M1.(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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M2.(a) sulfuric acid / H_2SO_4

1

(b) hydriodic acid / HI **OR** hydrobromic acid / HBr

1

(c) add **dilute** ammonia solution

Notes
* *do not allow 'concentrated ammonia' or 'ammonia'*

1

precipitate / ppt disappears / dissolves **OR** colourless solution forms

1

(d) would react with the acid / no gas evolved in tests

1

[5]

M3.

Mark Range	The marking scheme for this part of the question includes an overall assessment for the Quality of Written Communication (QWC). There are no discrete marks for the assessment of QWC but the candidates' QWC in this answer will be one of the criteria used to assign a level and award the marks for this part of the question **Descriptor** an answer will be expected to meet most of the criteria in the level descriptor
4-5	– claims supported by an appropriate range of evidence – good use of information or ideas about chemistry, going beyond those given in the question – argument well structured with minimal repetition or irrelevant points – accurate and clear expression of ideas with only minor errors of grammar, punctuation and spelling
2-3	– claims partially supported by evidence – good use of information or ideas about chemistry given in the

	question but limited beyond this – the argument shows some attempt at structure – the ideas are expressed with reasonable clarity but with a few errors of grammar, punctuation and spelling
0-1	– valid points but not clearly linked to an argument structure – limited use of information or ideas about chemistry – unstructured – errors in spelling, punctuation and grammar or lack of fluency

(a) Kills bacteria / prevents bacterial diseases QWC **1**

Chlorine is a toxic substance **1**

$Cl_2 + H_2O \rightarrow HCl + HClO$ **1**

(b) $Cl_2(aq)$ to $Br^-(aq)$; yellow-orange or yellow-red or QWC yellow-brown solution **1**

$2Br^- + Cl_2 \rightarrow 2Cl^- + Br_2$ or molecular equation **1**

$Cl_2(aq)$ to $I^-(aq)$; brown/black solution formed or QWC black/brown/grey ppt/solid **1**

$2I^- + Cl_2 \rightarrow 2Cl^- + I_2$

or molecular equation **1**

(c) Bromide: Brown/orange fumes **1**

Bromine produced **1**

Sulphur dioxide produced **1**

Iodide: Purple fumes or black/brown/grey solid QWC

or smell of bad eggs

1

Iodine produced

1

SO_2, S, H_2S produced (one mark each)

3

Half-equations $2Br^- \rightarrow Br_2 + 2e^-$1
OR $2I^- \rightarrow I_2 + 2e^-$

1

$H_2SO_4 + 2e^- + 2H^+ \rightarrow SO_2 + 4H_2O$
OR $H_2SO_4 + 6e^- + 6H^+ \rightarrow S + 4H_2O$
OR $H_2SO_4 + 8e^- + 8H^+ \rightarrow H_2S + 4H_2O$

1

Overall equation Any correct equation based on half-equations QWC

1

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