Chemistry

Higher level

Paper 1B

Practice paper

Topic: Redox Processes

Chemistry

Higher level

Paper 1B

Specimen paper

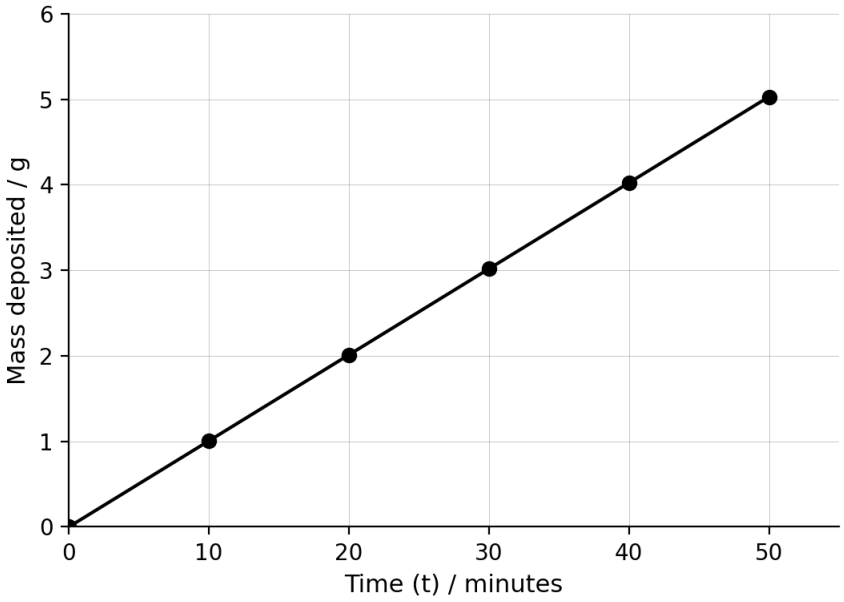
45 minutes

Instructions to candidates

- Answer all questions.
- Answers must be written within the answer boxes provided.
- A calculator is required for this paper.
- The maximum mark for paper 1B is [25 marks].

Section B

1. An experiment was conducted to determine the mass of silver deposited on a spoon during electroplating using a constant current of 1.50 A. The spoon was submerged in an $AgNO_3(aq)$ solution and the mass was recorded over a 50-minute period.



(a) Calculate the total charge (Q) passed through the cell after exactly 40 minutes. **[2]**

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(b) Use Faraday's constant (F = 96500 C mol^{-1}) and the charge from (a) to calculate the theoretical mass of silver deposited after 40.0 minutes. (A_r of Ag = 107.87). **[3]**

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(c) The graph shows a linear relationship. Deduce what would happen to the gradient of the line if a solution of $Cu(NO_3)_2(aq)$ was used instead to deposit copper metal whilst maintaining the exact same 1.50 A current. Outline your reasoning. **[3]**

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2. The dissolved oxygen in a 500 cm^3 water sample is determined using the Winkler method. The reactions involved include generating I_2 mathematically equivalent to the dissolved O_2, before titrating the I_2 against a sodium thiosulfate solution, $Na_2S_2O_3$.

(a) Formulate the half-equation for the oxidation of the thiosulfate ion, $S_2O_3^{2-}$, to the tetrathionate ion, $S_4O_6^{2-}$. **[1]**

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(b) Calculate the amount, in mol, of dissolved oxygen present in the 500 cm^3 water sample if it required 24.5 cm^3 of 0.0100 mol dm^{-3} sodium thiosulfate entirely neutralize the liberated iodine. **[4]**

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3. Permanganate ions, MnO_4^-, can oxidize sulfite ions, SO_3^{2-}, to sulfate ions, SO_4^{2-}, in a strongly basic aqueous solution. The permanganate ion is reduced to solid manganese dioxide, $MnO_2(s)$.

(a) Deduce the balanced half-equation for the reduction of the permanganate ion under strictly basic conditions. **[3]**

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(b) Deduce the balanced half-equation for the oxidation of the sulfite ion under strictly basic conditions. **[2]**

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(c) Combine the half-equations to form the overall balanced redox equation. **[2]**

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