

ACDA0514: THEMOCHEMISTRY

Risk Assessment

Before starting the experiment, you need to carry out a safety check and respond to the following statements.

I William Yang

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Hereby agree to the following statements:

- I have taken part in the lab induction session with Mark and Ewa
- I agree to follow all rules and instructions therein
- I have received my PPE
- I understand that I must wear safety goggles, gloves and fastened lab coat for the duration of the entire experiment.
- I understand not to touch my face and/or eyes while wearing gloves as they can be contaminated with chemicals.
- I am aware of the risk associated with the handling of laboratory glassware such as cuts from broken or damaged glass and potential burns from hot glassware/ Bunsen burners.
- I understand the COSHH hazards associated with the chemicals but if I am unsure, I will ask Mark or Ewa.
- I understand that should I have an issue that may prevent me from doing the practical's (such as illness, pregnancy or injury) I will inform Mark or Ewa in good time before the session so alternate arrangements can be made.
- That I will report unsafe behaviour in a confidential and professional manner.
- I also understand that should I fail to adhere to instructions/ guidance, I will be putting myself and others at risk and could be removed from the practical which may affect my course grades. This removal will also be reported to the Academic Liaison Officer and, by extension possibly your parent company.

Signed William Yang

Date 10/11/22

Lab Quiz

- The hazard(s) associated with the chemicals/equipment used in this experiment are:
~~Acid/Burns~~
Heat/burns / Hot metal
Glass / sharp cuts
- Where would I find the hazard information for a chemical? (2 answers)
SDS
COSHH
- If there is a fire, what are my (your) responsibilities?
Turn off gas, walk to muster point.
- Why must glassware be labelled (2 reasons):
Identify contents hazards. Differentiate clear liquids in water from acid. Know how ^{or remove} spills must be cleaned.
- Name 5 instructions for clothing and hair in the lab:
Tie ^{long} hair back. Wear PPE. Tie beard / protect head. Cover skin in no shorts / sandals. No loose clothing if handy.
- What are the precautions when working with Bunsen burners?
 - Leave on safety flame when not in use.
 - Turn off gas when finished.
 - Don't point at people / avoid heat burns from ~~equipment~~.

Student name & number: William Yang 2113840

Student signature: William Yang

Lab assistant: Eva

DATA SHEETS to RECORD CALCULATIONS and RESULTS

Write in the following box your student number and full name:

STUDENT NUMBER & NAME: William Yang 2113840

PARTNERS' NAMES: John, Matyn

REPORT IS DUE NOVEMBER 22, 2022 by mail

I. Measure the value of the heat capacity of the calorimeter ($HC_{\text{calorimeter}}$)

Use these entries to record your experimental data, results, and calculations.

$$T_{\text{HOT}} = \underline{60^{\circ}\text{C}} \quad m_{\text{HOT-WATER}} = \underline{50\text{g}} \quad \Delta T_{\text{HOT-WATER}} = \underline{-18^{\circ}\text{C}}$$

$$T_{\text{COLD}} = \underline{24^{\circ}\text{C}} \quad m_{\text{COLD-WATER}} = \underline{50\text{g}} \quad \Delta T_{\text{COLD-WATER}} = \underline{18^{\circ}\text{C}}$$

$$T_{\text{MAX}} = \underline{42^{\circ}\text{C}} \quad \Delta T_{\text{CALORIMETER}} = \underline{18^{\circ}\text{C}}$$

$$Q_{\text{COLD-WATER}} = \underline{3767.4\text{J}} \quad Q_{\text{HOT-WATER}} = \underline{-3767.4\text{J}} \quad Q_{\text{CALORIMETER}} = \underline{\cancel{3767.4\text{J}} - 7534.8\text{J}}$$

$$HC_{\text{CALORIMETER}} = \underline{\cancel{209.3\text{J}} / (9^{\circ}\text{C})}$$

Write the calculations for $Q_{\text{HOT WATER}}$, $Q_{\text{COLD WATER}}$, $Q_{\text{CALORIMETER}}$, and $HC_{\text{CALORIMETER}}$:

$$Q_{\text{hot water}} = 50 \times 4.186 \times 18$$

$$= 3767.4 \text{ J}$$

$$Q_{\text{cold water}} = 50 \times 4.186 \times -18$$

$$= -3767.4 \text{ J}$$

$$Q_{\text{calorimeter}} = Q_{\text{hot water}} - Q_{\text{cold water}}$$

$$= -3767.4 - 3767.4$$

$$= -7534.8 \text{ J}$$

$$HC_{\text{calorimeter}} = \frac{Q_{\text{calorimeter}}}{\Delta T_{\text{calorimeter}}}$$

$$= \frac{-7534.8}{18}$$

$$= -418.6 \text{ J/(g}^\circ\text{C)}$$

unit of HC
is $\text{J/}^\circ\text{C}$

-10p

if you swapped the Q s for hot and cold water, the HC for the calorimeter would be ZERO which means that the temperature were not measured accurately.

2. Measure the specific heat capacity of a metal ($c_{p \text{ metal}}$)

Use these entries to record your experimental data, results, and calculations.

Type of metal = Aluminium

$T_{\text{hot}} = 82^\circ\text{C}$

$m_{\text{metal}} = 18.5 \text{ g}$

$\Delta T_{\text{metal}} = -50.4^\circ\text{C}$

$T_{\text{cold}} = 24^\circ\text{C}$

$m_{\text{water}} = 30 \text{ g}$

$\Delta T_{\text{water}} = 7.6^\circ\text{C}$

$T_{\text{max}} = 31.6^\circ\text{C}$

$\Delta T_{\text{calorimeter}} = 7.6^\circ\text{C}$

$c_{p \text{ metal}} = -5427.4 \text{ J/(g}^\circ\text{C)}$

time (s)	$T_{\text{WATER}} (^\circ\text{C})$
10	30
20	30.5
30	31
40	31.5
50	31.6
60	31.2

time (s)	$T_{\text{WATER}} (^\circ\text{C})$
70	31
80	31
90	31
100	31
110	31
120	31

time (s)	$T_{\text{WATER}} (^\circ\text{C})$
130	31
140	31
150	31
160	31
170	31
180	31

190	31	220	31	250	30.6
200	31	230	31	~~260~~	
210	31	240	30.8	~~270~~	

Write the calculations for $C_{p \text{ metal}}$

$$C_{p \text{ metal}} = - \frac{(m_{\text{water}} \times C_{p \text{ water}} \times \Delta T_{\text{water}} + H(\text{calorimeter}) \times \Delta T_{\text{calorimeter}})}{m_{\text{metal}} \times \Delta T_{\text{metal}}}$$

$$= - \frac{(30 \times 4.186 \times 7.6 + -418.6 \times 7.6)}{(18.5 \times -50.4)}$$

$$= -2.388 \text{ J/(g}^\circ\text{C)}$$

C_p of aluminium should not be negative in this experiment, therefore a more likely figure would be:

$$C_{p \text{ metal}} = 2.388 \text{ J/(g}^\circ\text{C)}$$

all calculations are ok but due to inaccurate measurements in part 1, the specific heat of Al is different. If correct value of $H_C = 0$ be used, the calculated c_p (Al) would be 1.02 J/g-degC which is 18.9% off from the actual $c_p = 0.861 \text{ J/g-degC}$ -15p