

Exercise walk-through

5.4.3

Connect amine reactions and complete polymer structures

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 Write butylamine's equation with water and explain why a basic solution forms. [2]

2.2 Explain two different uses of butylamine's nitrogen lone pair when reacting with HCl and with a copper(II) complex. [2]

2.3 A primary amine reacts with a halogenoalkane. Explain why further alkylation can occur and how excess ammonia affects primary-amine preparation from a halogenoalkane.[2]

Exercises 2.1·2.3

2.1 Write butylamine's equation with water and explain why a basic solution forms. [2]

2.1 $\text{C}_4\text{H}_9\text{NH}_2 + \text{H}_2\text{O} \rightleftharpoons \text{C}_4\text{H}_9\text{NH}_3^+ + \text{OH}^-$. Nitrogen accepts a proton from water,

2.2 Explain two different uses of butylamine's nitrogen lone pair when reacting with HCl and with a copper(II) complex. [2]

2.2 It binds H^+ as a base, forming butylammonium; it donates an electron pair to Cu^{2+} as a ligand, forming a coordinate bond.

2.3 A primary amine reacts with a halogenoalkane. Explain why further alkylation can occur and how excess ammonia affects primary-amine preparation from a halogenoalkane.[2]

2.3 The first amine product is also a nucleophile and can react again. Excess ammonia makes its attack more likely relative to amine attack, reducing but not eliminating further substitution.

Exercise 3.1

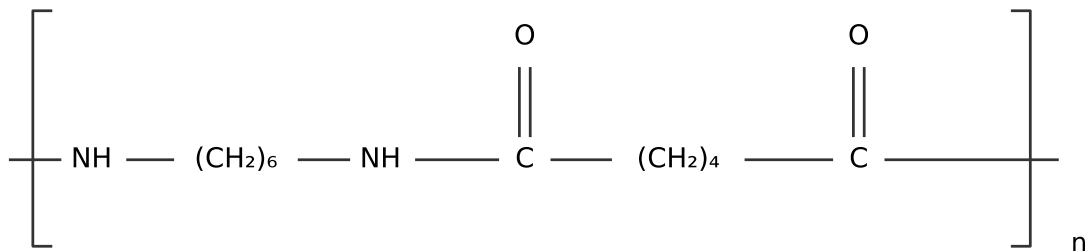
3.1 Draw a complete nylon-6,6 repeat from $\text{H}_2\text{N}(\text{CH}_2)_6\text{NH}_2$ and $\text{HOOC}(\text{CH}_2)_4\text{COOH}$, with amide links and continuing bonds through brackets. [4]

Exercise 3.1

3.1 Draw a complete nylon-6,6 repeat from $\text{H}_2\text{N}(\text{CH}_2)_6\text{NH}_2$ and $\text{HOOC}(\text{CH}_2)_4\text{COOH}$, with amide links and continuing bonds through brackets. [4]

3.1

Condensation polymer repeat unit



Nylon-6,6: open bonds continue through the brackets; amide links lie in the backbone.

B1 six-carbon diamine skeleton; B1 four- CH_2 diacid skeleton with both carbonyl carbons;
B1 correct amide links; B1 open bonds/brackets/n.

Exercises 3.2·3.3

3.2 Give condensed repeat units for poly(propenamide) and poly(ethenol), including continuing bonds at both ends. Explain the type of polymerisation for the former. [3]

3.3 Phenylamine is converted to a diazonium salt and coupled with phenol. State both conditions and name the link formed. Explain why warm diazonium storage is unsuitable. [4]

Exercises 3.2·3.3

3.2 Give condensed repeat units for poly(propenamide) and poly(ethenol), including continuing bonds at both ends. Explain the type of polymerisation for the former. [3]

3.2 $[-\text{CH}_2-\text{CH}(\text{CONH}_2)-]$; $[-\text{CH}_2-\text{CH}(\text{OH})-]$. Poly(propenamide) forms by addition across $\text{C}=\text{C}$ without loss of a small molecule.

3.3 Phenylamine is converted to a diazonium salt and coupled with phenol. State both conditions and name the link formed. Explain why warm diazonium storage is unsuitable. [4]

3.3 Nitrous acid from NaNO_2 /acid below about 10°C ; alkaline phenol coupling; $-\text{N}=\text{N}-$ azo linkage. Warming increases decomposition of the unstable diazonium salt.

Exercise 3.4

3.4 Draw displayed and skeletal formulae for ethanamine, ethanamide and uncharged 2-aminopropanoic acid. [6]

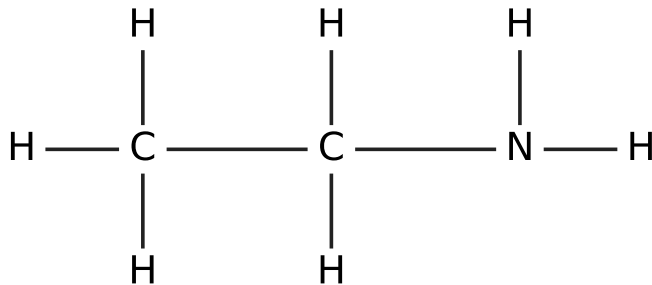
Exercise 3.4

3.4 Draw displayed and skeletal formulae for ethanamine, ethanamide and uncharged 2-aminopropanoic acid. [6]

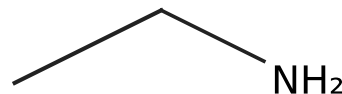
3.4

Ethanamine (ethylamine)

Displayed formula



Skeletal formula

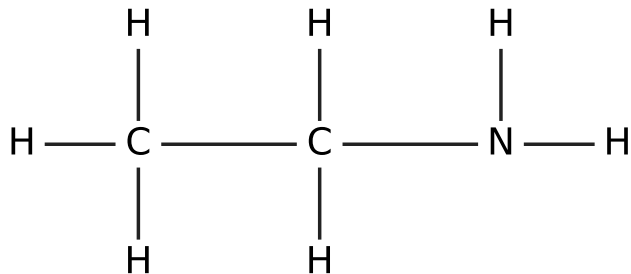


Full solution 3.4 (1/3)

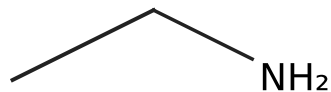
3.4

Ethanamine (ethylamine)

Displayed formula



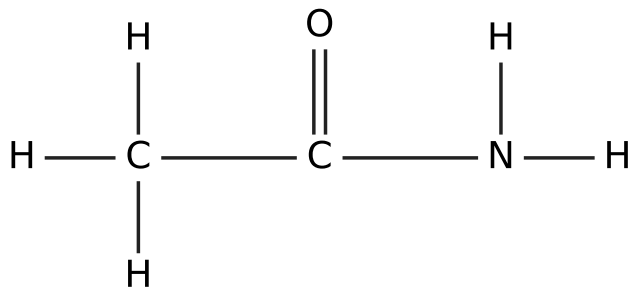
Skeletal formula



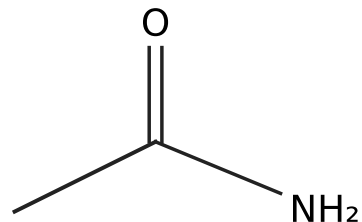
Full solution 3.4 (2/3)

Ethanamide

Displayed formula



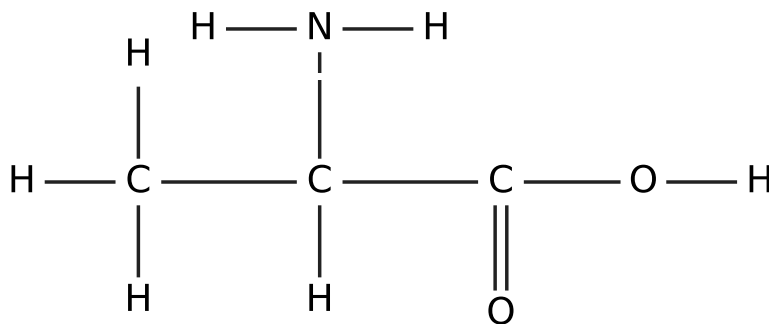
Skeletal formula



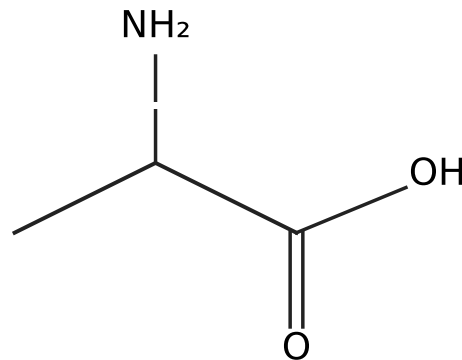
Full solution 3.4 (3/3)

2-aminopropanoic acid (alanine; uncharged form)

Displayed formula



Skeletal formula



B1 each correct displayed formula; B1 each correct skeletal formula (six marks total).