

M1. (a) 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 apply a **best-fit** approach to the marking.

0 marks

No relevant content.

Level 1 (1-2 marks)

There is a simple description of a laboratory procedure for obtaining potassium chloride.

Level 2 (3-4 marks)

There is a clear description of a laboratory procedure for obtaining potassium chloride from potassium hydroxide solution and hydrochloric acid that does not necessarily allow the procedure to be completed successfully by another person. The answer must include the use of an indicator or a method of obtaining crystals.

Level 3 (5-6 marks)

There is a detailed description of a laboratory procedure for obtaining potassium chloride from potassium hydroxide solution and hydrochloric acid that can be followed by another person. The answer must include the use of an indicator and a method of obtaining crystals.

examples of the chemistry/social points made in the response:

- One reagent in beaker (or similar)
- Add (any named) indicator
- Add other reagent
- Swirl or mix
- Add dropwise near end point
- Stop addition at change of indicator colour
- Note volume of reagent added
- Repeat without indicator, adding same volume of reagent **or** remove indicator using charcoal
- Pour solution into basin / dish
- Heat (using Bunsen burner)
- Leave to crystallise / leave for water to evaporate / boil off water

Accept any answers based on titration

(b) nitric (acid)
allow HNO₃
ignore incorrect formula 1

(c) (i) because it is a fertiliser / helps plants grow
allow plant food
*do **not** accept pesticide / herbicide / neutralising soil* 1

(ii) tick by: 'Should farmers stop using ammonium nitrate on their land?' 1

any **two** from:

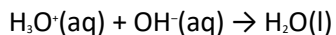
- cannot be done by experiment
accept difficult to get / not enough evidence
 - based on opinion / view
allow must be done by survey
 - ethical **or** economic issue
if top box ticked allow 1 mark for drinking water varies from place to place
- 2

[11]

- M2.** (a) to speed up the reaction **or** it is a catalyst
allow higher level answers such as to reduce the activation energy
ignore cost or yield 1
- (b) (i) reaction is exothermic
*accept reverse reaction is endothermic **or** high temperature causes decomposition of ammonia*
ignore reference to rate 1
- (ii) more (gaseous) reactant molecules than (gaseous) product molecules
accept 4 volumes / moles of reactant and 2 volumes / moles of product
*accept lower volume of products **or** volume lower on right hand side*
accept 'favours the reaction which produces fewer molecules'
ignore incorrect number of moles
ignore reference to 'amount' of product / reactant
ignore references to rate 1
- (c) (rate is) too slow / slower owtte
allow catalyst would not work
accept at higher temperature the rate is quicker
accept at lower temperatures particles
*do not collide as often **or** fewer particles have the activation energy **or** particles do not have the activation energy*
ignore reaction would not work
ignore optimum / compromise type answers 1
- (d) cooled
*allow ammonia / it is turned into a liquid **or** is condensed*
ignore references to boiling point 1

[5]

M3. (a) $H^+(aq) + OH^-(aq) \rightarrow H_2O(l)$ **or**

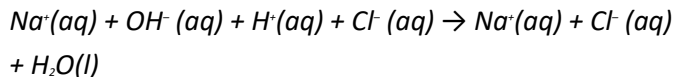


mark for correct equation

mark for state symbols

any other symbols = 0 marks

accept correct spectator ions e.g.



2

(b) (i) nitric acid **and** ammonia (solution)



mark for both

accept ammonium hydroxide /

NH₄OH instead of ammonia

*do **not** accept ammonia hydroxide*

*do **not** accept hydrogen nitrate solution*

accept correct formulae

1

(ii) provides oxygen or oxidising (agent) **or** oxidant

*do **not** accept it contains oxygen alone*

***or** rich in oxygen*

1

[4]

- M4.** (a) nitrogen
consider answers as a list 1
- hydrogen 1
- (b) speed up the reaction
accept increase rate of reaction 1
- (c) fertiliser
*accept to replace **or** add nitrogen **or** nutrients
do **not** accept minerals or nitrates* 1
- growth
*accept for protein **or** increased yield* 1

[5]

- M5.** (a) (i) fertilisers
for 1 mark 1
- (ii) 7
for 1 mark 1
- (iii) 5
for 1 mark
(ignore other units) 1
- (b) (i) both nitrogen and hydrogen
for 1 mark 1
- (ii) two of:
nitrogen;
hydrogen/methane/natural gas;
oxygen/air;
water;
any fuel
(allow symbols, do not allow nitrogen oxides)
any two for 1 mark each 2
- (c) (i) alkali/alkaline/base/basic
for 1 mark 1
- (ii) must be nitrate
for 1 mark 1
- (iii) thermometer or any other temperature measuring device
for 1 mark 1

[9]

- M6.** (i) A = air
B = natural gas
for 1 mark each **2**
- (ii) nitrogen
both for 1 mark **1**
- (iii) catalyst / speed up reaction
for 1 mark **1**
- (iv) recycle unreacted gases / save money
for 1 mark **1**

[5]

M7. (a)

*the answer yes **or** no does not gain a mark*

Yes – plants will grow faster

*do **not** accept grow better*

1

more food available, greater yield

1

OR

No – plants still grow without adding nitrates

*accept the idea that **small** amounts of nitrate could be used*

1

(nitrates) can 'kill' babies / causes brain damage

do not accept can stop respiration in babies

1

(b) (i) 2

accept two

1

(ii) $2 \times 14 + 4 \times 1 + 3 \times 16$

1

= 80

1

$$\frac{28}{80} \times 100 = 35\%$$

1

allow 1 mark for correct working for percentage $28/Y \times 100$, where Y is an incorrect formula mass

allow 2 marks for formula mass of 80 where no working

***or** correct working is shown*

allow 3 marks for 35 where no working

***or** correct working is shown*

[6]

M8. (a) as a catalyst
accept to speed up the reaction (equilibrium) 1

(b) nitrogen + hydrogen \rightleftharpoons ammonia
 $N_2 + H_2 \rightleftharpoons NH_3$
accept mixed formula / word equations
ignore balancing 1

(c) (i) the reaction is reversible / an equilibrium
accept that ammonia can break down
again into nitrogen and hydrogen
accept reaction goes both ways
*do **not** accept some nitrogen and*
hydrogen do not react 1

(ii) (the gases are cooled)
no marks as given in the diagram
accept correct formulae NH_3 , N_2 , H_2 1

ammonia removed as a liquid
*accept ammonia liquefies **or** condenses*

nitrogen and hydrogen are recycled
accept nitrogen and hydrogen are put
back through the converter
accept 'other gases' only if ammonia
identified for first mark 1

[5]

- M9. (a) ammonium nitrate
accept NH_4NO_3
*do **not** accept ammonia nitrate* 1
- (b) different reactions need different catalysts 1
- (c) they are used over and over again
accept they are reused
accept they are not used up
accept they are not changed
recycling is neutral 1
- (d) any **two** from
 they speed up reactions
 they reduce energy requirements
accept allow reactions to take place at a lower temperature
 they reduce costs
accept make process more economic 2
- (e) (high pressure) increases the
 frequency of collisions
accept more collisions
move faster is neutral 1
- this increases the rate of reaction
accept 'more successful collisions' for 2 marks 1

[7]