

Accept multiples.

Ignore state symbols, even if incorrect.

1

- (b) Hazard acid corrosive **or**
hydrogen flammable / explosive

Accept 'iron(II) sulfate / sulfuric acid an irritant'.

1

- Precaution gloves or eye protection **or**
avoid naked flames / spark

*Allow 'if reagent contacts skin wash off immediately' or
answers to that effect instead of gloves.*

Do not allow 'wipe up spillages'.

*Ignore 'lab coat' or 'use of fume cupboard' or 'do not ingest
chemicals'.*

1

[3]

- M2.** (a) (i) $M_r \text{MgO} = 40.3$

*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) $0.0184 \times \frac{5}{2} = 0.0460$

Allow 0.0459 to 0.0463

*Allow their (a)(i) $\times \frac{5}{2}$ ie allow process mark of $\times \frac{5}{2}$ 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 (dm³) 1

*3 marks for 11.1 (dm³)
However if 11.1 m³ or cm³ allow 2 (ie penalise wrong units in final answer)
Ignore sig figs- but must be 2 sig figs or greater*

(c) (i) $0.0152 \times 2 = 0.0304$ 1
Allow 0.03

(ii) $0.938 \text{ mol dm}^{-3}$ 1
*Allow range 0.92 – 0.94
Minimum 2 sig figs
Allow consequential marking from (c)(i)
Ignore units even if wrong*

[8]

M3.(a) Any **two** from:

Weigh by difference or rinse weighing bottle and add to beaker

Rinse beaker and add washings to graduated flask

Invert flask several times to ensure uniform solution

Use a funnel to transfer to the flask and rinse the funnel

Use a stirrer to prepare the solution and rinse the stirrer
If more than two answers apply the list rule.

Max 2

(b) $K_a = [H^+]^2 / [HA]$

Allow any correct expression relating K_a , $[H^+]$ and $[HA]$

1

$$[HA] = (10^{-2.50})^2 / 1.07 \times 10^{-3}$$

M2 also scores M1

1

$$= 9.35 \times 10^{-3} \text{ (mol dm}^{-3}\text{)}$$

Do not allow 9.4 (answer is 9.346).

Correct answer only scores 1 mark.

Do not penalise precision but must be to at least two significant figures.

1

(c) $(b) \times 138.0 / 4$

1

$$= 0.322$$

Using 8.50×10^{-3} gives 0.293

Correct answer scores M1 and M2.

Do not penalise precision but must be to at least two significant figures.

1

(d) $(c) \times 100 / 0.500 = 64.5\%$

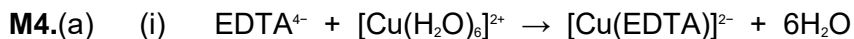
Using 0.293 from (c) gives 58.7%

Using 0.347 gives 69.4%

Do not penalise precision.

1

[8]



1

(ii) (Mol EDTA = $(6.45/1000) \times 0.015 = 9.68 \times 10^{-5}$ mol Cu(II))

1

Conc. Cu(II) = $((9.68 \times 10^{-5}) / 0.025 =) 0.00387 \text{ mol dm}^{-3}$

Correct answer without working gains M2 only.

1

- (b) Samples may not be consistent throughout the river
OR
Concentration may vary over time

Ignore comments on technique.

1



Accept name eg diamminesilver(I) ion.

1

aldehyde

Allow CHO.

1

[6]

M5.(a) Theoretical mass produced = $180 \times 2 / 138 = 2.61 \text{ g}$

Using $1.76 \times 100 / 2$ is a chemical error (CE), scores 0 / 2

1

Percentage yield = $1.76 \times 100 / 2.61 = 67.5\%$

Correct answer scores M1 and M2.

Accept 67.4%

Do not penalise precision but answers must be to at least two significant figures.

1

- (b) Crystals lost when filtering or washing / some aspirin stays in solution / other reactions occurring

Ignore references to impurities.

1

[3]

M6.

- (a) (i) 0.0212

Need 3 sig figs

Allow correct answer to 3 sig figs eg 2.12×10^{-2}

1

- (ii) 0.0106

Mark is for (a)(i) divided by 2 leading to correct answer 2 sig figs

1

- (iii) $M_r = \underline{100.1}$

1.06 g

Allow 100.1 as 'string'

Need 3 sig figs or more

Consequential on (a)(ii) $\times 100(.1)$

2

- (iv) Neutralisation or acid / base reaction

Allow acid / alkali reaction

Apply list principle

1

- (b) (i) $T = 304(K)$ and $P = 100\,000 (Pa)$

Only T and P correctly converted

1

$$\frac{100\,000 \times 3.50 \times 10^{-3}}{8.31 \times 304} \text{ OR } n = \frac{PV}{RT}$$

1

0.139 (mol)

Allow 0.138 – 0.139

1

(ii) $0.0276 - 0.0278(\text{mol})$

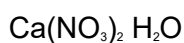
Allow answer to (b)(i) divided by 5 leading to a correct answer

Allow 0.028

1

(c) $4.20 \text{ g Ca(NO}_3)_2$

1



$$\frac{4.20}{164(.1)} \quad \frac{1.84}{18}$$

*Mark is for dividing by the correct Mr values
M2 and M3 dependent on correct M1*

$0.0256 \quad 0.102$

M2 can be awarded here instead

$1 \quad :$

$x = 4$

*If $\text{Ca(NO}_3)_2 \cdot 4\text{H}_2\text{O}$ seen with working then award 3 marks
Credit alternative method which gives $x = 4$*

1

[12]

M7.(a) $\text{Mol Pb} = 8.14 / 207(.2) (= 0.0393 \text{ mol})$

M1 and M2 are process marks

1

$\text{Mol HNO}_3 = 0.0393 \times 8 / 3 = 0.105 \text{ mol}$

Allow mark for $M1 \times 8/3$ or $M1 \times 2.67$

1

$\text{Vol HNO}_3 = 0.105 / 2 = 0.0524 \text{ (dm}^3\text{)}$

Accept range 0.0520 to 0.0530

No consequential marking for M3
Answer to 3 sig figs required

1

- (b) 101000 (Pa) and $638 \times 10^{-6} \text{ (m}^3\text{)}$

1

$$n = \frac{pV}{RT} \quad \left(= \frac{101000 \times 638 \times 10^{-6}}{298} \right) \quad \left(8.31 \times \right)$$

Can score M2 with incorrect conversion of p and V
If T incorrect lose M1 and M3

1

0.026(0) (mol)

If answer correct then award 3 marks
Allow answers to 2 sig figs or more
 $26.02 = 1$
If transcription error lose M3 only

1

- (c) (i) $2\text{Pb(NO}_3)_2(\text{s}) \rightarrow 2\text{PbO}(\text{s}) + 4\text{NO}_2(\text{g}) + (1)\text{O}_2(\text{g})$

Allow multiples
Allow fractions

1

- (ii) Decomposition not complete / side reactions / by-products / some (NO_2) escapes / not all reacts / impure $\text{Pb(NO}_3)_2$

Ignore reversible / not heated enough / slow

1

- (iii) Hard to separate O_2 from NO_2 / hard to separate the 2 gases

Allow mixture of gases
Not 'all products are gases'

1

[9]