**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 ± 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.*

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*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 <u>and</u> 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 $MgCO_3.H_2O$ = 138.3*

**1**

$MgCO_3.3H_2O$;

  *54 / 138.3 + 39.05%*
  *$MgCO_3.3H_2O$ without working scores 1 mark.*

**1**

(k)    Atom economy for Reaction 1 is (40.3 / 84.3) x 100 = 47.8%

  *Maximum 1 mark if no working.*
  *Ignore precision of answers.*

**1**

Atom economy for Reaction 2 is (40.3 / 58.3) x 100 = 69.1%

**1**

(l)    No gas produced <u>in stomach</u> / 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)**

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*OR same number of electrons*

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

**7**

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

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

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$_r$ 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]**