6.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.2	water molecules break down and reform at the same rate		1	AO2 4.6.2.3

4.10.1.3 Waste water treatment

Answer 04 · Mark scheme

June 2024 | 8462/2H | Original Q3

Question	Answers	Mark	AO / Spec. Ref.
03.3	**Level 3:** Relevant points (reasons / causes) are identified, given in detail and logically linked to form a clear account.	5–6	AO1 4.10.1.2 4.10.1.3
	Level 2: Relevant points (reasons / causes) are identified, and there are attempts at logical linking. The resulting account is not fully clear.	3–4	
	Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.	1–2	
	No relevant content	0	
	Indicative content **Potable water production** • pass water through filter beds • to remove solids • use chlorine / ozone / UV light • to sterilise water • to destroy microbes **Waste water treatment** • screening • using a metal grid • to remove solids • to remove grit • sedimentation • to produce sewage sludge and effluent • anaerobic digestion of sewage sludge • aerobic biological treatment of effluent access to **Level 3** requires reference to **both** potable water production **and** waste water treatment.		

Total Question 3	**9**

4.10.1.3 Waste water treatment

Answer 02 · Examiner comments

November 2020 | 8462/2H | Original Q2

Question 2 (standard demand)

02.1 Some good answers were seen, with many students giving a Level 2 response. However, the sources of fresh water were frequently omitted, and many students went beyond the requirements of the specification and added information about screening, flocculation and sedimentation, often adding confusion to the filtration process. The sterilisation phase was quite well known, but then further information about addition of fluoride and water softening was often added. A significant minority thought that water treatment works boiled the water as part of the process.

02.2 Many students made the link between sea water and energy and scored this mark. The most common errors were to mention only boiling the water with qualification or filtration.

02.3 A number of students knew neither of the processes. Some of these reversed the two responses but overall there was no discernible pattern in the errors.

02.4 This part was extremely well done. A minority of students used data for the wrong year or showed that they didn't understand the concept of significant figures.

02.5 The majority of students were able to make the link with population increase. Weaker responses merely referred to an increase in the amount of unspecified waste produced or treated.

02.6 Many students were able to give one valid reason – usually linked to increased demand for food or food production. Few though were able to give a second reason. The most common response that gave insufficient detail was that less sludge was sent to landfill.

4.10.1.3 Waste water treatment

Answer 03 · Examiner comments

June 2022 | 8462/2H | Original Q5

Question 5 (Standard, standard/high and high demand)

05.1 About a fifth of the students gained all the available marks. Many students answered the question in terms of treating water to make it potable, rather than treating sewage. Those who did answer in terms of treating sewage initially answered well though many answers broke down after mention of screening and sedimentation.

05.2 Half of the students were able to give the correct pair of concentrations in this multiple choice question.

05.3 The common error in this question was to concentrate on what Process 1 (filtering) did do, rather than the lack of effect on the ions. Of those who did correctly answer the question, more were awarded the first mark on the mark scheme. Around a quarter of the students gained both of the marks.

05.4 Students needed to state that the microbes were harmful and because of this some did not gain the first mark, although many were awarded the second. About 40% of the students scored both marks.

05.5 Less than a third of students answered this successfully with many responses stating the company meant the water was chemically pure, in spite of this being explicitly negated in the question.

05.6 Most students knew the test for chlorine gas; however a significant number did not refer to the need for the litmus paper to be damp and therefore did not gain the first mark. Over one-third of the students gained both marks.

4.10.1.3 Waste water treatment

Answer 04 · Examiner comments June 2024 | 8462/2H | Original Q3

Question 3 (standard demand)

03.1 This multiple-choice question proved challenging, with around a quarter of students gaining two marks. However, the vast majority were able to score one mark.

03.2 This multiple-choice question was extremely well answered, with more than 90% of students gaining credit.

03.3 This standard demand item was generally answered quite well. A majority of students had a good overall understanding of the sequence of steps involved in potable water production and wastewater treatment and so scored highly on this item. Weaker responses tended to focus on wastewater treatment, for which the diagram in the stem provided more scaffolding.

Most students recognised that ground water needed to be filtered initially. A few responses referred to screening before the use of filter beds, although only referring to screening in potable water production was considered insufficient. Sometimes the descriptions of things removed by filter beds did not make it clear that they were solid. The process of sterilisation was generally well described, although removal of microbes rather than their destruction was not creditworthy.

Removal of solids using a metal grid was included by most students. Fewer students referred to this step as screening and again things removed by screening were not always clearly identified as solid. Organic matter in sewage is not removed by screening as this is treated subsequently. The final steps were less well addressed overall. Most students referred to sludge and effluent (again these featured in the diagram), but many failed to recognise that these were separated by sedimentation. Some responses confused the separation of sludge and effluent with their biological treatment afterwards. Some students recognised that sludge is treated anaerobically and effluent aerobically but did not refer to digestion or biological treatment or an equivalent description of microbial action.

References to flocculation, desalination, fluoridation or pH adjustment were considered irrelevant and ignored in the marking of this item.

Around a third of students gained a Level 3 mark, with roughly another third achieving Level 2.