# Chapter Summary Worksheet

## Chapter 13
## Introduction to chemical equilibrium

Print out and complete this worksheet to generate a summary for Chapter 13.

**1** Pink hydrated cobalt(II) ions, $[Co(H_2O)_6]^{2+}$, react with aqueous chloride ions in an endothermic reaction to form the blue cobalt(II) chloride complex, $[CoCl_4]^{2-}$:

$$[Co(H_2O)_6]^{2+}(aq) + 4Cl^-(aq) \rightleftharpoons [CoCl_4]^{2-}(aq) + 6H_2O(l)$$

When heated, a solution containing hydrated cobalt(II) ions and chloride ions will

- ☐ **A** turn blue
- ☐ **B** turn pink
- ☐ **C** turn purple
- ☐ **D** stay unchanged

**2** Which will move the position of the equilibrium below to the right?

$$3Fe(s) + 4H_2O(g) \rightleftharpoons Fe_3O_4(s) + 4H_2(g) \quad \Delta H = -149\,kJ\,mol^{-1}$$

- ☐ **A** an increase in pressure
- ☐ **B** a decrease in pressure
- ☐ **C** an increase in temperature
- ☐ **D** a decrease in temperature

**3** In aqueous solution, orange dichromate(VI) ions are in equilibrium with yellow chromate(VI) ions:

$$Cr_2O_7^{2-}(aq) + H_2O(l) \rightleftharpoons 2CrO_4^{2-}(aq) + 2H^+(aq)$$

The equilibrium position lies to the left, so a solution of potassium dichromate(VI) is orange. Lead(II) chromate(VI) is an insoluble yellow solid. When a few drops of lead(II) nitrate are added to an aqueous solution of potassium dichromate(VI), there is

- ☐ **A** a yellow precipitate
- ☐ **B** an orange precipitate
- ☐ **C** a white precipitate in a yellow solution
- ☐ **D** no precipitate because lead ions do not react with dichromate(VI) ions

**4** In the presence of an iron catalyst, nitrogen and hydrogen react to form ammonia:

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g) \quad \Delta H = -92\,kJ\,mol^{-1}$$

An increase in temperature will

- ☐ **A** slow down the forward exothermic reaction and increase the rate of the reverse endothermic reaction, thus moving the position of equilibrium to the left
- ☐ **B** have no effect as the catalyst controls the reaction
- ☐ **C** make less ammonia more quickly
- ☐ **D** make more ammonia more quickly



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