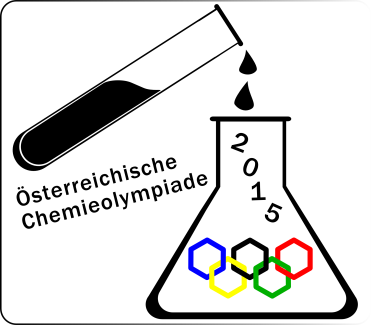
**41st Austrian Chemistry Olympiad**

**National Competition**



**Solutions**

# Task 1 47/17 points

**Quantitative Analysis**

|  |
| --- |
| Titration volume chosen *V1* = 12.4 mL ***max12bp1*** |
| Titration equation: Ag+ + Cl- ⇄ AgCl ***0.5bp*** |
| Equation for the indication reaction: 2 Ag+ + CrO42- ⇄ Ag2CrO4 ***1bp*** |
| Amount of chloride in the flask *n1* = 6.20 mmol ***1bp***  12.4·0.0500 = 0.620 mmol Ag+ = 0.620 mmol Cl-  0.620·10 = 6.20 mmol |

|  |
| --- |
| Titration volume chosen V2 = 16.85 ml  ***max12bp2*** |
| Titration equation: 2 MnO4- + 5 C2O42- + 16 H+ ⇄ 2 Mn2+ + 10 CO2 + 8 H2O ***1,5bp*** |
| concentration of the MnO4- -solution *c* = mol/L ***1bp***  10.00·0.0500 = 0.500 mmol C2O42- ⇒ 0.200 mmol MnO4-  mol/L |

|  |
| --- |
| Titration volume chosen *V3* = 9,90 mL ***max14bp3*** |
| amount oxalate *n3* = 0,2945 mmol ***4bp***  amount CaCl2 in the flask *nCaCl2* = 2,07 mmol  amount NaCl in the flask *nNaCl* = mmol  mass CaCl2 in the flask *mCaCl2* = 228 mg  mass NaCl in the flask *mNaCl* = 121 mg  composition in percent: 65.3% CaCl2 + 34.7% NaCl  mL  6.95·0.0119·2.5 = 0.2068 mmol ⇒ 2.07 mmol CaCl2 in the flask  mmol |

1 mL; mL; in between:

2 mL; mL; in between:

3 mL; mL; in between:

# Task 2 29/11 points

**Photometric Analysis of a Coordination Compound**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| *2.1. Fill in the concentrations and the measured absorptions.* | | | | | | | |
| Nr. | *c*(Fe3+)/ mmolL−1 | *c*(SCN−)/ mmolL−1 | *A* (447nm) | Nr. | *c*(Fe3+)/ mmolL−1 | *c*(SCN−)/ mmolL−1 | *A* (447nm) |
| 1 | 2.40 | 0 | 0.001 | 6 | 0.40 | 2.00 | 0.463 |
| 2 | 2.00 | 0.40 | 0.429 |  |  |  |  |
| 3 | 1.60 | 0.80 | 0.712 |  |  |  |  |
| 4 | 1.20 | 1.20 | 0.817 |  |  |  |  |
| 5 | 0.80 | 1.60 | 0.731 | 7 | 0 | 2.40 | 0.003 |

for each measurement 2bp, maximum ***14bp***

|  |
| --- |
| *2.2. Job-Plot for the evaluation max.* ***10bp*** |
| *GS MBP SSD:Users:schoeb:Documents:Chemie:Olympiade:OECHO 41 IChO 47:Bewerb:PraxisKurveVorgabe.pdf* |

|  |
| --- |
| *2.3. Stoichiometry of the complex* [Fe(SCN)*x*](3-*x*)+ *– as can be read from the Job-plot.* |
| *x = 1* ***1bp*** |

|  |
| --- |
| *2.4. Calculation of the formation constant using the plot.* |
| *Formation constant K = 3335* |
| *Show your calculation of K:*  *tangents in the diagram → right extrapolation of the peak value* ***1bp***  *right calculation of K* ***3bp***  *peak value : A’ = 1.34 →*  *Absorption at the stoichiometric proportion A = 0.817 →*  *c0 at the stoichiometric proportion: .* |

**Task 3 23/11 points**

**Synthesis of 2-iodobenzoic acid**

|  |
| --- |
| *3.1. Hand in the product on the petri-dish:*  light yellow crystals……***3 bp***  other appearence……***0-2 bp*** |

|  |
| --- |
| *3.2. Calculate the theoretical yield:*  ***1 bp*** |
| *Calculation:*  1 mol anthranilic acid (137 g/mol) gives 1 mol of product (248 g/mol),  2.00 g of starting material give ***3,62 g*** of product |

|  |
| --- |
| *3.3. Calculate your yield in g and in % of the theory:* |
| *Calculation:*  no product: ***0 bp***  ≥ 2.20 g: ***15 bp,*** in between 0 and 2.20 g:  ***1 bp*** |

|  |
| --- |
| *3.4. Melting point of your product:*  *tM*= 161-162°C: ***3 bp***; *tM* = 160°-159°C: ***2 bp***; *tM* = 158°-157°C: ***1 bp***; |