AQA GCSE Chemistry | 8462

SPECIFICATION POINT 4.10.4.2

Production and uses of NPK fertilisers

Mark schemes and examiner comments

Tier	**Higher**
Question groups	**11**
Available paper years	**2008–2025**

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.

4.10.4.2 Production and uses of NPK fertilisers

Answer 01 · Mark scheme

January 2008 | CHY2H | Original Q3 | Legacy

The full source mark scheme begins on page 24. Follow original question 3 in that document.

4.10.4.2 Production and uses of NPK fertilisers

Answer 02 · Mark scheme

June 2010 | CHY2H | Original Q1 | Legacy

Question 1

question	answers	extra information	mark
1(a)(i)	(nitrogen) + hydrogen → ammonia	accept H_2 and NH_3 ignore incorrect symbols ignore balancing	1
1(a)(ii)	any **one** from: • catalyst • to speed up the reaction • lower activation energy	 ignore causes reaction ignore heat / reference to particles 	1
1(a)(iii)	any **two** from: • cooled • ammonia condenses / turns into liquid • nitrogen and hydrogen do not condense / turn into liquid **or** nitrogen and hydrogen stay as gases	it = ammonia ignore references to boiling point if no marks awarded accept pass through / separated in condenser **or** unreacted nitrogen and hydrogen / gases recycled for **1** mark	2

Question 1 continues on the next page

4.10.4.2 Production and uses of NPK fertilisers

CHY 2H

Question 1 continued

question	answers	extra information	mark
1(b)	80	correct answer with or without working gains **2** marks ignore units if answer incorrect, evidence of correct working gains **1** mark eg 14 + (4 x 1) + 14 + (3 x 16) (= 70) **or** 2N + 4H +30	2
1(c)	fertiliser is **C** evidence of correct working	 examples of minimum correct working: 39/101 **or** 14/101 **or** 38.61/100 **or** 13.86/100	1 1
Total			**8**

4.10.4.2 Production and uses of NPK fertilisers

Answer 02 · Mark scheme

June 2010 | CHY2H | Original Q1 | Legacy

CHY 2H

4.10.4.2 Production and uses of NPK fertilisers

Answer 03 · Mark scheme

June 2011 | CHY2H | Original Q3 | Legacy

Question 3

question	answers	extra information	mark
3(a)	particles move faster **or** particles have more energy	accept molecules / atoms / ions instead of particles ignore move / vibrate more	1
	so they collide more often / frequently **or** more of the collisions are successful / have the activation energy	allow particles collide harder / with more force ignore collide quicker ignore collide more / more collisions	1
3(b)	any **one** from: • increase surface area (of the rock) • increase the concentration (of the acid) • add a catalyst • stir / mix the mixture	 accept crush / powder the rock ignore increase the pressure / temperature	1
Total			**3**

4.10.4.2 Production and uses of NPK fertilisers

Answer 03 · Mark scheme

June 2011 | CHY2H | Original Q3 | Legacy

CHY2H

4.10.4.2 Production and uses of NPK fertilisers

Answer 04 · Mark scheme

June 2011 | CHY2H | Original Q7 | Legacy

Question 7

question	answers	extra information	mark
7(a)(i)	nitrogen – air	accept atmosphere	1
	hydrogen – north sea gas / natural gas / methane / CH_4	accept water / (crude) oil / coal / hydrocarbons / brine	1
7(a)(ii)		allow converse throughout	
	• high temperature gives a low yield		1
	• because reaction is exothermic	must be linked to first bullet point	1
	• but at low temperatures the rate is (too) slow		1
		if no other marks awarded accept 450°C is a compromise between yield and rate **or** 450°C gives a reasonable yield in a reasonable time for **1** mark	
7(a)(iii)	nitric (acid)	accept HNO_3	1
7(b)	Ammonia / Haber process can be used to make fertiliser		1
	with a specified economical reason eg raw materials for Haber process readily available eg transport costs are lower or no need to import eg Haber process is a continuous process	ignore employment / labour costs	1
Total			**8**

The AQA UMS Conversion Calculator is available on the Results statistics page of the AQA Website

Answer 05 · Mark scheme

June 2011 | CHY3H | Original Q5 | Legacy

Question 5

question	answers	extra information	mark
5(a)(i)		incorrect test or no test = **0** mark testing the solution **or** using blue litmus = **0** mark	
	(test ammonia / gas with red) litmus	accept any acid-base indicator with correct result	1
	(goes) blue		1
	OR		
	(conc.) HCl (1)		
	white fumes / smoke / solid (1)	allow white gas / vapour	
	OR		
	(test ammonia / gas with) Universal Indicator (1)		
	blue / purple (1)		
5(a)(ii)		incorrect test or no test = **0** marks	
	add barium chloride / $BaCl_2$ (solution) **or** add barium nitrate / $Ba(NO_3)_2$ (solution)	do **not** accept H_2SO_4 added allow Ba^{2+} solution / aqueous added	1
	white precipitate / solid (formed)	allow white barium sulfate / $BaSO_4$ ignore barium sulfate / $BaSO_4$ alone	1
5(b)(i)	fully / completely ionised / dissociated **or** hydrogen ions fully dissociated	accept has more ions than weaker acid / alkali of same concentration ignore strongly ionised do **not** accept ions are fully ionised ignore concentrated **or** reference to concentrations of ions	1

Question 5 continues on the next page

Question 5 continued

question	answers	extra information	mark
5(b)(ii)	methyl orange	accept correct spelling only accept any strong acid-weak base indicator do **not** allow phenolphthalein / litmus / universal indicator	1
5(b)(iii)	32 × 0.05/1000 **or** 0.0016 (mole H_2SO_4) (reacts with) 2 × 0.0016 **or** 0.0032 (mole NH_3 in 25cm^3) (0.0032 × 1000/25 =) 0.128	accept (0.05 x 32) = (V x 25) **or** 0.05 x 32 / 25 accept dividing rhs by 2 **or** multiplying lhs by 2 allow ecf from previous stage correct answer 0.128 **or** 0.13 with or without working gains all **3** marks	1 1 1
5(b)(iv)	2.176 **or** 2.18 **or** ecf from candidate's answer to (b)(iii) **or** 2.55 if 0.15 moles used	correct answer with or without working if answer incorrect or no answer 0.128 × 17 **or** 0.13 x 17 **or** their (b)(iii) × 17 **or** 0.15 × 17 gains **1** mark	2
Total			**11**

4.10.4.2 Production and uses of NPK fertilisers

Answer 05 · Mark scheme

June 2011 | CHY3H | Original Q5 | Legacy

CHY3H

4.10.4.2 Production and uses of NPK fertilisers

Answer 06 · Mark scheme

June 2016 | CH2HP | Original Q2 | Legacy

Question	Answers	Extra information	Mark	AO / SpecRef
2(a)	endothermic		1	AO1 2.5.1d
2(b)	82 (%)	correct answer with working gains **3** marks if 17 or 34 not shown in working **max 2** marks accept 82.4 accept 82.35 to full calculator display (82.35294...) correctly rounded to at least 2 sf if no answer or incorrect answer, then (M_r =) 17 gains **1** mark **or** 14/17 gains **2** marks **OR** ($2M_r$ =) 34 gains **1** mark **or** 28/34 gains **2** marks **OR** 14/their M_r shown gains **1** mark **or** correct calculation of 14/their M_r gains **2** marks	3	AO2 2.3.3a, 2.3.1f
2(c)(i)	7 / seven		1	AO1 2.6.2d
2(c)(ii)	$H^+ + OH^- \rightarrow H_2O$		1	AO1 2.6.2e
2(c)(iii)	ammonium chloride	allow NH_4Cl ignore an incorrect formula	1	AO1 2.6.2b

Question 2 continues on the next page

Question 2 continued

Question	Answers	Extra information	Mark	AO / SpecRef
2(d)			6	2AO2 / 4AO3 2.6.2c

Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5 and apply a 'best-fit' approach to the marking.

0 marks	Level 1 (1–2 marks)	Level 2 (3–4 marks)	Level 3 (5–6 marks)
No relevant content.	Suggestion with a reference to a graph.	Suggestion with reasons referring to more than one graph.	Suggestion with reasons from all three graphs, and linking of ideas which may explain a compromise.

Examples of chemistry points made in response:
A reasonable suggested amount of fertiliser would be in the region of 200 kg (per ha). Accept any suggestion from about 180 kg (per ha) to 500 kg (per ha).

Yield:
- Using fertiliser improves yield.
- Yield improved most up to about 200 kg (per ha) of fertiliser.
- Yield only increased slightly above about 200 kg (per ha).

Profit:
- About 200 kg of fertiliser gives the most profit.
- Above about 200 kg (per ha) of fertiliser profit declines.

Run off:
- Run off is at low levels until about 300 kg (per ha) of fertiliser.
- Above about 300 kg (per ha) of fertiliser, run off increases.

Examples of linking of ideas:
- Overall 200 kg gives high crop yield and most profit.
- In conclusion 200 kg gives high crop yield and low run off.
- 200 kg gives most profit and low run off.

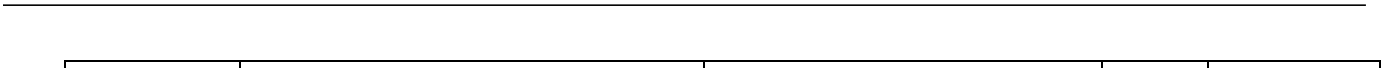
Examples of compromise:
- Profits go down after about 200 kg (per ha) of fertiliser because cost of fertiliser is not covered by increased yield.
- 200 kg gives the highest profit although it is not the highest yield.
- 500 kg gives the best yield but has the most runoff.

Total			13

4.10.4.2 Production and uses of NPK fertilisers

Answer 06 · Mark scheme

June 2016 | CH2HP | Original Q2 | Legacy



4.10.4.2 Production and uses of NPK fertilisers

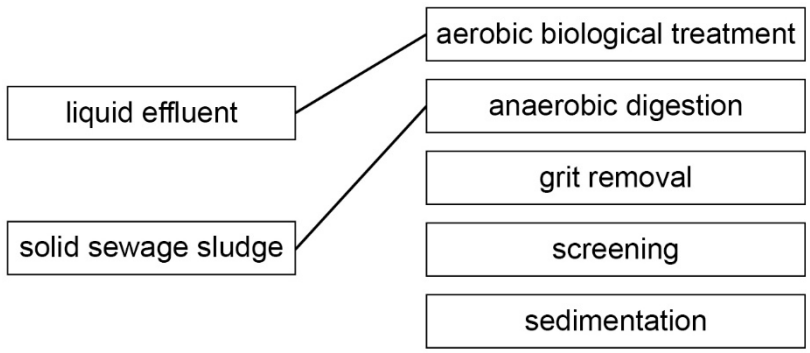
Answer 07 · Mark scheme

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**	

4.10.4.2 Production and uses of NPK fertilisers

Answer 08 · Mark scheme

November 2021 | 8462/2H | Original Q5

Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	ammonium phosphate potassium nitrate		1 1	AO2 4.10.4.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.2	(nitric acid) calcium nitrate (phosphoric acid) (calcium) triple superphosphate **or** calcium dihydrogenphosphate		1 1	AO1 4.10.4.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.3		allow converse for laboratory process ignore references to cost / energy		AO3 4.10.4.2
	(industrial process) (is) large(er) scale	ignore large mass produced	1	
	(is) quicker		1	
	(is a) continuous process	allow does not need to be repeated	1	
	reasoned judgement		1	

Total			8

4.10.4.2 Production and uses of NPK fertilisers

Answer 09 · Mark scheme

June 2023 | 8462/2H | Original Q10

Question 10

Question	Answers	Mark	AO/ Spec. Ref
10.1	**Level 3:** A judgement, strongly linked and logically supported by a sufficient range of correct reasons, is given.	3–4	AO3 4.10.1.1 4.10.2.2 4.10.4.2
	Level 2: Some logically linked reasons are given. There may also be a simple judgement.	1–2	
	No relevant content	0	
	Indicative content **reasons** • compound **A** (potassium chloride) only contains potassium • compound **A** (potassium chloride) is the only source of potassium so is needed. • compound **B** (ammonium nitrate) only contains nitrogen • compound **B** (ammonium nitrate) contains more nitrogen than compound **C** (diammonium hydrogen phosphate) so is preferable • compound **B** (ammonium nitrate) contains more nitrogen and is cheaper than compound **C** (diammonium hydrogen phosphate) and so is more cost effective • compound **C** (diammonium hydrogen phosphate) contains phosphorus which is not needed **judgement** • none of the compounds contain both nitrogen and potassium so a mixture is needed • (both) compound **A** (potassium chloride) and **B** (ammonium nitrate) should be used • (both) compound **A** (potassium chloride) and **C** (diammonium phosphate) could be used		

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.2	mining	allow quarrying	1	AO1 4.10.4.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.3	potassium sulfate	ignore potassium chloride allow potassium nitrate allow any other named potassium salt	1	AO1 4.10.4.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.4	ammonia	allow water	1	AO1 4.10.4.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.5	(phosphate rock is) insoluble (in water)	allow (phosphate rock) cannot be absorbed as a solid	1	AO3 4.10.4.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.6	(sulfuric acid) calcium sulfate (phosphoric acid) calcium phosphate	 allow single superphosphate allow calcium phosphate allow triple superphosphate	 1 1	AO1 4.10.4.2

Total Question 10	**10**

4.10.4.2 Production and uses of NPK fertilisers

Answer 10 · Mark scheme

June 2024 | 8462/2H | Original Q2

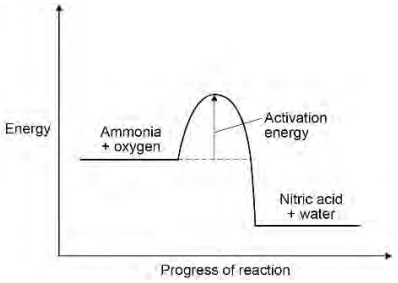
Question 2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	to recycle (remaining) nitrogen and hydrogen	allow to recycle unreacted gases allow to return nitrogen and hydrogen to the reactor	1	AO1 4.10.4.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.2	iron	allow Fe	1	AO1 4.6.1.4 4.10.4.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.3	(test) glowing splint (result) (splint) relights	 MP2 is dependent upon MP1 being awarded	 1 1	AO1 4.8.2.2

Answer 10 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.4	labelled vertical arrow from dotted line to peak ammonia **and** oxygen on left **and** nitric acid **and** water on right	ignore arrow heads allow NH_3 for ammonia allow O_2 for oxygen allow HNO_3 for nitric acid allow H_2O for water an answer of  scores **2** marks	1 1	AO2 4.6.1.4 4.10.4.1 4.10.4.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.5	the line would reach a higher peak		1	AO1 4.6.1.4 4.10.4.1 4.10.4.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.6	fertilisers	allow explosives allow sports injury packs	1	AO3 4.10.4.1 4.10.4.2

Total Question 2	**8**

4.10.4.2 Production and uses of NPK fertilisers

Answer 11 · Mark scheme

June 2025 | 8462/2H | Original Q9

Question 9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.1	the forward reaction is endothermic		1	AO2 4.6.1.3 4.6.2.4 4.6.2.6
	(so high temperature) shifts the equilibrium (position) to the right		1	
	(which) increases the yield (of products)	allow (and a high temperature) increases the rate of reaction	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.2		allow converse		AO2 4.6.2.4 4.6.2.7
	(low pressure) shifts the equilibrium (position) to the right		1	
	(because) there are more moles on the right	allow (because) there are more molecules on the right	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.3	no effect on equilibrium position		1	AO3 4.6.1.4 4.6.2.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.4	(volume ~) $\frac{50 \times 100}{80}$	allow a value in the range 78.0 to 80.0 for percentage of nitrogen	1	AO2 4.9.1.1 4.10.4.1
	~ 62.5 (dm^3)		1	

4.10.4.2 Production and uses of NPK fertilisers

Answer 11 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.5	(the reaction mixture is) cooled		1	AO1 4.10.4.1
	(so that) ammonia condenses / liquefies		1	
	(but) nitrogen **and** hydrogen are gases		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.6	any **three** from: • nitrogen is an abundant gas (in the air) • the use of nitrogen releases fewer greenhouse gases • the nitrogen released replaces that used to make ammonia • natural gas is a finite resource • (the use of hydrogen / methane releases) carbon dioxide which contributes to climate change	allow nitrogen is renewable allow (the use of hydrogen / methane releases) carbon dioxide contributes to global warming	3	AO3 4.10.1.1 4.10.4.1

Total Question 9	14

Version 1.0: 0108

ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Secondary Education

Additional Science 4463 / Chemistry 4421

CHY2H Unit 2 Chemistry

Mark Scheme

2008 examination – January series

4.10.4.2 Production and uses of NPK fertilisers

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Further copies of this Mark Scheme are available to download from the AQA Website: www.aqa.org.uk

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4.10.4.2 Production and uses of NPK fertilisers

MARK SCHEME

Information to Examiners

1. General

The mark scheme for each question shows:

- the marks available for each part of the question
- the total marks available for the question
- the typical answer or answers which are expected
- extra information to help the Examiner make his or her judgement and help to delineate what is acceptable or not worthy of credit or, in discursive answers, to give an overview of the area in which a mark or marks may be awarded.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example: where consequential marking needs to be considered in a calculation; or the answer may be on the diagram or at a different place on the script.

In general the right hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

2. Emboldening

2.1 In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following lines is a potential mark.

2.2 A bold **and** is used to indicate that both parts of the answer are required to award the mark.

2.3 Alternative answers acceptable for a mark are indicated by the use of **or**. (Different terms in the mark scheme are shown by a / ; eg allow smooth / free movement.)

3. Marking points

3.1 Marking of lists

This applies to questions requiring a set number of responses, but for which candidates have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

Each error/contradiction negates each correct response. So, if the number of error/contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

4.10.4.2 Production and uses of NPK fertilisers

Example 1: What is the pH of an acidic solution? (1 mark)

Candidate	Response	Marks awarded
1	4,8	0
2	green, 5	0
3	red*, 5	1
4	red*, 8	0

Example 2: Name two planets in the solar system. (2 marks)

Candidate	Response	Marks awarded
1	Pluto, Mars, Moon	1
2	Pluto, Sun, Mars, Moon	0

3.2 Use of chemical symbols / formulae

If a candidate writes a chemical symbol / formula instead of a required chemical name, full credit can be given if the symbol / formula is correct and if, in the context of the question, such action is appropriate.

3.3 Marking procedure for calculations

Full marks can be given for a correct numerical answer, as shown in the column 'answers', without any working shown.

However if the answer is incorrect, mark(s) can be gained by correct substitution / working and this is shown in the 'extra information' column;

3.4 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

3.5 Errors carried forward

Any error in the answers to a structured question should be penalised once only.

Papers should be constructed in such a way that the number of times errors can be carried forward are kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation e.c.f. in the marking scheme.

3.6 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

3.7 Brackets

(…..) are used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

3.8 Unexpected Correct Answers not in the Mark Scheme

The Examiner should use professional judgement to award credit where a candidate has given an unexpected correct answer which is not covered by the mark scheme. The Examiner should consult with the Team Leader to confirm the judgement. The Team Leader should pass this answer on to the Principal Examiner with a view to informing all examiners.

4.10.4.2 Production and uses of NPK fertilisers

CHY2H

Question 1

question	answers	extra information	mark
(a)	sensible line of best fit which goes through or close to all the points **except** the anomalous point	allow wobbly / short double lines ± ½ square	1
(b)	loss of gas / loss of CO_2	idea of gas produced / formed	1
(c)	7		1
(d)(i)	steeper line from around the same starting point and left of the points levelling off at 99	allow crosses if they are fully correct for **1** mark accept short level line at 99 ± ½ square	1 1
(d)(ii)	any **three** from: • particles / molecules / atoms/ ions have more energy • move faster • collide more often **or** more chance of collisions **or** bump into each other more • collide with more force / energy **or** more particles have the activation energy **or** more collisions result in reaction **or** more collisions are successful	 allow given / gain / get energy ignore move about more ignore vibrate more / faster ignore collide quicker / faster	3
total			8

4.10.4.2 Production and uses of NPK fertilisers

CHY2H

Question 2

question	answers	extra information	mark
(a)	any **one** from: • they are made of layers • atoms / ions / particles / layers (of atoms) can slide over each other	do **not** accept line / rows / lattice	1
(b)	any **one** from: • smaller / tiny **or** very small • correct size range 1 to 100 nanometres • a few hundred atoms in size	do **not** allow small alone if they state smaller and give a size outside range ignore size if it is less than 20,000	1
(c)	harder plus **one** from: • so does not wear as quickly / erode as quickly • less vulnerable to damage owtte • because they have a high surface area to volume ratio **or** stronger (1) plus **one** from: (1) • less likely to break / do not break • not as vulnerable to damage owtte • do not bend out of shape • because they have a high surface area to volume ratio	ignore corrode harder to wear down = **1** mark accept withstand pressure harder and stronger alone gains **1** mark	1 1
total			4

4.10.4.2 Production and uses of NPK fertilisers

CHY2H

Question 3

question	answers	extra information	mark
(a)	N_2O		1
(b)	13.8 to 14	gains full marks without working if answer incorrect 13 gains **1** mark **or** 14/101 × 100 gains **1** mark	2
total			3

4.10.4.2 Production and uses of NPK fertilisers

CHY2H

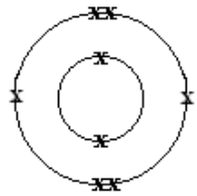
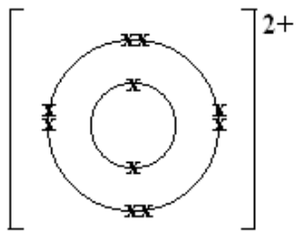
Question 4

question	answers	extra information	mark
(a)	electric current / electricity		1
	plus **one** from:		1
	• is passed through ionic compound / substance / electrolyte • passed through molten/aqueous compound / substance	must be linked to electricity allow liquid compound / substance do **not** allow solution / liquid alone	
	• causing decomposition	accept split up / breakdown / breaking up owtte ignore separated accept elements are formed ignore new substances form	
(b)	hydrogen	accept H_2 do **not** accept H / H^2	1
(c)	one electron from each atom	accept each carbon is bonded to three other carbon atoms leaving one (unbonded) electron owtte	1
	is delocalised / free (to move)	must be linked to electrons answers of delocalised / free electrons only, gains **1** mark accept each carbon is bonded to three other carbon atoms leaving delocalised / free electrons = **2** marks **maximum 1** mark if graphite described as a metal / giant ionic lattice	1
total			5

4.10.4.2 Production and uses of NPK fertilisers

CHY2H

Question 5

question	answers	extra information	mark
(a)	any **one** from: • gives out heat / energy • transfers energy from a substance to the surroundings • ΔH / energy change / enthalpy change is negative	accept releases / gives off owtte ignore references to light	1
(b)	$2Mg + O_2 \rightarrow 2MgO$	accept correct multiples / fractions	1
(c)		electrons do not need to be paired accept dots / circles / e instead of crosses do **not** allow 2.6 without diagram	1
(d)		electrons do not need to be paired allow without brackets must have the charge accept dots / circles / e instead of crosses ignore extra empty outer shells ignore nucleus do **not** allow $[2.8]^{2+}$ without diagram	1

continued…

4.10.4.2 Production and uses of NPK fertilisers

CHY2H

Question 5 continued…

question	answers	extra information	mark
(e)	oppositely charged (ions / atoms)	allow positive and negative(ions / atoms)	1
	(they) attract	must be in correct context accept held by electrostatic forces ignore ionic bonding **maximum 1** if they refer to intermolecular forces / attractions / covalent bonds	1
(f)	magnesium chloride	accept $MgCl_2$ (if correctly written)	1
total			7

4.10.4.2 Production and uses of NPK fertilisers

CHY2H

Question 6

question	answers	extra information	mark
(a)	**Compound A** any **one** from: • sodium bromide • potassium bromide • ammonium bromide • hydrogen bromide • any metal bromide except silver and lead. **Compound B** silver nitrate	accept correct formulae accept silver sulfate	1 1
(b)	the silver compound will decompose / silver ions be reduced to silver (owtte)	accept film would darken owtte accept any idea of light changing silver bromide / silver ions / silver nitrate / silver sulfate allow 'forms a black solid' / it would turn black	1
(c)	precipitation	accept descriptions of precipitation reactions accept double decomposition accept precipitate do **not** allow displacement	1
(d)	electrons are gained	 the second mark **must** be linked to electrons accept it / silver / silver ions gains electrons for **both** marks ignore references to oxygen	1 1
total			6

4.10.4.2 Production and uses of NPK fertilisers

CHY2H

Question 7

question	answers	extra information	mark
(a)	1213.8 to 1214.3 correct answer not given then check working 1) moles of N_2 = $\frac{1000}{28}$ = 35.7 mol 2) moles of NH_3 = 2 × (answer from (1)) = 71.4 mol 3) mass of NH_3 = (answer from 2) × 17 = 71.4 × 17 = 1214 g **or** • 28g of N_2 → 34g of NH_3 • 1g of N_2 → $\frac{34}{28}$ = 1.214g NH_3 • 1000 g of N_2 → 1000 × 1.214 = 1214g **or** • $1000 \times \frac{34}{28}$ **or** **other correct methods**	gains **3** marks without working **1** mark for each correct step do **not** penalise rounding errors in this part **1** mark for each correct step do **not** penalise rounding errors in this part allow error carried forward eg gains **2** marks if correct answer not given $1000 \times \frac{28}{34}$ gains **1** mark, **2** marks if correctly calculated (823.5g) $1000 \times \frac{28}{17}$ gains **1** mark if calculated correctly (1647.05g) look for the key ideas in the methods above	3

continued…

4.10.4.2 Production and uses of NPK fertilisers

CHY2H

Question 7 continued…

question	answers	extra information	mark
(b)	25 / 25.035 **or** ecf from (a)	gains **2** marks even when there is no working incorrect answer then 304/(their answer from (a)) × 100 gains **1** mark	2
	or using figures from part (b) **27.6 / 28**	gains **2** marks even when there is no working accept 27 for **1** mark if answers incorrect then304/1100 × 100 gains **1** mark	
(c)(i)	increase yield reaction is exothermic **or** allow decreased yield because rate of reaction is slower / fewer collisions for **2** marks	**must** get both points for **2** marks	1 1
(c)(ii)	increase yield plus **one** from: • more (gaseous) reactant molecules than (gaseous) product molecules (owtte) • increased rate of reaction / more collisions	accept greater volume on the left than the right owtte	1 1

continued…

4.10.4.2 Production and uses of NPK fertilisers

CHY2H

Question 7 continued…

question	answers	extra information	mark
(d)	any **one** from: **economic** • large town provides workforce • workers do not have to travel far to the factory. (owtte) • transport infrastructure already in place for large town. (owtte) • factory brings prosperity to town (owtte) • factory provides employment • reduced tourism • reduction in local house prices • any other sensible economic factor linked to town		1
	any **one** from: **safety** • <u>escape</u> of dangerous / harmful chemicals / gases (owtte) • <u>danger</u> of increased traffic • risk of explosion.(owtte) /danger of high pressure • consequences of an accident could be severe if the town is close • any other sensible safety idea	do **not** allow polluting gases unqualified	1

continued…

4.10.4.2 Production and uses of NPK fertilisers

CHY2H

Question 7(d) continued…

question	answers	extra information	mark
	any **one** from: **environmental** • factory might be unsightly (owtte) • screening of factory (owtte) • loss of habitats (owtte) • plant trees/ hedges etc on and around plant site • pollution of water / air / soil could harm plants / animals **or** noise pollution • CO_2 is produced by burning fuels / heating • CO_2 causes global warming / any effect of global warming • eye sore • any other sensible environmental factor	must be explained	1
total			12

4.10.4.2 Production and uses of NPK fertilisers

Answer 07 · 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.

Answer 08 · Examiner comments — November 2021 | 8462/2H | Original Q5

Question 5 (standard / high and high demand)

05.1 Nearly four-fifths of students identified one salt, while more than a third worked out both.

05.2 Around two-thirds of students could identify calcium nitrate.

05.3 Two marks were usually easily scored, often for ideas relating to a quicker or continuous process. Four marks were almost never awarded, because students did not appear to appreciate the need for a reasoned judgement when the command word is 'evaluate'.

Answer 09 · Examiner comments — June 2023 | 8462/2H | Original Q10

Question 10 (standard, standard / high and high demand)

10.1 The command word in this extended response question was 'evaluate'. Therefore, a reasoned judgement was needed to access Level 3. Level 1 was not used in the mark

scheme because of the level of demand of the question overall. Therefore, simple statements without linkages did not contribute to a creditworthy response.

Many students tried to identify a single fertiliser to be used, so were able to gain little credit. Those who did realise that a mixture should be used were often able to choose A and B, but were less able to articulate sufficient linked reasons. Some focused only on the overall percentage figures, without considering what elements those percentages represented; they treated 'N, P and K' as if it were a single entity or compared the percentage of potassium in A with the percentage of nitrogen in B. Many compared the costs of all three, failing to realise that cost was only relevant when comparing B and C in conjunction with their nitrogen content. Some students confused potassium and phosphorus, thinking P was the symbol for potassium. It was clear that many students had not considered all the information given in the question. Only around 10% of students achieved a Level 3 score of 3 or 4 marks.

10.2 Many students thought the process was phytomining. Others gave the source (rocks) rather than the process. Some gave electrolysis, probably thinking about how potassium is extracted from potassium chloride (even though it is not in the specification) instead of answering the question. Just over one-third of students gained a mark.

10.3 This was quite well answered, with most choosing a suitable potassium salt. Over half of students gained this mark.

10.4 Students found this question difficult and water was about as popular a response as ammonia. There were many students who gave oxides of nitrogen, or elements, or non-existent substances.

Many students seemed to know about the production of nitric acid (even though it is not in the specification) and the intermediate compounds in this process were ignored as the compounds needed are those which feed into the Ostwald Process – ammonia and water. Oxygen is not a compound. Less than one-quarter of students gained the mark.

10.5 Many students realised that the lack of solubility was the issue. There were a lot of answers which went no further than the information in the question, stating that the rock needs to be dissolved rather than it cannot be dissolved, or stating that phosphorus cannot be absorbed from rock without explaining why. Many thought that other toxic or harmful substances might be present. Around one-third of students gained this mark.

10.6 There were very many incorrect answers which attempted to name compounds starting with 'phosphorus'. The answers which were correct tended to split into two camps; those who used their knowledge of fertilisers to name single superphosphate and triple superphosphate, and those who used their knowledge of acids and salts to name calcium sulphate and calcium phosphate. Around 5% of students gained both marks.

4.10.4.2 Production and uses of NPK fertilisers

Answer 09 · Examiner comments

June 2023 | 8462/2H | Original Q10

Mark Ranges and Award of Grades

Grade boundaries and cumulative percentage grades are available on the Results Statistics page of the AQA Website.

4.10.4.2 Production and uses of NPK fertilisers

Answer 10 · Examiner comments

June 2024 | 8462/2H | Original Q2

Question 2 (standard demand)

02.1 Around two-fifths of students gained credit on this question. Some students referred to both hydrogen and nitrogen gases being recycled or reused. A few referred to only one of the gases or unspecified unreacted gases.

A number of students referred to excess gases or gases alone. In addition, some students focused their answer on the condenser part of the flow chart and responded with the idea that uncondensed gases needed to be recycled.

02.2 This question was answered well by the majority of students, with roughly two-thirds of students gaining the mark.

02.3 Although this question was answered well, some students referred to a splint being lit initially and then blown out. These students did not often mention the splint was still glowing. The majority of students who stated glowing splint also gained the second marking point. Around three-quarters of students gained both marks; of those who did not, most described the test for hydrogen.

02.4 There were many variations of drawing the arrow for the activation energy. A number of students labelled the activation energy with abbreviations such as E_a. The majority of students correctly named the reactants and products and placed them above and below the lines, with a few using arrows to point out their positions. More than 60% of students gained both marks.

02.5 This multiple-choice question was well answered, with around 70% of students gaining credit. The most popular distractor was that the peak would be lower rather than higher.

02.6 This question was answered extremely well with fertiliser or NPK fertiliser. A small minority stated farming or agricultural use unqualified. Only a handful of students identified its use in explosives or sports injury packs.

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4.10.4.2 Production and uses of NPK fertilisers

Answer 11 · Examiner comments

June 2025 | 8462/2H | Original Q9

Question 9

09.1 Three quarters of students scored at least one mark on this item. This was for either identifying the forward reaction as endothermic, or giving the allow statement for marking point 3, that a high temperature increases the rate. The answers for marking point 2 were often quite vague, talking about the reaction moving to the right-hand side, rather than the position of the equilibrium. Many students gave answers in terms of the Haber process, rather than the given reaction, so answers that suggest an increase in the yield of ammonia were incorrect.

09.2 Fewer than half of students scored either or both marks for this high demand item. The most common response was for identifying that the equilibrium position moved to the right, with far fewer giving the link to the number of molecules on either side of the equation. Many incorrect answers were seen in terms of rate of reaction, or because safety is a factor.

09.3 Two thirds of students correctly identified that catalysts have no effect on the position of the equilibrium.

09.4 It is quite rare to ask for an estimate in a calculation question and this was included because the percentage of nitrogen in the air is given as four fifths in the specification. Around 40% of students recognised that nitrogen makes up between

Answer 11 · Examiner comments

78 and 80% of the atmosphere, so would require between 62 and 65 dm^3 of air to produce 50 dm^3 of nitrogen. Where students did not score was because they did not know the percentage of nitrogen in the air.

09.5 Around half of students gained at least one mark on this item, usually for the idea that ammonia condenses. Far fewer students knew that this is done by cooling the mixture or that both nitrogen and hydrogen stay as gases and are recycled, many only mentioning recycling, which was given in the diagram.

09.6 Around two-thirds of students gained at least one mark for this high demand interpretation question. The most common answer was for linking carbon dioxide to climate change. Many students did not gain this mark as there was a need to mention that the production of hydrogen causes this, if further detail was given. Mant talked about hydrogen producing carbon dioxide, which is incorrect and did not gain credit. The next most common response was for the idea that nitrogen was abundant in the atmosphere.

4.10.4.2 Production and uses of NPK fertilisers

Answer 11 · Examiner comments

June 2025 | 8462/2H | Original Q9

Mark Ranges and Award of Grades

Grade boundaries and cumulative percentage grades are available on the Results Statistics page of the AQA Website.