M1.(a) $[Fe(H_2O)_6]^{2+} + 2NH_3 \rightarrow Fe(H_2O)_4(OH)_2 + 2NH_4^+$

Allow equation with OH^- provided equation showing formation of OH^- from NH_3 given

1

Green precipitate

1

$[Fe(H_2O)_6]^{2+} + CO_3^{2-} \rightarrow FeCO_3 + 6H_2O$

1

Green precipitate

effervescence incorrect so loses M4

1

(b) (i) Colourless / (pale) green changes to pink / purple (solution)

Do not allow pale pink to purple

1

Just after the end−point MnO_4^- is in excess / present

1

(ii) $MnO_4^- + 8H^+ + 5Fe^{2+} \rightarrow Mn^{2+} + 4H_2O + 5Fe^{3+}$

1

Moles $KMnO_4 = 18.7 \times 0.0205 / 1000 = (3.8335 \times 10^{-4})$

Process mark

1

Moles $Fe^{2+} = 5 \times 3.8335 \times 10^{-4} = 1.91675 \times 10^{-3}$

Mark for M2 × 5

1

Moles Fe^{2+} in 250 $cm^3 = 10 \times 1.91675 \times 10^{-3} = 0.0191675$ moles in 50 cm^3

Process mark for moles of iron in titration (M3) × 10

1

Original conc $Fe^{2+} = 0.0191675 \times 1000 / 50 = 0.383$ $\underline{\text{mol dm}^{-3}}$

Answer for moles of iron (M4) × 1000 / 50

Answer must be to at least 2 sig. figs. (0.38)

1

[11]

M2.A

[1]

M3.(a) (i) M_r N−phenylethanamide = 135.0

1

Theoretical yield = 135.0 × 2 (1.15 / 284.1) = 1.09 g

1

Answer recorded to 3 significant figures.

1

(ii) $\frac{0.89}{\text{Ans to (a)}} \times 100$

= 81.4 %

Mark consequentially to (a)
Allow 81 to 82

1

(b) (i) Dissolve the product in the **minimum** volume of water / solvent (in a boiling tube / beaker)

If dissolving is not mentioned, CE = 0 / 4

1

Hot water / solvent

Steps must be in a logical order to score all 4 marks

1

Allow the solution to cool and allow crystals to form.

1

Filter off the pure product under reduced pressure / using a Buchner funnel and side arm flask

Ignore source of vacuum for filtration (electric pump, water pump, etc.)

1

(ii) Measure the melting point

1

Use of melting point apparatus or oil bath

1

Sharp melting point / melting point matches data source value

1

(iii) Any **two** from:
Product left in the beaker or glassware
Sample was still wet

Sample lost during recrystallisation.

Do not allow "sample lost" without clarification.

2 Max

(c) An identified hazard of ethanoyl chloride

E.g. "Violent reaction", "harmful", "reacts violently with water"
Do not allow "toxic", "irritant" (unless linked with HCl gas).

1

HCl gas / fumes released / HCl not released when ethanoic anhydride used

1

[15]

M4. Pipette = 0.05 × 100 / **25.0** = 0.2%

Ignore precision

1

Burette = 0.15 × 100 / 24.25 cm^3

Must show working
Allow one mark for two correct answers with no working

1

[2]

M5.(a) As a droplet from the funnel could enter the burette / affect volume / readings / titre

1

(b) Air bubble in jet or wtte

Do not allow misreading burette or overshooting end point.

1

(c) Ensures **all** reagents are able to react / mix / come into contact

Accept no reagent is left unreacted on sides of flask
Do not allow any reference to 'removal' of the solution unless it is clear that it is added to the flask.

1

(d) The added water does not affect the mols / amount of reagents / reactants / solution Z

Do not allow mols of solution or mols in the flask.

Allow water does not react with the reagents / water is not one of the reactants

Do not allow 'water is not involved'

1

[4]