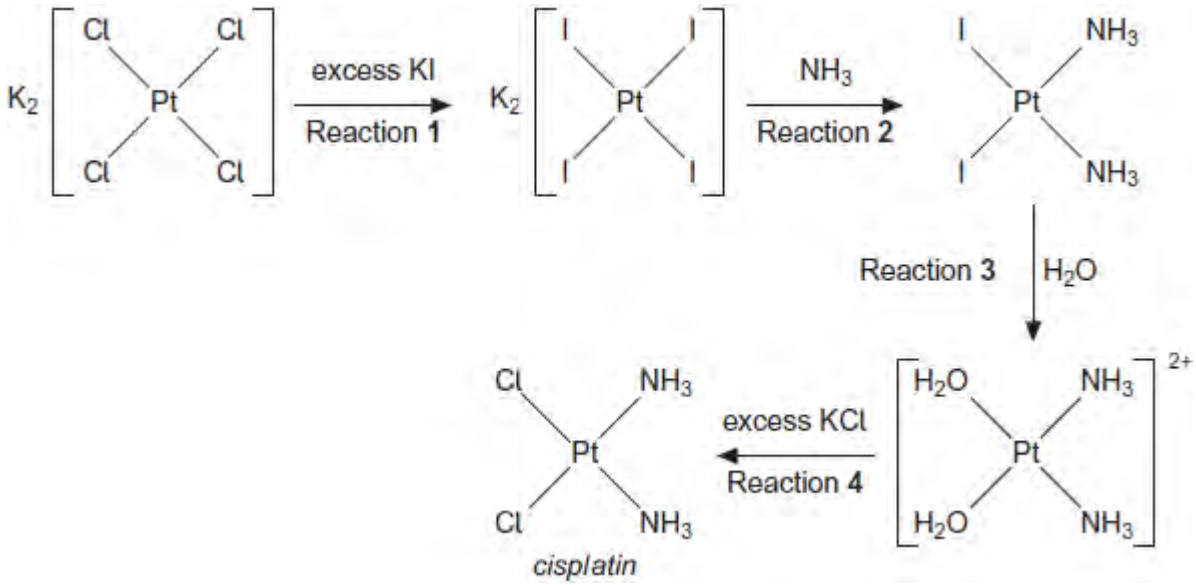
Q1. Complexes containing transition elements have a wide variety of uses including acting as dyestuffs like *Prussian Blue*.

Cisplatin is a platinum-based chemotherapy drug used to treat various types of cancers. It was the first member of a class of anti-cancer drugs that react with DNA in tumour cells.

Cisplatin is prepared from K_2PtCl_4 according to the following scheme.

All the reactions shown are reversible.



(a) Name the type of reaction occurring in all four steps of the scheme.

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(1)

(b) Explain why an excess of potassium iodide is used in Reaction **1**.

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.....

(2)

(c) (i) Write an equation for Reaction **1**.

.....

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(1)

(ii) Calculate the percentage atom economy for the formation of K_2PtI_4 in Reaction **1**.
Show your working.

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(2)

(d) In Reaction **3**, silver nitrate solution is added to improve the yield of product.

(i) Write the **simplest ionic** equation for the reaction of iodide ions with silver nitrate.

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(1)

(ii) Suggest why addition of silver nitrate improves the yield of product from Reaction **3**.

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(1)

(e) Suggest two reasons, other than poor practical technique, why the overall yield of *cisplatin* in this synthesis may be low.

Reason 1 .....

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Reason 2 .....

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(2)

(f) The *cisplatin* formed in Reaction **4** is impure. Outline how the impure solid is purified

by recrystallisation.

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(3)

(g) Platinum compounds are highly toxic.

(i) State why *cisplatin* is used in cancer treatment despite its toxicity.

.....

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(1)

(ii) Suggest a suitable precaution that should be taken by medical staff when using *cisplatin*.

.....

(1)

(Total 15 marks)

Q2.A chemical company's records refer to the following acids

hydrochloric acid	nitric acid
hydrobromic acid	sulfuric acid
hydriodic acid	

A waste tank was thought to contain a mixture of two of these acids. A chemist performed test-tube reactions on separate samples from the waste tank. The results of these tests are shown below.

Test	Reagent	Observations
A	Barium chloride solution	White precipitate

B	Silver nitrate solution	White precipitate

(a) Use the result from Test **A** to identify an acid in the company's records which must be **present** in the waste tank.

.....

(1)

(b) Use the results from Test **A** and Test **B** to identify an acid in the company's records which must be **absent** from the waste tank.

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(1)

(c) The chemist suspected that the waste tank contained hydrochloric acid. State how the precipitate formed in Test **B** could be tested to confirm the presence of hydrochloric acid in the waste tank. State what you would observe.

Test .....

.....

Observation .....

.....

(2)

(d) Suggest one reason why carbonate ions could not be present in the waste tank.

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(1)
(Total 5 marks)

Q3. (a) In Peru, chlorine was removed from the water supply due to concerns about it reacting with organic chemicals in the water to produce toxic substances. This resulted in the death of ten thousand people due to cholera. The cholera epidemic ceased when chlorination of the water supply was restarted.

State why chlorine is added to the water supply and give a reason why the amount

of chlorine must be carefully monitored. Write an equation for the reaction of chlorine with water.

(3)

(b) How can the addition of an aqueous solution of chlorine be used to distinguish between aqueous solutions of sodium bromide and sodium iodide?

State any observations you would make and write equations for the reactions occurring.

(4)

(c) How can reactions with concentrated sulphuric acid be used to distinguish between solid samples of sodium bromide and sodium iodide?

State the observations you would make and give all the oxidation and reduction products formed in both reactions. Using half-equations, construct an overall equation for **one** of these redox reactions.

(11)
(Total 18 marks)