

# IBDP Chem 2025 Data-based Questions (series A)

Jon Chui

## 1 Overview

This is a collection of ten data-based questions, in the style of Paper 1 Section B, for the IB Diploma Chemistry 2025 syllabus.

Each question is 10 points, and focus on one or two particular “prescribed practicals”. The full set encompasses all of the prescribed practicals, with the coverage shown in Table 1. Questions are standalone, and each starts on a new page. This collection is designed to be easy to drop in as study material after teaching a practical, or as portion of a test.

A separate folder named solutions contain hand-written, colored solution, point assignments, *and explanations*. Color-coding makes it easy to trace the flow of numerical variable, and hand-writing in the same space as that provided for students provides some training / examples in using the answer space effectively. Usage is straight-forward, and is altogether a big time-saver for teachers.

Planned for 2023-Q4 is a separate Series B that is a direct parallel to Series A (10 x [10]), and would offer an alternate so you could be using one for student practice, and the other for testing. Series C (n x [20]) would integrate different parts of theory, practical, and data-processing. Writing tests like these is like writing poems, and there is no ETA at the moment.

Question	Skills	Level
1	Dilution, colorimetry	
2	Standard solutions, acid-base titration	
3	Molecular modeling	
4	Thin-layer chromatography, melting point	
5	Distillation	
6	Mixture separation by extraction	
7	Calorimetry	
8	Voltaic cell	
9	Redox titration	
10	Database / Data-based calculations	

**Table 1** Index of questions to prescribed practicals

**1. Dilution, spectrophotometry**

Cobalt chloride hexahydrate  $\text{CoCl}_2 \cdot 6\text{H}_2\text{O}$  (molar mass =  $237.93 \frac{\text{g}}{\text{mol}}$ ) is a dark crystalline solid. Using a spectrometer, Betty investigates how its aqueous solutions changes color when hydrochloric acid is used as a solvent.

Betty prepared three solutions:

- a  $0.400 \text{ mol dm}^{-3} \text{ CoCl}_2$  in water,
- b  $0.400 \text{ mol dm}^{-3} \text{ CoCl}_2$  in  $6.0 \text{ mol dm}^{-3} \text{ HCl}_{(\text{aq})}$ , and
- c  $0.400 \text{ mol dm}^{-3} \text{ CoCl}_2$  in  $9.0 \text{ mol dm}^{-3} \text{ HCl}_{(\text{aq})}$

- [1] (a) Calculate the mass of the solid required to make up  $100 \text{ cm}^3$  of solution at  $0.400 \text{ mol dm}^{-3}$  concentration.

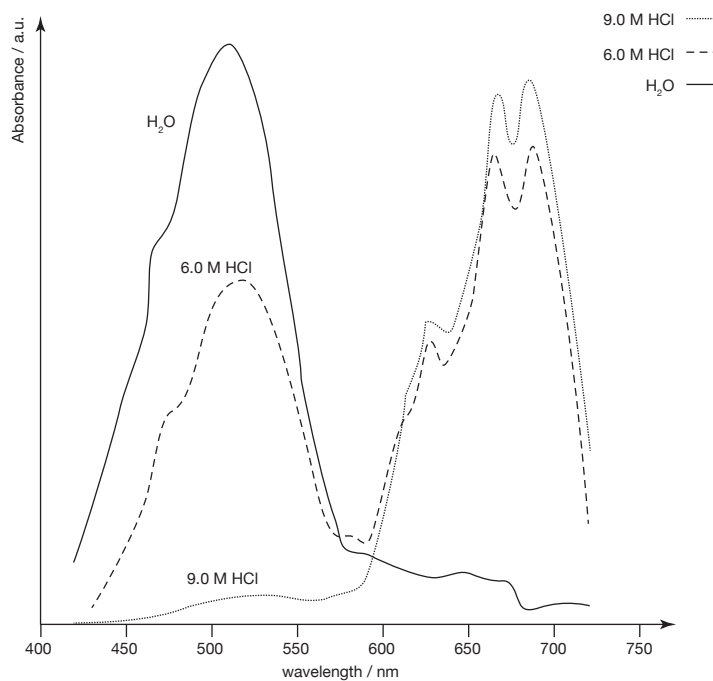
(a) \_\_\_\_\_

..... ..... .....
-------------------------

- [2] (b) State **two** precautions needed in preparing the solutions.

..... ..... ..... .....
----------------------------------

(c) Figure 1 shows the absorption spectra Betty obtained. A color wheel with wavelengths of the visible spectrum is given in Table 15 of the Data Booklet.



**Figure 1** Absorption spectra of  $\text{CoCl}_2$  in various HCl concentration.

- [2] i. State the color of the  $\text{CoCl}_2$ -water solution, and explain your reasoning.

.....  
.....  
.....

- [2] ii. Explain how  $100.00 \text{ cm}^3$  of a  $0.100 \text{ mol dm}^{-3} \text{ CoCl}_{2(\text{aq})}$  solution can be prepared, using the  $0.400 \text{ mol dm}^{-3}$  solution as a stock.

.....  
.....  
.....

- [1] iii. In Figure 1, sketch the spectra that may be expected for a  $0.100 \text{ mol dm}^{-3}$   $\text{CoCl}_2$  in water solution.
- [2] iv. Explain what can be expected when concentrated hydrochloric acid is added to a  $\text{CoCl}_2(\text{aq})$  solution.

.....

.....

.....