

Solution problem 35: Preparation and volumetric determination of strontium peroxide octahydrate

- 35.1 From experiment
- 35.2 From experiment, 1 mL of 0.02 mol L⁻¹ KMnO₄ solution corresponds to 1.701 mg of H₂O₂
- 35.3 From experiment, 1 mL of 0.02 mol L⁻¹ KMnO₄ solution corresponds to 6.031 mg of SrO₂
- 35.4 From experiment, 1 mL of 0.1 mol L⁻¹ Na₂EDTA solution corresponds to 12.062 mg of SrO₂
- 35.5 $\text{SrCl}_2 + \text{H}_2\text{O}_2 + 2 \text{NH}_3 \longrightarrow \text{SrO}_2 + 2 \text{NH}_4\text{Cl}$
- 35.6 $2 \text{MnO}_4^- + 5 \text{H}_2\text{O}_2 + 6 \text{H}^+ \longrightarrow 2 \text{Mn}^{2+} + 5 \text{O}_2 + 8 \text{H}_2\text{O}$
- 35.7 Manganese(II) cations act as a catalyst.

Solution problem 36: Preparation and iodometric determination of potassium iodate

- 36.1 From experiment
- 36.2 From experiment, 1 mL of 0.1 mol L⁻¹ Na₂S₂O₃ solution corresponds to 3.576 mg of KIO₃
- 36.3 $\text{IO}_3^- + 5 \text{I}^- + 6 \text{H}^+ \longrightarrow 3 \text{I}_2 + 3 \text{H}_2\text{O}$
- 36.4 It is a comproportionation reaction
- 36.5 In a basic solution, tetrathionate dianions are oxidized to sulfate dianions
- 36.6 Oxidising ability increases from fluorine to iodine, because the ionization energy and electron affinity decrease and the ionic radii increase in this direction.
- 36.7 a) After adding an excess of potassium iodide, iron(III) cations can be titrated directly with sodium thiosulfate solution, because an equivalent amount of iodine is produced.
- $\text{Fe}^{3+} + 2 \text{I}^- \longrightarrow 2 \text{Fe}^{2+} + \text{I}_2$
- b) $\text{Cu}^{2+} + 2 \text{I}^- \longrightarrow \text{CuI} + \frac{1}{2} \text{I}_2$
- c) A well defined excess of iodine solution must be added for the titration of sulfide. The unreacted iodine is subsequently titrated with thiosulfate solution (back titration).
- $\text{S}^{2-} + \text{I}_2 \longrightarrow \frac{1}{8} \text{S}_8 + 2 \text{I}^-$

Solution problem 37: Qualitative analysis of anions in an unknown solution

- 37.1 From experiment
- 37.2 $\text{NO}_3^- + 3 \text{Fe}^{2+} + 4 \text{H}^+ \longrightarrow 3 \text{Fe}^{3+} + \text{NO} + 2 \text{H}_2\text{O}$
 $\text{NO} + [\text{Fe}(\text{H}_2\text{O})_6]^{2+} \longrightarrow [\text{Fe}(\text{NO})(\text{H}_2\text{O})_5]^{2+} + \text{H}_2\text{O}$
- 37.3 The hydroxide anions produced during the formation of the nitrosyl complex are removed by sulfuric acid. This is the reason why the equilibrium is shifted towards the right side of the equation.
- 37.4 $5 \text{C}_2\text{O}_4^{2-} + 2 \text{MnO}_4^- + 16 \text{H}^+ \longrightarrow 2 \text{Mn}^{2+} + 10 \text{CO}_2 + 8 \text{H}_2\text{O}$
- 37.5 $\text{ClO}_4^- + 8 \text{Fe}(\text{OH})_2 + 4 \text{H}_2\text{O} \longrightarrow \text{Cl}^- + 8 \text{Fe}(\text{OH})_3$

Solution problem 38: Recycling of polymethylmethacrylate

38.1 From experiment

38.2 30 g polymethylmethacrylate = 30 g methyl methacrylate ($M = 100 \text{ g mol}^{-1}$)
theoretical yield: 30 g (0.3 mol) methyl methacrylate.

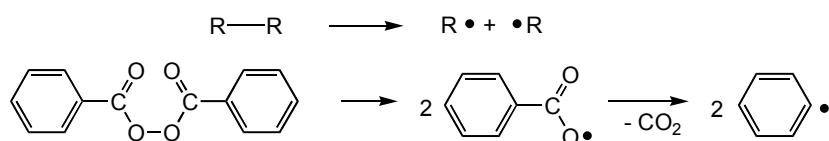
38.3 From experiment

38.4 Refractive index of methyl methacrylate: $n_D = 1.4142$.

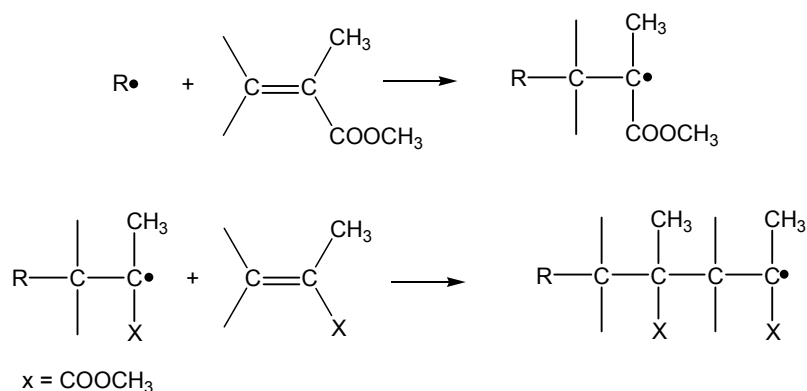
38.5 Boiling point of methyl methacrylate: b.p. = 100 – 101 °C.

38.6 Polymerization reaction of methyl methacrylate:

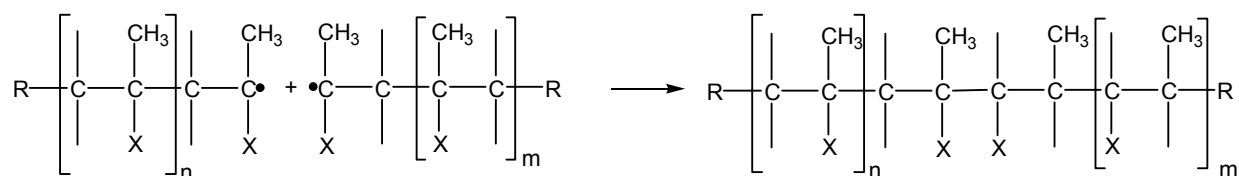
1. Initial step: decomposition dibenzoylperoxide



2. Chain initiation and chain extension:



3. Chain termination (other chain terminations are possible):



Solution problem 39: Synthesis of *para*-chlorobenzyl alcohol – an example of the Cannizzaro Reaction

39.1 From experiment.

39.2 Colorless needles from water.

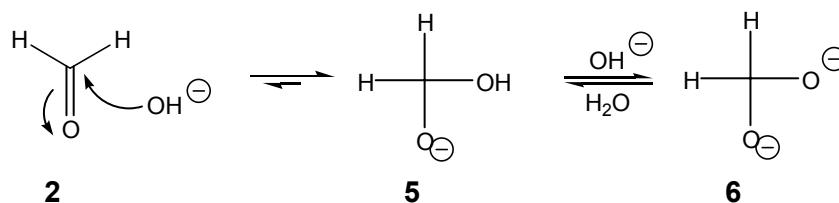
39.3 Melting point of *para*-chlorobenzylalcohol: m.p. = 75°C.

39.4 From experiment.

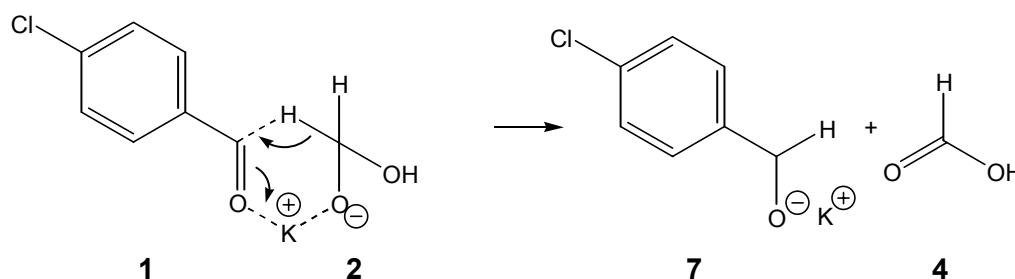
39.5 From experiment.

39.6 Reaction mechanism:

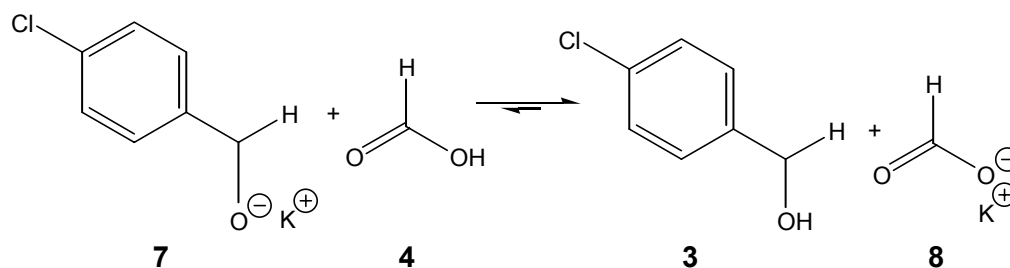
The mechanism of the Cannizzaro reaction involves a hydride (H^-) shift. In the first step a hydroxidion (OH^-) of the strong base adds to the formaldehyde **2** to give the tetrahedral anion **5**, which may lose a proton in the strong basic reaction mixture to give the dianion **6**.



The strong electron-donating character of the negative charged oxygen of **5** or much stronger in **6** forces the hydrogen to leave the anion or the dianion with its electron pair. This hydride transfer takes place, when **5** (or **6**) attacks an other molecule, which acts as a hydride acceptor, and runs through a cyclic transition state.



The final step is a rapid proton transfer from the acid **4** to alcoholat **7**.



Solution problem 40: Ammonolysis of an activated carbonic acid ester: synthesis of cyano acetamide

40.1 From experiment.

40.2 32.0 mL (0.301 mol) of cyanoacetic acid ethyl ester ($\rho = 1.065 \text{ g mL}^{-1}$, $M = 113.1 \text{ g mol}^{-1}$) = 25.3 g (0.301 mol) of cyano acetamid ($M = 84.1 \text{ g mol}^{-1}$).

40.3 From experiment.

40.4 Melting point of cyano acetamid: m.p. = 121–122°C.

Avoiding culture shock or The German way of life

People of different countries have different ways of doing things. So, to avoid culture shock, it's important to be prepared before you visit another country. Here are some notes students made after their year in Germany. This list is supposed to help you while you stay in Germany.

- Germans close room doors and pull shades.
- They worry about their health. (There's something wrong with them if they don't.)
- They get up early – and go to bed early.
- They have small refrigerators. (You shouldn't raid them.)
- There is more fresh food, less processed stuff.
- Meals are social events (so hold back with your fork until everybody is there.)
- If guests want more food, they take it. (Don't wait to be asked or you'll wait for ever.)
- Germans absolutely love mineral water.
- They would never visit other people's home without an invitation.
- They bring flowers when they visit friends. (Uneven number, no red or white roses unless in love.)
- They shake hands any time they meet people.
- They don't stand in line. (You have to push your way to the front of stores and onto trains.)
- Few people use credit cards for shopping.
- There are often restroom attendants. (They expect money.)
- Weekends are totally dead.
- German families go for long walks on Sundays.
- Germans don't waste time on polite phrases – they say what they mean.