

# MARK SCHEME

# GCSE

## CHEMISTRY

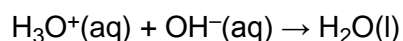
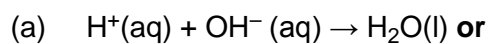
## AQA - TRIPLE SCIENCE

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C10 - TEST 4  
USING RESOURCES  
Intermediate

## Mark schemes

1.

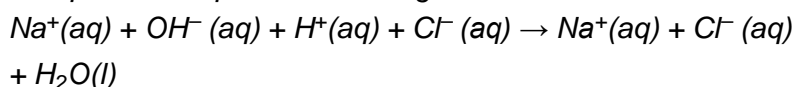


*mark for correct equation*

*mark for state symbols*

*any other symbols = 0 marks*

*accept correct spectator ions e.g.*



2



*mark for both*

*accept ammonium hydroxide /*

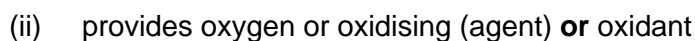
*$\text{NH}_4\text{OH}$  instead of ammonia*

*do **not** accept ammonia hydroxide*

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

*accept correct formulae*

1



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

***or** rich in oxygen*

1

[4]

2.

(a) any **one** from:

- disposal / lack of space / does not decompose in landfill sites

*ignore non-biodegradable alone*

- other specified problems with waste (e.g. litter **or** eyesore **or** harm to animals **or** destroys habitats)

*ignore pollution unqualified*

1

(b) (i) (from) orange

*allow red / brick red / brown / yellow*

1

(to) colourless

*allow decolourised*

*do **not** allow discoloured*

*ignore clear*

1

(ii) one carbon-carbon bond and four carbon-hydrogen bonds correctly drawn

*do **not** accept h*

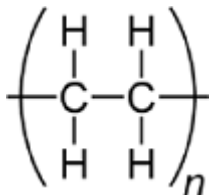
1

two trailing / connecting bonds extending beyond brackets

1

structure in bracket and n at the bottom right corner only

do **not** accept N



would score **3** marks

1

(c) there are (covalent) bonds / links between chains **or** crosslinks

any mention of ionic bonds or strong intermolecular forces scores a maximum of **2** marks

allow intermolecular bonds

1

which are strong

1

so the bonds between chains cannot be (easily) overcome / broken (by heating)

allow bonds between chains require a lot of energy to be broken

allow so molecules cannot move past each other / separate

ignore converse for thermosoftening

1

[9]

**3.**

(a)  $1 \times 10^{-2}$  g

1

(b)  $\frac{0.46}{8.45} \times 100$

1

(test tube 1) 5.44 %

**and**

(test tube 2) 0.854 %

1

4.586

1

4.59

1

*allow ecf answer correctly calculated to 3 significant figures*

*allow 4.59 with no working for 4 marks*

*allow 4.586 with no working for 3 marks*

(c) **Level 3 (5–6 marks):**

Detailed and coherent conclusions based on the evidence together with an evaluation are given in a response that is coherent and well-structured. A range of relevant points is made demonstrating a broad understanding of the key scientific ideas.

**Level 2 (3–4 marks):**

An attempt to relate relevant points and draw conclusions or to make an evaluation. The logic may be inconsistent at times but builds towards a coherent argument.

**Level 1 (1–2 marks):**

Simple descriptive statements are made. The logic may be unclear and any conclusions, if present, may not be consistent with the reasoning.

**0 marks:**

No relevant content.

**Indicative content**

Simple statements

- nail rusted in test tubes 1 and 5
- test tubes 1 and 4 contained air / oxygen and water
- nail did not rust in test tubes 2, 3 and 4
- test tube 2 no water present
- test tube 3 no air / oxygen present
- test tube 4 paint stopped rusting
- test tube 6 scratched galvanised iron did not rust
- test tube 6 galvanising stopped rusting

Conclusions

- both water and oxygen are required for rusting
- coatings that prevent water and oxygen reaching the metal prevent rusting
- when paint is scratched, iron comes into contact with water and oxygen and the iron rusts
- in test tube 5 less iron exposed so less rusting than in test tube 1
- galvanising is better at resisting rusting than paint when scratched
- zinc is more reactive than iron, so when galvanised metal is scratched, zinc reacts with water and oxygen first / sacrificially

Evaluation

- oil and paint are effective at preventing rusting when the coating is intact
- galvanising is the most effective coating because it prevents rusting even when scratched.

- (d) iron + oxygen + water  
*all three needed for 2 marks*  
*2 correct = 1 mark*  
*ignore air*

2

[13]

4.

- (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]

5. (a) (i) (thermal) decomposition  
*allow decomposes or endothermic* 1
- (ii) copper oxide 1
- (b) (i) the (potassium) carbonate did not decompose/change/react (when heated)  
*allow temperature not high enough*  
*do **not** allow potassium did not decompose*  
*ignore references to reactivity* 1
- the mass did not change or the limewater did not go cloudy 1
- because no carbon dioxide produced 1
- (ii) the less reactive the metal the more (easily) its carbonate will decompose/react or vice versa  
*needs to be a relative comparison* 2
- allow max 1 mark where the distinction between a metal and its carbonate is not clear*  
*allow 1 mark for carbonates of reactive metals do not decompose or vice versa*
- (c) (i) make it economical (to extract the metal/iron)  
*allow make it worth extracting*  
*allow so they can make money/profit* 1
- (ii) Fe 1
- balanced correctly (2,3,4,3)  
*not ecf*  
*allow correct balanced equation but with 2Fe<sub>2</sub> on right for one mark* 1
- (iii) **iron** from the blast furnace is brittle 1
- steel** produced is strong / flexible  
*allow steel has more/specific uses*  
*allow steel is rust-resistant* 1
- "it" = iron*
- (iv) (recycling) is used to conserve iron (ore) **or** energy **or** resources **or** minimise pollution **or** reduce the need to quarry  
*allow reverse arguments.* 1

(not reuse) because of damage, paint removal, rusting/corrosion, metal fatigue/weaker

1

(not landfill) because sites have limited space **or** loss of habitats  
*allow to reduce the use of landfill*

1

[15]

6.

(a) endothermic

1

(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

(c) (i) 7 / seven

1

(ii)  $H^+ + OH^- \rightarrow H_2O$

1

(iii) ammonium chloride

*allow  $NH_4Cl$*

1

*ignore an incorrect formula*

- (d) 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.

**Level 3 (5 – 6 marks):**

Suggestion with reasons from all three graphs, and linking of ideas which may explain a compromise.

**Level 2 (3 – 4 marks):**

Suggestion with reasons referring to more than one graph.

**Level 1 (1 – 2 marks):**

Suggestion with a reference to a graph.

**0 marks:**

No relevant content.

**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.

6

[13]



7.

(a) giant structure / lattice / layers / close packed

*first 3 marks can be obtained from a suitably labelled diagram*

*incorrect structure or bonding or particle = max 3*

1

made up of atoms / positive ions

1

with delocalized / free electrons

1

so electrons can move / flow through the metal

*accept so electrons can carry charge through the metal*

*accept so electrons can form a current*

1

(b) an alloy (is a metal which) has different types / sizes of atoms

*accept converse for pure metal throughout*

*both marks can be obtained from suitable diagrams*

*allow made of different metals*

*allow mixture of metals / atoms / elements*

*ignore particles*

*ignore properties*

*do **not** accept compound*

1

alloy has distorted layers

*allow layers are unable to slide*

1

- (c) (i) can return to its original shape  
*accept shape memory alloy*  
*accept smart alloy*  
*ignore other properties* 1
- (ii) (pure copper is too) soft  
*accept converse*  
*accept malleable or bends*  
*accept copper is running out*  
*ignore references to strength and weakness* 1
- (iii) aluminium oxide  
*accept alumina*  
*accept  $Al_2O_3$*   
*ignore bauxite / aluminium ore* 1
- (iv) any **one** from:  
  - different conditions
  - different catalyst
  - different pressure*allow different concentration*  
  - different temperature.*do **not** accept different monomers* 1
- (d) any **two** from:  
  - accurate
  - sensitive
  - rapid
  - small sample.*both needed for 1 mark* 1
- [11]

8.

- (a) (i) contain enough metal to make it economical / worth while to extract 1
- (ii) reduction  
*accept displacement*  
*accept redox* 1
- (iii)  $\text{Fe} + \text{CO}_2$   
*do not accept  $\text{Fe}_2 / \text{Fe}_4$*  1
- correct balancing  
*accept multiples and halves*
- $2\text{Fe}_2\text{O}_3 + 3\text{C} \rightarrow 4\text{Fe} + 3\text{CO}_2$   
*allow  $\text{Fe}_2 / \text{Fe}_4$  as ecf* 1
- (b) **Pure Iron**
- (in pure metal all the atoms are the same size and) able to slip / slide over each other – (property soft)  
*OWTTE*  
*ignore references to molecules / particles*  
*if they say 'move' both times, allow **one** mark but 'crack' or 'split' is wrong..* 1
- Cast iron**
- (in cast iron) different sized atoms / larger atoms **or** structure is distorted / disrupted  
*OWTTE* 1
- so it is difficult for layers of atoms to slip / slide over each other  
*OWTTE* 1
- (c) any **three** from:
- conserves / saves resources / metal ores
  - saves energy resources (used for extraction / processing)  
*accept cheaper / saves money*
  - decreases waste materials
  - decreases a named pollution  
*do not accept acid rain*
- 3

[10]