**IB · SL · Chemistry**

45 mins    2 questions

# Practice Paper 1B

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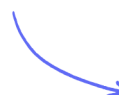
**Total Marks**                    **/25**

**1 (a)** Every winter, road salt is spread on icy surfaces to lower the freezing point of water. A student investigates how the mass of calcium chloride ($CaCl_2$) added to water affects the freezing point of the solution.

In each trial, a measured mass of solid $CaCl_2$ is added to 100 g of distilled water. The solution is stirred and cooled, and the freezing point is recorded.

Write an ionic equation to show how $CaCl_2$ dissociates in water.

_____ **(1 mark)**

**(b)** Explain how the dissociation of $CaCl_2$ helps to lower the freezing point of water.

_____ **(1 mark)**

**(c)** The table below shows the freezing points recorded during the investigation.

| Mass of $CaCl_2$ added / g | Freezing point / °C |
|:---:|:---:|
| 0.0 | 0.0 |
| 5.0 | −2.6 |
| 10.0 | −5.1 |
| 15.0 | −7.5 |
| 20.0 | −9.8 |
| 25.0 | −11.6 |

(i) Describe the trend shown in the data.

[1]

(ii) Calculate the average decrease in freezing point per gram of $CaCl_2$ added.

[2]

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**(d)** Estimate the freezing point if 30.0 g of $CaCl_2$ were added.

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**(e)** Explain one reason why your estimate in (d) may not be completely accurate.

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**(f)** The student later discovers the $CaCl_2$ used was slightly damp and not pure.

Explain how this would affect the results of the experiment.

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**(g)** A second student suggests:

"The bigger the molar mass of the salt, the more it lowers the freezing point."

Evaluate this suggestion.

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**2 (a)** A student investigates the effectiveness of four commercial antacids in reducing stomach acidity. The active ingredients of the antacids are shown below:

| Brand | Active ingredients |
|---|---|
| A | $Mg(OH)_2$, $Al(OH)_3$ |
| B | $NaHCO_3$, $CaCO_3$ |
| C | $CaCO_3$ |
| D | $Mg(OH)_2$, $Al_2O_3$ |

Each tablet is crushed and added to 25.0 cm$^3$ of 1.00 mol dm$^{-3}$ hydrochloric acid (HCl). After 5 minutes, the final pH is recorded.

(i) Write a balanced chemical equation for the reaction between calcium carbonate and hydrochloric acid.

[1]

(ii) State the formula of one ion produced in the reaction that causes the pH to increase.

[1]

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**(2 marks)**

**(b)** Suggest two experimental variables, other than time, that should be controlled to ensure a fair comparison between the antacid tablets.

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**(2 marks)**

**(c)** The results of the experiment are shown below.

| Antacid | Dose used | Final pH |
|---------|-----------|----------|
| A | 1 tablet (0.80 g) | 3.42 |
| B | 1 tablet (1.25 g) | 5.01 |
| C | 0.5 tablet (0.75 g) | 3.48 |
| D | 1 tablet (0.95 g) | 2.12 |

(i) Assuming that the initial pH of the acid was 1.00, calculate the change in pH for antacid A.

[1]

(ii) Calculate the uncertainty in the pH change for antacid A, using ±0.02 for each pH value.

[1]

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**(2 marks)**

**(d)** Explain one reason why antacid B may appear more effective than C, even though both contain calcium carbonate.

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**(2 marks)**

**(e)** The student concludes that "Antacid B is the most effective."

Use the data to evaluate this conclusion.

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**(3 marks)**

**(f)** The student later discovers the antacid B tablet was slightly damp.

Explain how this might affect the result.

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**(1 mark)**

**(g)** Suggest one environmental concern with using excess antacid tablets that contain carbonate or hydroxide compounds.

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**(1 mark)**