AQA GCSE Chemistry

Quantitative chemistry mark scheme · goes with “Quantitative chemistry · Higher tier” · whiteboardchemistry.com/revision/gcse-chemistry/exam-questions

Mark schemes

Quantitative chemistry · Higher tier · 5 questions

Q1 · June 2023 · Paper 1 Higher · Q10 · [8 marks]

10.1

allow converse arguments for fine particles

(nanoparticles)

any **two** from:

- have a higher surface area to volume ratio
- less (material) needed (for the same effect)
- more light gets through

allow a thinner coating is needed

[2 marks]

10.2

(M_r TiO_2 =) 80

(conversion 100 kg =) 100 000

(g)

(moles TiO_2= $\frac{100\,000}{80}$ =)

1250

allow correct use of an incorrectly determined M_r

allow correct use of an incorrect / no conversion of mass

(moles Cl_2 = 1250 × 2 =) 2500

allow correct use of an incorrectly determined number of moles of TiO_2

(volume Cl_2 =) 2500 x 24

allow correct use of an incorrectly determined number of moles of Cl_2

= 60 000 (dm^3)

[6 marks]

Q2 · June 2024 · Paper 1 Higher · Q7 · [15 marks]

07.1

(thermal) energy is transferred

allow heat is transferred

by delocalised electrons

[2 marks]

07.2

allow (positive / metal) ions for atoms throughout

(the alloy / mixture has) different sized atoms

(so the) layers are distorted

(so the) layers cannot easily slide

allow (so the) atoms cannot slide over each other

[3 marks]

07.3

$2Fe + 3Cl_2 \rightarrow 2FeCl_3$

[1 mark]

07.4

1 Fe^{2+} : 2 Fe^{3+} : 4 O^{2-}

[1 mark]

07.5

(M_r Fe_3O_4 =) 232

(% Fe =) $\frac{3 \times 56}{232} \times 100$

allow $\frac{168}{232} \times 100$

allow correct use of an incorrectly determined M_r using the values of A_r given in the question

= 72.4 (%)

allow 72.41379 correctly rounded to at least 2 significant figures

[3 marks]

07.6

a maximum of 4 marks can be awarded for a method which determines and uses the volume of iron oxide as a gas

(40.0 kg =) 40000 (g)

(moles $Fe_2O_3 = \frac{40\,000}{160}$ =) 250

allow correct use of an incorrectly converted or unconverted mass

(moles $CO_2 = 250 \times \frac{3}{2}$ =) 375

allow correct use of an incorrectly determined number of moles of Fe_2O_3

(volume of CO_2 =) 375 × 24

allow correct use of an incorrectly determined number of moles of CO_2

= 9000 (dm^3)

[5 marks]

Q3 · June 2025 · Paper 1 Foundation · Q10 · Paper 1 Higher · Q3 · [11 marks]

10.1

(substance reduced)

SnO_2

allow tin oxide

(reason)

(SnO_2) loses oxygen

allow (tin oxide) loses oxygen

MP2 is dependent upon MP1 being awarded

[2 marks]

10.2

carbon is more reactive than tin

allow tin is less reactive than carbon

[1 mark]

10.3

(total M_r = 128 + 12 =) 140

allow (total M_r = 112 + 12 + 16

=) 140

(% atom economy =)

(112)/(140) ×100

allow correct use of an incorrectly determined total M_r

= 80 (%)

[3 marks]

10.4

allow the converse for potassium

allow the transition metal for tungsten

allow the Group 1 metal for potassium

ignore references to atomic structure

any **two** from:

tungsten

- has a higher melting / boiling point
- is denser
- is harder

allow is less malleable / ductile

- is stronger
- is less reactive

allow specific reactions showing difference in reactivity

- has ions with different charges
- forms coloured compounds
- can be a catalyst

[2 marks]

10.5

(sum of relative formula masses on left hand side =)

232 + (3 × 2) = 238

allow (sum of relative formula masses on left hand side =)

232 + 6 = 238

(is equal to sum of relative formula masses on right hand side =)

184 + (3 × 18) = 238

allow (is equal to sum of relative formula masses on right hand side =)

184 + 54 = 238

if no other mark awarded,

*allow **1** mark for 232 + 6 = 184 + 54*

or

*allow **1** mark for both sides = 238*

[2 marks]

10.6

for sustainable development

allow to minimise use of limited resources

allow to minimise use of energy

allow to minimise waste

or

for economic reasons

ignore references to yield

[1 mark]

Q4 · June 2025 · Paper 1 Higher · Q9 · [11 marks]

09.1

Level 3 (5–6 marks): The method would lead to the production of a valid outcome. The key steps are identified and logically sequenced.

Level 2 (3–4 marks): The method would not necessarily lead to a valid outcome. Most steps are identified, but the method is not fully logically sequenced.

Level 1 (1–2 marks): The method would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear.

No relevant content (0 marks)

Indicative content

dissolve iodine in ethanol

- in a beaker

add zinc to iodine solution

- stir

continue adding until zinc is in excess

- shown by solid remaining

filter (the reaction mixture)

- to remove the excess zinc

heat the solution

- using a water bath **or** using an electric heater
- to evaporate off some of the ethanol
- cool / leave remaining solution to crystallise

[6 marks]

09.2

(moles I_2 = (6.35)/(254) =) 0.025

(moles ZnI_2 = 0.025

theoretical mass ZnI_2 = 0.025 × 319 =)

7.975 (g)

allow (moles Zn = 0.025

mass of Zn = 0.025 × 65 = 1.625 g theoretical mass ZnI_2 = 1.625 + 6.35 =) 7.975 (g)

allow correct use of an incorrectly determined number of moles of I_2

(% yield =) (6.29)/(7.975) × 100

allow correct use of an incorrectly determined theoretical mass of ZnI_2

= 78.871 (%)

= 78.9 (%)

allow an answer correctly rounded to 3 significant figures from an incorrect calculation which uses both mass values in the question

alternative approach 1:

(moles I_2 = (6.35)/(254) =) 0.025 (1)

(moles ZnI_2 =

(6.29)/(319) =) 0.019717868 (1)

(% yield =)

(0.019717868)/(0.025) × 100 (1)

allow correct use of an incorrectly determined number of moles of I_2 and/or ZnI_2

= 78.871 (%) (1)

= 78.9 (%) (1)

allow an answer correctly rounded to 3 significant figures from an incorrect calculation which uses both mass values in the question

alternative approach 2:

(moles ZnI_2 =

(6.29)/(319) =) 0.019717868 (1)

(moles I_2 reacted = 0.019717868

mass I_2 reacted = 0.019717868 × 254 =)

5.0083 (g) (1)

allow correct use of an incorrectly determined number of moles of ZnI_2

(% yield =) (5.0083)/(6.35) × 100 (1)

allow correct use of an incorrectly determined mass of I_2 reacted

= 78.871 (%) (1)

= 78.9 (%) (1)

allow an answer correctly rounded to 3 significant figures from an incorrect calculation which uses both mass values in the question

[5 marks]

Q5 · November 2021 · Paper 1 Foundation · Q10 · Paper 1 Higher · Q3 · [10 marks]

10.1

(3 × M_r H_2O = 3 × (2 + 16) =) 54

(A_r R = 150 – 54 =) 96

ignore units

alternative approach:

(M_r RO_3 = 150 – 6 =) 144 (1)

(A_r R = 144 – (3 × 16) =) 96 (1)

ignore units

[2 marks]

10.2

(R =) molybdenum / Mo

allow ecf from question 10.1

[1 mark]

10.3

(total M_r of reactants) = 163

(% atom economy =) (119)/(163) (×100)

allow correct use of an incorrectly calculated value of total M_r

= 73 (%)

allow 73.00613 (%) correctly rounded to at least 2 significant figures

[3 marks]

10.4

Level 2 (3–4 marks): Some logically linked reasons are given. There may also be a simple judgement.

Level 1 (1–2 marks): Relevant points are made. They are not logically linked.

No relevant content (0 marks)

Indicative content

- carbon and iron are the cheapest reactants
- hydrogen is the most expensive reactant
- separating solid products is expensive
- separating solid products is time consuming
- in method 1, tungsten needs to be separated from tungsten carbide
- in method 1, some tungsten is lost as tungsten carbide
- in method 1, the carbon dioxide produced will escape
- in method 2, the water vapour produced will escape
- in method 2, no separation of solids is needed
- in method 3, tungsten needs to be separated from iron oxide

[4 marks]

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