M1.(a) (i) Volume of crater-lake solution on x-axis

Do not penalise missing axes labels.

If axes unlabelled use data to decide.

Lose this mark if axes mis-labelled.

1

Sensible scales

*Lose this mark if **plotted points** do not cover at least half the paper or plot goes off the squared paper.*

1

All points plotted correctly +/– one square

1

(ii) Draws appropriate line of best fit, omitting point at 20 cm^3 / 15 cm^3

Lose this mark if the line deviated towards the anomalous result.

Lose this mark if the candidate's line is doubled or kinked.

Candidate does not have to extrapolate to the origin.

1

(iii) 16.5 cm^3 +/– 0.5 cm^3

Accept this answer only.

Do not mark consequentially on candidate's graph.

1

(iv) Value corresponding to 10 cm^3 crater-lake solution / 6.00 cm^3

Must have correct identity for explanation mark.

Accept results aren't concordant.

1

Greatest % error from use of burette

Accept difficult to be accurate with small volumes (owtte).

1

(b) (i) $pV = nRT$

Accept any correct rearrangement.

Ignore case.

1

(ii) $V = 81.0 \times 10^{-6}$ or 8.1×10^{-5}

1

$n = (1 \times 10^{5} \times 81.0 \times 10^{-6}) / (8.31 \times 298)$

Mark consequentially on candidate's volume.

1

$n = 3.27 \times 10^{-3}$ (mol)

Correct answer without working scores one mark only.

Allow consequential mark using incorrect conversion.

Incorrect units lose this mark.

1

(iii) M_r $CaCO_3$ = 100.1 (M1)

Accept 100 (can score this mark in calculation for M2 and M3).

1

Moles $CaCO_3 = (3.27 \times 10^{-3} \times 10) = 3.27 \times 10^{-2}$ (M2)

Do not penalise lack of units.

Allow b(ii) × 10

Allow $1.25 \times 10^{-3} \times 10$

1

Mass $CaCO_3$ = M1 × M2 (= 3.27 g)

Correct mass without working scores one mark only.

Allow $1.25 \times 10^{-2} \times 10 \times 100.1 = 12.5$ g

1

(iv) $(3.27 / 95) \times 100$

Accept (b(iii) / 95) × 100.
Do not penalise precision.

1

3.44 g

Do not penalise lack of units.
Using 12.5 g gives 13.2 g
Correct answer without working scores 2 marks.

1

(v) Abundant / readily available

Accept not caustic or alkaline.

Non-corrosive

Accept insoluble so safe to add in excess (owtte).

1

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M2.(a) (ligand) substitution

Allow 'ligand exchange'.

1

(b) To displace the equilibrium to the right

To ensure reaction goes to completion.

1

To improve the yield

Allow 'to replace all chlorines'.

1

(c) (i) $K_2PtCl_4 + 4KI \rightarrow K_2PtI_4 + 4KCl$

Allow correct ionic equations $PtCl_4^{2-} + 4I^- \rightarrow PtI_4^{2-} + 4Cl^-$

Allow multiples and fractions.

1

(ii) = (780.9) ×100 / (415.3 + 664)

Working must be clearly shown.

Allow one mark for correct relationship even if M_r values are incorrect eg using values from ionic equation.

1

= 72.4

Allow 72%

1

(d) (i) $Ag^+ + I^- \rightarrow AgI$

Ignore state symbols even if incorrect.

This equation only.

1

(ii) Stops the reverse reaction / equilibrium displaced to the right

1

(e) Number of steps in the process

Allow 'equilibrium may lie on the reactant side' / side reactions / isomer formation.

1

Losses at each stage of the synthesis

Equilibrium losses or practical losses or yield not 100% for each step.

1

(f) Minimum amount of hot solvent

Accept 'small' for minimum.

Accept water.

1

Cool / crystallise

1

Filter

1

(g) (i) Small amounts are more likely to kill cancer cells rather than the patient

1

(ii) Wear gloves / wash hands after use

Ignore masks.

Apply the list principle if more than one answer.

1

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M3. (a) (i) M_r MgO = 40.3

If used 40 then penalise this mark but allow consequential M2 (0.0185)

1

0.741/40.3 = 0.0184

0.018 with no M_r shown = 0

Penalise if not 3 sig figs in this clip only

1

(ii) 0.0184 × 5/2 = 0.0460

Allow 0.0459 to 0.0463

Allow their (a)(i) × 5/2 ie allow process mark of × 5/2 but insist on a correct answer being written down

Ignore sig figs

1

(b) pV = nRT

1

$$(V = \frac{0.402 \times 8.31 \times 333)}{100\,000})$$

If rearranged incorrectly then lose M1

If this expression correct then candidate has scored first mark

0.0111

1

Ignore units

11.1 (dm^3)

3 marks for 11.1 (dm^3)
However if 11.1 m^3 or cm^3 allow 2 (ie penalise wrong units in final answer)
Ignore sig figs- but must be 2 sig figs or greater

1

(c) (i) 0.0152 × 2 = 0.0304

Allow 0.03

1

(ii) 0.938 mol dm^{-3}

Allow range 0.92 – 0.94
Minimum 2 sig figs
Allow consequential marking from (c)(i)
Ignore units even if wrong

1

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