

## Beauty in simplicity

11% of total				
Question	3.1	3.2	3.3	Total
Points	30	14	15	<b>59</b>
Score				

### Introduction

You are provided with 6 solutions **S1–S6** (ca. 10 mL of each) of unknown composition. Solution **S<sub>x</sub>** is labeled “[student code] + **S<sub>x</sub>**”, with **x** going from 1 to 6. **Your task is to identify all cations and anions dissolved in these solutions.**

Hints:

- There are 7 cations and 7 anions which have been introduced in aqueous solutions **S1–S6** from the list:
  - Cations:  $\text{Ag}^+$ ,  $\text{Ba}^{2+}$ ,  $\text{Ca}^{2+}$ ,  $\text{Fe}^{3+}$ ,  $\text{K}^+$ ,  $\text{Mn}^{2+}$ ,  $\text{Na}^+$ ;
  - Anions:  $\text{CH}_3\text{COO}^-$ ,  $\text{Cl}^-$ ,  $\text{I}^-$ ,  $\text{NO}_3^-$ ,  $\text{PO}_4^{3-}$ ,  $\text{S}^{2-}$ ,  $\text{SO}_4^{2-}$ ;
- 2 or 3 ions in total were introduced into each solution;
- Each of the ions was introduced only into one solution;
- $\text{Na}^+$  and  $\text{K}^+$  are present together in the same solution;
- In some cases, it might take up to 15 minutes before a visible change occurs; fill in the table in question 3.1 with your final observations;
- Some solutions can get colored or attain some precipitate due to oxidation under air.

## Questions

**3.1** **Perform** the cross-reactions between solutions **S1–S6**. **Fill in** the first table of your **answer sheet** with your observations using these symbols: 30pt

- “↓” for precipitation;
- “↑” for gas evolution;
- “S” for colour change of the solution;
- “–” if there are no visible observations.

**Report** the colours of the precipitates using the following letters:

- “W” for white/colorless;
- “B” for black;
- “C” for colored.

**3.2** Based on your observations and the above-mentioned hints, **identify** the ions in **S1–S6**. **Fill in** the second table in your **answer sheet**. 14pt

**3.3** **Write** ionic equations of the performed reactions that explain your observations in the third table of your **answer sheet**. Use “↓” for precipitates and “↑” for gases. 15pt

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