

Exercise walk-through

5.5.1

Choose carbon-building routes and purification methods

Pearson Edexcel · International A-Level · Chemistry

Choose a cell voltage

Your turn

Reduction potentials are $+0.80\text{ V}$ and $+0.34\text{ V}$. What is spontaneous E°_{cell} ?

- A. $+1.14\text{ V}$
- B. $+0.46\text{ V}$
- C. -0.46 V

Find oxidation state and coordination

Your turn

$[\text{Cr}(\text{H}_2\text{O})_4\text{Cl}_2]^+$ has which chromium state and coordination number?

- A. +1 and 4
- B. +3 and 6
- C. +3 and 2

Aspirin transfer calculation

Your turn

2.76 g salicylic acid, $M=138$, gives aspirin $M=180$ in 1:1 ratio. Dry mass is 2.52 g. What is yield?

- A. 50.0%
- B. 70.0%
- C. 91.3%

Exercises 2.1·2.3

2.1 State how ethylmagnesium bromide is made and why the solvent must be dry. [2]

2.2 Identify the product after propylmagnesium bromide reacts with CO_2 then acid. Count carbon atoms. [2]

2.3 Select the carbonyl reagent that gives propan-2-ol with methylmagnesium bromide then acid. [2]

Exercises 2.1·2.3

2.1 State how ethylmagnesium bromide is made and why the solvent must be dry. [2]

2.1 Bromoethane with Mg in dry ether; water reacts with/destroys Grignard reagent.

2.2 Identify the product after propylmagnesium bromide reacts with CO_2 then acid. Count carbon atoms. [2]

2.2 Butanoic acid, four carbons: three from propyl plus one from CO_2 .

2.3 Select the carbonyl reagent that gives propan-2-ol with methylmagnesium bromide then acid. [2]

2.3 Ethanal, CH_3CHO ; its carbonyl carbon gains CH_3 and becomes bonded to two methyl groups and OH.

Exercises 3.1·3.2

3.1 Plan four organic conversions from bromoethane to butan-2-one using ethanol, ethanal and butan-2-ol as intermediates. Give conditions for every arrow. [4]

3.2 Salicylic acid, 2.76 g at $M = 138 \text{ g mol}^{-1}$, is limiting in aspirin synthesis. Aspirin $M = 180 \text{ g mol}^{-1}$, ratio 1:1, dry product 2.52 g. Find theoretical mass and percentage yield. Explain why wet product could mislead. [4]

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3.1 Bromoethane $\rightarrow$ ethanol: aqueous OH^- , heat. Ethanol $\rightarrow$ ethanal: controlled oxidation, distil. Ethanal $\rightarrow$ butan-2-ol: ethylmagnesium bromide/dry ether then acidic work-up. Butan-2-ol $\rightarrow$ butan-2-one: acidified dichromate oxidation. Grignard reagent is prepared separately.

3.2 Salicylic acid, 2.76 g at $M = 138 \text{ g mol}^{-1}$, is limiting in aspirin synthesis. Aspirin $M = 180 \text{ g mol}^{-1}$, ratio 1:1, dry product 2.52 g. Find theoretical mass and percentage yield. Explain why wet product could mislead. [4]

3.2 Amount = $2.76/138 = 0.0200 \text{ mol}$; theoretical mass = 3.60 g; yield = $2.52/3.60 \times 100 = 70.0\%$. Water adds mass that is not aspirin.

Exercise 3.3

3.3 An organic liquid contains acidic impurities and water. Explain carbonate washing and drying; identify one safety control in extraction and one reason the organic layer may be lower. [4]

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3.3 Carbonate removes acidic impurity by reaction; anhydrous drying agent removes remaining water. Vent separating funnel to release CO_2 /pressure away from people. A dense organic solvent can form the lower layer.