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| Year 12 Chemistry Lab 1  **Application of Le Chatelier's Principle** | | |
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| **Name:** | **Teacher:** | **Mark / 25** |
| **Comment:** | | |

Background

This experiment contains two activities concerning chemical equilibrium in aqueous solution. The purpose of the activities is to observe the effect of various changes on these equilibria and to determine whether the observed effects are those expected from an application of Le Chatelier’s Principle.

The two reactions to be investigated are:

* The chromate-dichromate equilibrium
* The equilibrium between hydrated cobalt ions and cobalt tetrachloride ions.

Pre lab (1 mark each)

1. What is the formula for potassium chromate?

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| K2CrO4 |  |

1. What colour is a solution with a high concentration of potassium chromate?

|  |  |
| --- | --- |
| yellow |  |

1. What is the formula for potassium dichromate?

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| --- | --- |
| K2Cr2O7 |  |

1. What colour is a solution with a high concentration of potassium dichromate.

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| --- | --- |
| Orange |  |

1. Write an equation to represent the equilibrium between chromate and dichromate in an acidified solution.

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| 2CrO42-(aq) + 2H+(aq) → Cr2O72-(aq) + H2O(l) |  |

1. What is the formula of hydrated Cobalt Chloride?

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| CoCl2.6H2O |  |

1. What is the colour of a solution containing hydrated cobalt chloride?

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| Pink |  |

1. This colour is due to the presence of which complex ion?

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| Co(H2O)62+ |  |

1. What is the colour of cobalt chloride when dissolved in hydrochloric acid? This colour is due to the presence of which ion?

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| Blue in hydrochloric acid  Colour is due to CoCl42- |  |

1. Write the equilibrium equation for the two ions mentioned in Q 8 and 9 when in the presence of hydrochloric acid.

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| Co(H2O)62+(aq) + 4Cl-(aq) ↔ CoCl42-(aq) + 6H2O(l) |  |

Pre Lab Mark /10

Equipment required

Four strips of Cobalt(II) chloride paper

Hydrochloric acid [HCI] 6 mol L-1 (5 mL)

Distilled water

Beaker (100 mL)

Dropper

Forceps or tweezers

Kettle

Beaker (250 mL)

**Procedure**

**Part A: The Chromate-Dichromate Equilibrium**

These chemicals are considered unsafe and so data must be collected from videos of similar experiments.

1. Observe the video.

* The starting solution is potassium dichromate to which sodium hydroxide is added.
* The secondary solution is potassium dichromate and sodium hydroxide to which hydrochloric acid is added.

2. Record your observations in a suitable table.

Assume there are two starting solutions, one is potassium dichromate (as per the video) and the other is potassium chromate.

**Part B The Equilibrium Between** Co(H2O)62+ **and CoCl42-.**

Safety Note

Concentrated hydrochloric acid is very corrosive and must be handled with extreme care. **If** any concentrated HCl comes in contact with your skin immediately wash it off with copious quantities of water.

1. Using the forceps place a piece of blue cobalt (II) chloride paper into a 100 mL beaker.

2. Add ONE drop of water to the blue paper. Record your observations.

3. Use the hot water from kettle and the 250 mL beaker to create a water-bath. Place the 100 mL beaker in the water bath.

4. To the same piece of paper add ONE drop of 6.0 mol.L-1 HCl in the fume-hood. Record your observations.

**Results (Use this space for suitable tables) (3 marks)**

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| Starting Solution | Change | Observation |
| K2Cr2O7 | OH- | yellow |
| K2CrO4 | H+ | Orange |

Only award marks for Part 1 table

-1 mark if no table for Part 2

Processing of results, and questions (3 marks each)

1. Use LCP to explain the observed colour change when NaOH solution is added to the K2Cr2O7 solution.

When NaOH solution is added to a HCl solution, the concentration of H+ ions is

reduced because of the neutralisation reaction H+(aq) + OH-(aq) -» H2O(l)

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| H+ + OH- → H20 ↓ [H+]  2CrO42- (yellow) + 2 H+ → Cr2O72- (orange) + H2O  Equilibrium shifts to yellow reactant (1) |  |

2. Use LCP to explain the observed colour change that occurred when HCl solution was added to the secondary solution of K2Cr2O7 to which NaOH had been added.

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| --- | --- |
| ↑[H+]  2CrO42- (yellow) + 2 H+ → Cr2O72- (orange) + H2O  Equilibrium shifts to favour orange product |  |

3. Explain the colour change that occurredwhen concentrated HCl was added to the solution containing the Co(H2O)62+ ion.

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| ↑[Cl-] Equilibrium shifts to favour product (blue) |  |

4. From your observations of the colour change that occurred when the solution containing the Co(H2O)62+ ion was heated predict whether the reaction, **as written on page 29 of STAWA**, is exothermic or endothermic.

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| + heat → Blue or product  ↑T favours forward reaction  hence forward reaction is endothermic |  |

Results Section / 15

**Total Lab Mark / 25**