

- 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.B

[1]

- M3.** (a) Proton: mass 1, charge + 1 (1)
Neutron: mass 1, charge 0 (1)
Electron mass 1/1840, charge -1 (1)

Allow mass = 0, or negligible, or 1/1800 to 1/2000

Isotopes have the same number of protons (1)

OR atomic number

different number of neutrons (1)

Isotopes have the same electronic configuration (1)

OR same number of electrons

Chemical properties depend on electrons **(1)**

7

(b)
$$\frac{\text{average(1) mass of an atom/isotopes}}{\text{mass of 1 atom of } ^{12}\text{C}} \times 12 \text{ (1)}$$

$$\text{OR } \frac{\text{mass of 1 mol of atoms}}{\text{mass of 1 atom of } ^{12}\text{C}} \times 12 \text{ or in words}$$

Spectrum gives (relative) abundance **(1)**

OR % or amount

And m/z **(1)**

Multiply m/z by relative abundance for each isotope **(1)**

Allow instead of m/z mass no, A , or actual value from example

Sum these values **(1)**

Divide by the sum of the relative abundances **(1)**

only award this mark if previous 2 given

Max 2 if e.g. has only 2 isotopes

7

[14]