**Le Chatelier and Cobalt Chloride**

When cobalt (2) chloride dissolves in water it establishes an equilibrium involving 2 differently coloured complex ions.

The two different coloured Co(2) complex ions, **[Co(H2O)6]2+** and **[CoCl4]2-**, exist together in equilibrium in solution in the presence of chloride ions according to the following equation:

**[Co(H2O)6]2+(aq) + 4Cl-(aq) ⇌ [CoCl4]2-(aq) + 6H2O(l)**

**Purpose**

* To determine the colour of the 2 complex ions
* To determine the original equilibrium position of the reaction i.e. which way does the aforementioned equilibrium lie

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| **Procedure** | **Colour of Solution** |
| **Control tt**   * add 20 drops of 0.1 M cobalt (2) chloride soln |  |
| **New tt**   * 20 drops of 0.1 M cobalt (2) chloride soln * Table salt * Heat in hot water bath 1-2 minutes |  |
| **Same tt**   * Cool in ice water bath for 1-2 minutes |  |
| **Same tt**   * Heat in hot water bath until the colour changes |  |
| **Same tt**   * Remove tt from hot water bath * Add 7 drops of 0.1 M silver nitrate soln * Gently swirl the tt to ensure good mixing |  |
| **Same tt**   * Reheat the same tt in the hot water bath until the colour changes |  |

**Analysis**

**1.** What is the identity of the white precipitate that formed in step 5? \_\_\_\_\_\_\_\_\_\_\_

BCE\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**2.** Why would adding silver nitrate solution affect the equilibrium, even though neither silver ions nor nitrate ions appear in the equilibrium equation?

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**3.** Which reaction would be favoured when heat energy is added? Explain.

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| **stress** |
| **want** |
| **shift** |

**4.** Should the addition of salt shift the equilibrium in the same direction as the addition of heat? Explain.

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| **stress** |
| **want** |
| **shift** |

**5.** Which rxn would be favoured by cooling the soln? Explain.

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| **stress** |
| **want** |
| **shift** |

**Conclusion**

**1)** What are the colours of the following ions:

[CoCl4]2- \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

[Co(H2O)6]2+ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**2)** Initially, before any stresses were applied to the system, what was the position of the equilibrium? Justify.

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