

Name	Student Code
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33rd IChO • Laboratory Task 1

Answer sheet

12 points

Preparation of 2-iodobenzoic acid

Mass of empty watch glass /g		Expert's initials
Mass of watch glass with product /g		Expert's initials

1.1 The mass of your product:

1.27 grams

13 marks

1.2 The calculated theoretical yield (based on 2 aminobenzoic acid) in g :

1.81 g

1 mark

1.3 The yield obtained as a percentage of the theoretical yield:

70%

1 mark

1.4 Colour of the product obtained:

[The laboratory expert will mark X in the appropriate box with initials.]

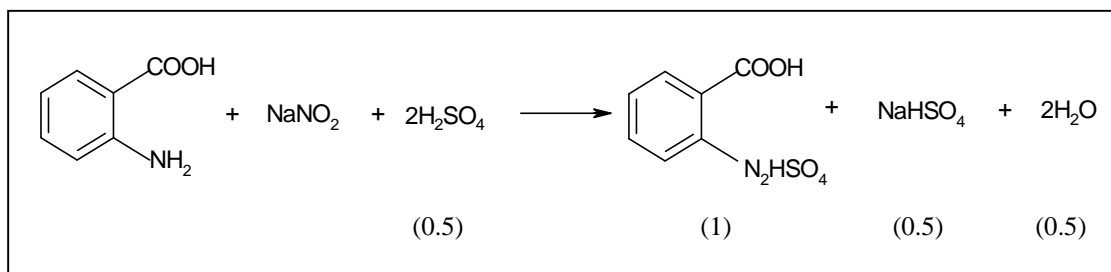
- | | | |
|--------------------------------|-------------------------------------|---|
| (a) Brownish yellow | <input type="checkbox"/> | 2 |
| (b) Yellow | <input type="checkbox"/> | 3 |
| (c) Pale yellow / cream yellow | <input checked="" type="checkbox"/> | 4 |
| (d) Brown | <input type="checkbox"/> | 1 |
| (e) Any other | <input type="checkbox"/> | 0 |

4 marks

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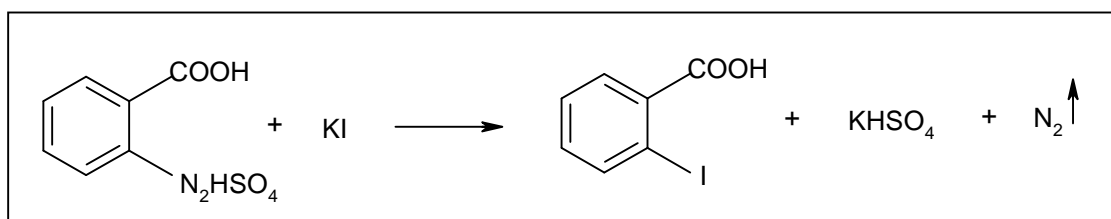
1.5 Write down the balanced chemical equations for

(a) diazotization of 2-aminobenzoic acid using NaNO_2 and H_2SO_4 .



2.5 marks

(b) the reaction of KI with the diazotized product.



1 mark

Penalty!

Additional chemicals and/or glassware can be requested if used up or broken. The penalty will be 1 mark for each replacement.

No.	Chemical/Glassware	Student's initials	Expert's initials

Total marks deducted: _____

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33rd IChO • Laboratory Task 2

Answer Sheet

18 points

Estimation of Mn (II) and Mg (II) present in the given sample

Concentration of standard Na₂EDTA : 0.050 M

Concentration of Mn (II) solution : 0.050 M

2.1 Batch number of the sample provided to you:

	Trial I		Trial II	
	Titration 1	Titration 2	Titration 1	Titration 2
Initial burette reading (mL)	00.0 mL	00.0 mL	00.0 mL	00.0 mL
Final burette reading (mL)	19.6 mL	10.8 mL	19.6 mL	10.8 mL
Volume of Na₂EDTA (mL)	19.6 mL (A)	10.8 mL (B)	19.6 mL (A)	10.8 mL (B)

22 marks

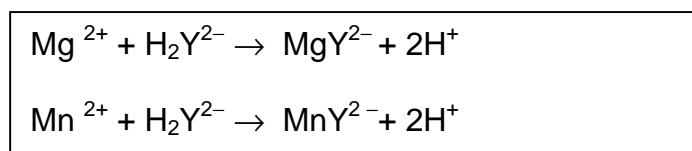
Recalculated using student's data

Maximum marks: 22 (15 marks for Mg, 7 marks for Mn)

Linear scale: 0–3% deviation, full marks; > 10% deviation, 0 mark

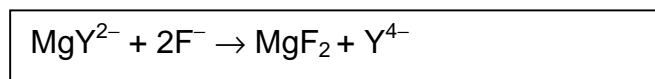
(The higher of the student's scores in Trials I and II will be regarded as the true score.)

2.2 Give the balanced chemical equation for the reactions of Mg(II) and Mn(II) with Na₂EDTA . (Use the symbol Na₂H₂Y for Na₂EDTA.)



1 mark

2.3 Give the equation for the release of EDTA by the addition of NaF to the MgEDTA complex.



1 mark

- 2.4 Calculate the amount of Mg (II) and Mn (II) in gram for any one of the two trials. (Show the main steps in your calculation.)

Calculation:	Trial No. _____
<u>Mg</u>	
A = 19.6 mL	B = 10.8 mL
Volume of Mn (II) added externally = 20.0 mL	
EDTA released after addition of NaF = $(20.0 \times 0.050) - (10.8 \times 0.050)$	
	= 0.46 mmol (2.5)
Amount of Mg in the sample = $0.46 \times 24.305 = 0.012$ g (0.5)	
<u>Mn</u>	
Total EDTA used (in Titration 1) = $19.6 \times 0.050 = 0.98$ mmol	
Amount of Mg (in Titration 2) = 0.46 mmol	
Amount of Mn = $0.98 - 0.46 = 0.52$ mmol	
	= $0.52 \times 54.94 = 0.028$ g (1)

4 marks

- 2.5 The colour change at the end point (wine red to blue) in Titration 1 is due to

- (a) the formation of metal-indicator complex.
- (b) the release of free indicator from metal-indicator complex.
- (c) the formation of metal-EDTA complex.

[Mark X in the correct box.]

1 mark

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Penalty!

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Total marks deducted: _____

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33rd IChO • Laboratory Task 3

Answer Sheet

10 points

Determination of the rate constant for the redox reaction between ethanol and chromium (VI)

Concentration of standard $\text{Na}_2\text{S}_2\text{O}_3$: 0.010 M

Concentration of HCrO_4^- at $t = 0$: 0.0074 M

	Titration 1 [10 mins.]	Titration 2 [20 mins.]	Titration 3 [30 mins.]	Titration 4 [40 mins.]
Initial burette reading (mL)	00.0 mL	00.0 mL	00.0 mL	00.0 mL
Final burette reading (mL)	16.4 mL	12.2 mL	9.0 mL	6.8 mL
Volume of $\text{Na}_2\text{S}_2\text{O}_3$ (mL)	16.4 mL	12.2 mL	9.0 mL	6.8 mL

3.1 Write down the possible oxidation products in the reaction of HCrO_4^- and $\text{CH}_3\text{CH}_2\text{OH}$.

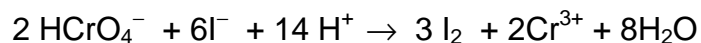
Acetic acid	CH_3COOH
Acetaldehyde	CH_3CHO

1 mark

33rd IChO • Laboratory Task 3

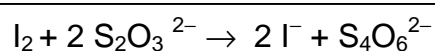
Answer Sheet

- 3.2 Write down the balanced chemical equation for the reaction between HCrO_4^- and KI.



1 mark

- 3.3 Write down the balanced chemical equation involved in the titration.



0.5 mark

- 3.4 Give the main steps for the calculation of HCrO_4^- concentration (M) for any one titration reading.

$$[\text{S}_2\text{O}_3^{2-}] \times V_{\text{S}_2\text{O}_3^{2-}} = 3 [\text{HCrO}_4^-] \times V_{\text{HCrO}_4^-}$$

$$0.010 \times 6.8 = 3 [\text{HCrO}_4^-] \times 10.0$$

$$[\text{HCrO}_4^-] = 0.0027$$

2 marks

- 3.5 Concentration (M) of HCrO_4^- at different times:

Time (mins.)	$[\text{HCrO}_4^-]$	$\ln [\text{HCrO}_4^-]$
0	0.0074	-4.906
10	0.0056	-5.185
20	0.0041	-5.497
30	0.0030	-5.809
40	0.0027	-5.914

1.5 marks

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3.6 Plot the graph of $\log [\text{HCrO}_4^-]$ vs time. **2 marks**

3.7 From the nature of the graph, determine the order (**x**) of the reaction with respect to HCrO_4^- .

$x = 1$

1 mark

3.8 Determine the rate constant for the reaction.

$k = 0.026 \text{ min}^{-1}$

16 marks*1 mark for correct calculation*

Recalculated using student's data

Maximum marks: 15

Linear scale: 0 to 3 % deviation, 15 marks; > 10 % deviation, 0 mark

Penalty!

Additional chemicals and/or glassware can be requested if used up or broken. The penalty will be 1 mark for each replacement.

No.	Chemical/Glassware	Student's initials	Expert's initials

Total marks deducted: _____