

- M1.(a)** Mass of mineral on x -axis;
If axes unlabelled use data to decide if mass of mineral is on the x -axis. 1
- Sensible continuous scales;
*Lose this mark if the **plotted points** do not cover at least 9 squares by 7.*
Lose this mark if the graph plot goes off the squared paper.
The graph does not have to start at the origin. 1
- Plots points correctly \pm one square;
Award this mark if the line is close to your line. 1
- Draws a best fit straight line
Award this mark if best fit line is consistent with candidate's plotted points.
Lose this mark if line is kinked or doubled. 1
- (b) 1.48 or 1.49 or 1.50 or 1.5 (g);
*Accept these answers **only***
Ignore precision of answer.
Allow range 1.48 – 1.5 1
- (c) 0.0124 (mol);
Accept 0.012, 0.0125.
Allow answer without working. 1
- (d) $(1.49 / 0.0124) = 119.4 - 125.0$;
Must divide answer to part (b) by answer to part (c) to score first mark.

*Allow consequential answer from part (b).
Allow answer without working.
Ignore precision of answer.*

1

- (e) Answer to part (e) close to 120.3;
*Allow consequential answer from part (d).
Allow correct calculation of x*

1

- (f) \underline{x} must be a whole number;

1

- (g) Good / straight line so results good / reliable;
*Allow consequential answers from candidate's graph
Do not allow 'so results are accurate'.*

1

Anomaly at 1.34 g;
Allow anomaly clearly indicated on the graph.

1

- (h) Ensure reaction / decomposition goes to completion;
*Do not allow 'to make fair test' or 'improve reliability'
Accept to 'remove all carbon dioxide and water'.*

1

- (i) (i) Percentage errors too high / errors in weighing too high;
*Do not allow 'to make fair test' or 'improve reliability'
Do not allow 'errors' on its own.*

1

- (ii) Incomplete decomposition or words to that effect;
*Do not allow 'to make fair test' or 'improve reliability'
Do not allow 'takes too long' or 'wastes chemicals'
Do not allow 'not all of the water removed'.*

1

- (j) $39.05 / 18 = 2.170$ and $60.95 / 84.3 = 0.723$;
 Allow M_r of $MgCO_3 \cdot H_2O = 138.3$

1

$MgCO_3 \cdot 3H_2O$;

$54 / 138.3 = 39.05\%$

$MgCO_3 \cdot 3H_2O$ without working scores 1 mark.

1

- (k) Atom economy for Reaction 1 is $(40.3 / 84.3) \times 100 = 47.8\%$
 Maximum 1 mark if no working.
 Ignore precision of answers.

1

Atom economy for Reaction 2 is $(40.3 / 58.3) \times 100 = 69.1\%$

1

- (l) No gas produced in stomach / won't cause wind;
 Do not allow 'gas produced' on its own.

1

[19]

M2.

Mark Range	<p>The marking scheme for this part of the question includes an overall assessment for the Quality of Written Communication (QWC). There are no discrete marks for the assessment of QWC but the candidates' QWC in this answer will be one of the criteria used to assign a level and award the marks for this part of the question</p> <p style="text-align: center;">Descriptor</p> <p>an answer will be expected to meet most of the criteria in the level descriptor</p>
4-5	<ul style="list-style-type: none"> — claims supported by an appropriate range of evidence — good use of information or ideas about chemistry, going beyond those given in the question

	<ul style="list-style-type: none"> - argument well structured with minimal repetition or irrelevant points - accurate and clear expression of ideas with only minor errors of grammar, punctuation and spelling
2-3	<ul style="list-style-type: none"> - claims partially supported by evidence - good use of information or ideas about chemistry given in the question but limited beyond this - the argument shows some attempt at structure - the ideas are expressed with reasonable clarity but with a few errors of grammar, punctuation and spelling
0-1	<ul style="list-style-type: none"> - valid points but not clearly linked to an argument structure - limited use of information or ideas about chemistry - unstructured - errors in spelling, punctuation and grammar or lack of fluency

- (a) (i) M_r of $C_6H_5NH_2 = 93$ M_r of $CH_3COCl = 78.5$
total M_r of reagents = 264.5

1

$$\% \text{ atom economy} = \frac{M_r \text{ of wanted product}}{\text{total } M_r \text{ of all reagents}} \times 100 \text{ QWC}$$

1

$$= \frac{135}{264.5} \times 100 = 51.0 \%$$

1

(ii) expected yield = $\frac{10}{93} \times 0.5 \times 135 = 7.26 \text{ kg}$

1

$$\% \text{ yield} = \frac{5.38}{7.26} \times 100 = 74.1 \%$$

1

- (iii) Although yield appears satisfactory (74%) % atom economy is only 51% QWC

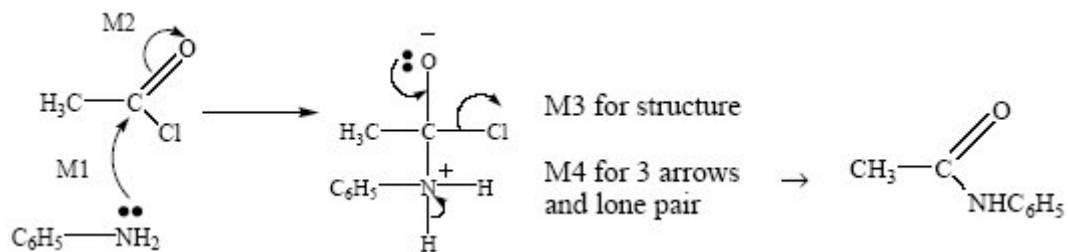
1

nearly half of the material produced is waste and must be disposed of QWC

1

(b) (nucleophilic) addition-elimination

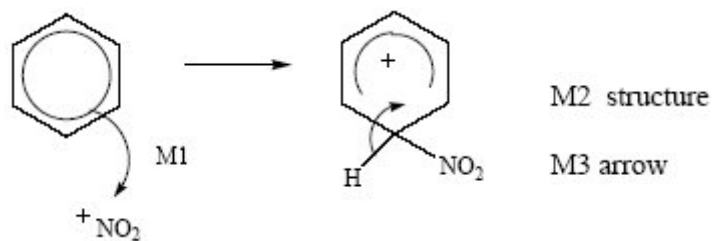
1



4

(c) $\text{HNO}_3 + 2\text{H}_2\text{SO}_4 \rightarrow \text{NO}_2^+ + \text{H}_3\text{O}^+ + 2\text{HSO}_4^-$

1



3

[16]

M3. (a) (i) 0.013;

1

(ii) 0.0065;
Answer to (i) ÷ 2

1

(iii) $\frac{0.548}{0.0065} = 84.3;$
Allow 0.548 ÷ answer to (ii)
Allow 84.1 – 84.4

1

(b) $84.3 - 60 = 24.3;$
1 mark for -60

1

Mg;

If 147.6 used the answer is 87.6 (1)
 And this is Sr (1)

Allow consequential metal from their calculated A
Answer has got to be a metal to score M2

1

[5]

M4. (a) (i) $\frac{79.9}{225.9} \times 100;$
Whole expression
Ignore >3 sig figs

1

$= 35.37(\%)$ allow 35.0 – 35.4%;
Allow 35%
Allow 2 marks if correct %

1

(ii) Sell the HCl or sell the other product or sell the acid (formed in the reaction);

Need a financial gain

1

(b) (i) $\frac{165}{189.9} = 0.869;$
One mark for $M_r = 189.9$

allow 0.86 – 0.87;;
Ignore units

2

(ii) 0.869
Accept same value as in (i)

1

(iii) $0.869 \times 79.9 = 69.4$;
Allow 68.7 – 70;
Accept answer to (ii) $\times 79.9$

1

(iv) $\frac{63}{69.4} \times 100$;
Accept 63×100 /answer to (iii)

= 90.75%;
If > 100% lose this mark

Accept 90.6 to 92%

1

[8]