| Name: | Student code: |
|---|---|

# Laboratory Task I 50 points

## RESULTS SHEET

A. Standardisation of Iodine Solution

| Concentration of standard $Na_2S_2O_3$ in bottle : ..... 0.01970..... M |
|---|

| | Volume | | |
|---|---|---|---|
| **Titration Number** | **1** | **2** | **3** |
| aliquot of $I_2$ (mL) | 5.00 | 5.00 | 5.00 |
| initial buret reading (mL) | 0.00 | 0.00 | 0.00 |
| final buret reading (mL) | 10.00 | 10.05 | 9.95 |
| standard $Na_2S_2O_3$ (mL) | 10.15 | 10.10 | 10.05 |

The value of titre = 10.10 mL

Calculation for iodine concentration:

mol ratio of $I_2 : S_2O_3^{2-}$ = 1:2

$$I_2 + 2\ S_2O_3^{2-} \longrightarrow 2I^- + S_4O_6^{2-}$$

$$[I_2].V_{I_2} = \frac{[S_2O_3^{2-}].V_{S_2O_3^{2-}}}{2}$$

$$[I_2] = \frac{0.01970 \times 10.10}{2 \times 5.00} = 0.0199\ M$$

1 mark for correct mol ratio.
max 2 marks for correct calculation.
-1 mark for less than 2 or more than 3 significant figures.

Concentration of $I_2$ 0.0199 M

Accuracy (max 7 marks)-recalculated using student's data 7 marks
Sliding scale 7 marks for 0 to 0.5 % deviation.
0 mark for greater than 3.0 % deviation.

Name: Student code:

Laboratory Task I

B. A kinetic study of the acid catalyzed reaction between acetone and iodine in aqueous solution

B-1. Calculation for initial concentrations (M) in the solution mixtures

| | Concentration | | | |
|---|---|---|---|---|
| **Flask No.** | **I** | **II** | **III** | **IV** |
| $[I_2]$, M | 0.00498 | 0.00998 | 0.00498 | 0.00498 |
| [acetone], M | 1.69 | 1.69 | 3.39 | 1.69 |
| [HCl], M | 0.0250 | 0.0250 | 0.0250 | 0.0500 |

0.25 mark for each correct concentration of $I_2$ and HCl.
0.5 mark for each correct concentration of acetone.

B-2. Calculation for the concentration (M) of iodine remaining in Flasks I to IV at 7 minutes.

| | Volume | | | |
|---|---|---|---|---|
| **Flask No.** | **I** | **II** | **III** | **IV** |
| initial buret reading (mL) | 0.00 | 0.00 | 0.00 | 0.00 |
| final buret reading (mL) | 8.35 | 18.55 | 6.75 | 6.85 |
| standard $Na_2S_2O_3$ (mL) | 8.35 | 18.55 | 6.75 | 6.85 |
| $[I_2]$ remaining at 7 minutes (M) | 0.00412 | 0.00914 | 0.00332 | 0.00338 |

0.5 mark for each correct calculation of remaining iodine.

B-3. Calculation for initial rate of disappearance of $I_2$ at 7 minutes for Flasks I to IV (in M $s^{-1}$)

$$\text{Initial rate of disappearance of iodine (M s}^{-1}) = -\frac{d[I_2]}{dt}$$

| **Flask No.** | **I** | **II** | **III** | **IV** |
|---|---|---|---|---|
| **Calculation for rate** | $\frac{0.00498-0.00412}{7 \times 60}$ | $\frac{0.00997-0.00914}{7 \times 60}$ | $\frac{0.00498-0.00333}{7 \times 60}$ | $\frac{0.00498-0.00338}{7 \times 60}$ |
| **Initial rate** | $2.05 \times 10^6$ | $1.98 \times 10^6$ | $3.95 \times 10^6$ | $3.811 \times 10^6$ |

4 marks for correct calculation.

B-4. Calculation for the kinetic orders x, y and z

| Name: | Student code: |
|---|---|



$$\text{rate} = -\frac{d[I_2]}{dt} = k[CH_3COCH_3]^x [I_2]^y [H^+]^z$$

| Calculation for x | Calculation for y | Calculation for z |
|---|---|---|
| $\frac{\text{Rate (III)}}{\text{Rate (I)}} = \frac{3.95 \times 10^{-6}}{2.05 \times 10^{-6}}$ | $\frac{\text{Rate (II)}}{\text{Rate (I)}} = \frac{1.98 \times 10^{-6}}{2.05 \times 10^{-6}}$ | $\frac{\text{Rate (IV)}}{\text{Rate (I)}} = \frac{3.81 \times 10^{-6}}{2.05 \times 10^{-6}}$ |
| $2^x = 1.93$ | $2^y = 0.965$ | $2^z = 1.86$ |
| $x = 0.95$ | $y = -0.051$ | $z = 0.90$ |
| $x = 1$ (integer) | $y = 0$ (integer) | $z = 1$ (integer) |

max 1 mark for each correct calculation

Write rate equation or rate law

Rate = $k[CH_3COCH_3][H^+]$

2 marks

B-5. Calculation for the rate constant, k, for Flasks I to IV with proper unit.

| Flask No. | I | II | III | IV |
|---|---|---|---|---|
| **Calculation** | $\frac{2.05 \times 10^{-6}}{(1.69)(0.0250)}$ | $\frac{1.98 \times 10^{-6}}{(1.69)(0.0250)}$ | $\frac{3.95 \times 10^{-6}}{(3.39)(0.0250)}$ | $\frac{3.81 \times 10^{-6}}{(1.69)(0.0500)}$ |
| **Rate Constant k =** | $4.85 \times 10^{-5}$ | $4.68 \times 10^{-5}$ | $4.66 \times 10^{-5}$ | $4.51 \times 10^{-5}$ |
| **Unit** | $M^{-1} s^{-1}$ | $M^{-1} s^{-1}$ | $M^{-1} s^{-1}$ | $M^{-1} s^{-1}$ |

Max 0.5 mark for each correct calculation.
1 mark for correct unit.

B-6. Mean value of rate constant = $4.68 \times 10^{-5}$

22 marks

Accuracy: (max 22 marks)-recalculated using student's data.
Sliding scale 22 marks for 0 to 6% deviation.
0 mark for greater than 18% deviation.
0 mark for greater than ±10% deviation.