# Assignment – Data in the workplace

## Criteria

### Unit code, name and release number

MSL924003 - Process and interpret data Release 1

### Qualification/Course code, name and release number

MSL60118 Advanced Diploma of Laboratory Operations Release 1

MSL50118 Diploma of Laboratory Technology Release 1

MSL40118 Certificate IV in Laboratory Operations Release 1

MSL30118 Certificate III in Laboratory Skills Release 1

\*\*Amend the qualification box before distributing to the student. The information here should only contain the qualification the student is enrolled in\*\*

## Student details

### Student number

### Student name

## Assessment Declaration

* This assessment is my original work and no part of it has been copied from any other source except where due acknowledgement is made.
* No part of this assessment has been written for me by any other person except where such collaboration has been authorised by the assessor concerned.
* I understand that plagiarism is the presentation of the work, idea or creation of another person as though it is your own. Plagiarism occurs when the origin of the material used is not appropriately cited. No part of this assessment is plagiarised.

### Student signature and Date

Version: *1.0*

Date created: *10 August 2018*

Date modified: *23/04/2019*

For queries, please contact:

*SkillsPoint: Innovative Manufacturing, Robotics and Science*

*Location: Hamilton*

© 2019 TAFE NSW, Sydney  
RTO Provider Number 90003 | CRICOS Provider Code: 00591E

This assessment can be found in the: [Learning Bank](https://share.tafensw.edu.au/share/access/searching.do?doc=%3Cxml%2F%3E&in=P7ac4831b-430a-4b8d-8b56-f7b32ed5b9cf&q=&type=standard&sort=rank&dr=AFTER)

The contents in this document is copyright © TAFE NSW 2018, and should not be reproduced without the permission of the TAFE NSW. Information contained in this document is correct at time of printing: 23 April 2019. For current information please refer to our website or your teacher as appropriate.

## Assessment instructions

Table 1 Assessment instructions

| Assessment details | Instructions |
| --- | --- |
| **Assessment overview** | The objective of this assessment is to assess your knowledge and performance as would be required to **perform a complete sequence of data treatments and assessments in a workplace laboratory**.  You will be assessed on your ability to;   * Retrieve and store data electronically * Organise, clean and verify the quality of data * Perform calculations using calculators or spreadsheets * Provide basic statistical data from the data set you retrieved * Interpret data to create appropriate graphs, charts and plots * Present graphs, charts and plots * Interpret graphs |
| **Assessment Event number** | 7 of 7 |
| **Instructions for this assessment** | This assessment will be assessing you on your knowledge and performance of skills required by the unit.  This assessment is in 6 major parts;   1. Retrieving, storing and transcribing data 2. Data and quality control 3. Descriptive statistics 4. Reporting data 5. Calculating scientific quantities 6. Graphing and interpretation   Assessment feedback is provided at the end of this document. |
| **Submission instructions** | On completion of this assessment, you are required to upload it or hand it to your trainer on a storage device for marking.  Ensure you have written your name at the bottom of each page of this assessment.  It is important that you keep a copy of all electronic and hardcopy assessments submitted to TAFE and complete the assessment declaration when submitting the assessment. |
| **What do I need to do to achieve a satisfactory result?** | To achieve a satisfactory result for this assessment all tasks must be completed within the prescribed limits. |
| **What do I need to provide?** | Students will need to provide their own;   * Calculator * Writing materials |
| **What the assessor will provide?** | The assessor will provide;   * Access to computer room/classroom as required * Instructions on how to access the assignment database. |
| **Due date and time allowed** | It is expected that this assessment will be performed in the student’s own time. The due date for this assessment will be no later than the second last week of the semester it was started in. |
| **Assessment feedback, review or appeals** | Your assessor will provided feedback as set out in the Unit Assessment Guide. Appeals are addressed in accordance with Every Students Guide to Assessment. |

## Specific task instructions

The instructions below will be used by the assessor to determine whether you have satisfactorily completed this assignment. Use these instructions to ensure you demonstrate the required knowledge.

Throughout this assignment instructions are provided which are similar to workplace procedures. Follow the instructions provided for each task of this assignment.

To perform this assessment you will need to access to files that are referenced in the assessment. These include;

* Assignment – Data in the workplace (this document)
* Field record sheets (Appendix A of this document)
* Assignment database (your teacher will provide the file location)

### Assessment products (what you produce for marking)

* Electronic copy of the G1S1 (xslx or xls) – for Parts 1, 2 and 3
* Electronic copy of the database report (pdf) – for Part 4
* Hardcopy of this document with written answers – for Parts 5 and 6

### File naming conventions

Name your files in the following way;

**Unit code- assessment part-your name-due date**

So, *as an example*, all files should be named so they look like this;

**MS924003-Part123-Jill-Civillian-20-12-2018**

**MS924003-Part4-Jill-Civillian-20-12-2018**

#### Part 1 – Retrieving, storing and transcribing data

*You cannot work on data you don’t have so the first task involves* ***retrieving*** *the data, which will be stored in a Microsoft Access™ database. You will add data from physical data sheets to the database. This will also need to be* ***stored*** *(saved), so that you have a stable version to work with.*

Use the following procedure to complete this task:

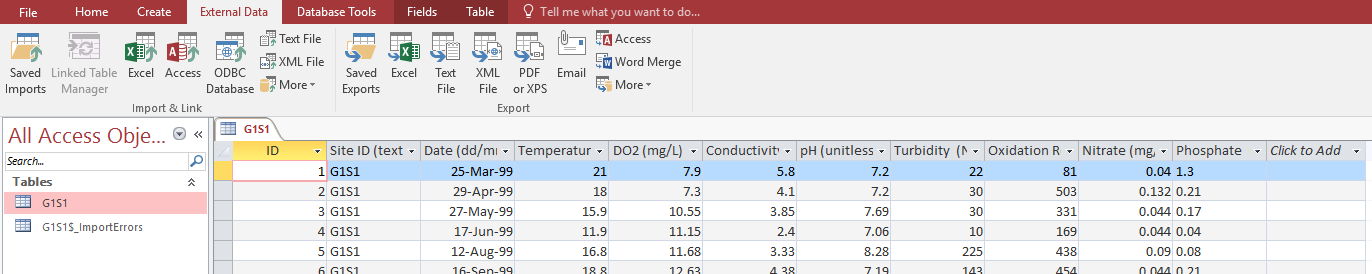
1. Open Microsoft Access™ on your computer
2. Your teacher will provide the file location. Navigate to the file location on your computer or network
3. Open the **Table** titled **G1S1** from the **Object** pane. A large data set should appear as in the screenshot below;

Figure 1 – What you should see when you open the correct table in MS Access™. © TAFE NSW

1. Refer to the four field record sheets found in Attachment 1 of this document. This contains the data you need to enter.
2. Enter the data from the field record sheets into the database (use new row at bottom). This will need to be done for ALL record sheets (that is, four new rows of data). Not all of the data on the sheets is required. Only enter the required data.
3. Check that you have entered the data correctly into the database from the field record sheets.
4. Save the database when complete.

Check your progress

|  |  |
| --- | --- |
| Have you…? | |
| Entered the required data into the database? |  |
| Have you saved (stored) the files to work on? |  |
| Does your work look like the example below? |  |

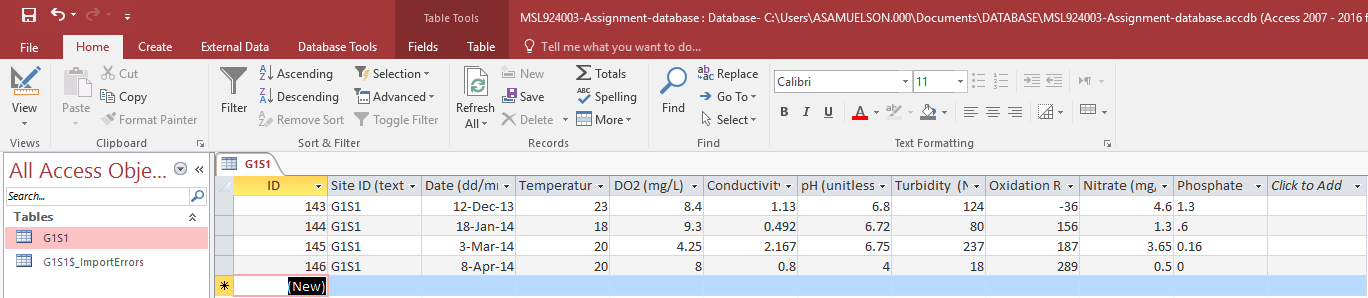


Figure 2 – Screenshot of what your database should look like upon completion of this part of the assessment.

#### Part 2 – Data quality control

*We now have the data in a database, but the formatting of the data is completely incorrect and needs to be ‘cleaned’ and checked.*

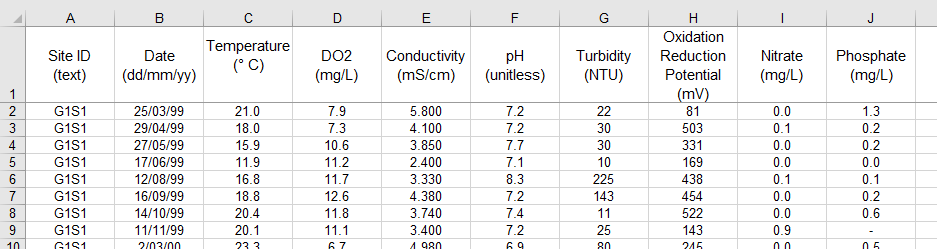
Use the following procedure to complete this task:

1. Open the database if it is not already. Export the data to an Excel spreadsheet (from the External Data tab, export group), named G1S1 to a folder on your computer.
2. Open the spreadsheet to start work on it (if it didn’t open automatically for you).
3. For all the data on the spreadsheet, use the Data Quality Control (QC) Checklist (below) to ensure that the data is in the correct format.
4. If the data is incorrect or improperly formatted (in accordance with Table 1 below), rectify the data in the spreadsheet accordingly.
5. Tick the checkbox in the table when you have completed each check, including Rules 1-3.

**Data Quality Control (QC) procedure checklist**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Data QC Table** | | | | |
| **Parameter** | **Style/Rule** | **Notes** | **Expected range** | **Actioned/Checked?** |
| Site ID | Capitals | e.g. G1S1 | n/a |  |
| Date | dd/mm/yy | 01/12/08 | n/a |  |
| Temperature | 1 decimal place | °C | 0-50 |  |
| DO2 | 1 decimal place | DO2 in mg/L | 0-20 |  |
| Conductivity | 3 decimal place | mS.cm-1 | 0-60 |  |
| pH | 1 decimal place | Unitless | 0-14 |  |
| Turbidity | 0 decimal place | NTU | 0-1000 |  |
| ORP | 0 decimal place | mV | -500-500 |  |
| Nitrate | 1 decimal place | mg/L | 0-50 |  |
| Phosphate | 1 decimal place | mg/L | 0-10 |  |
| Rule 1 – Remove all wildcards.  Change all ‘<1’signs to ‘0.5’ so that a number is recorded. | | | |  |
| Rule 2 – remove all text items (such as ‘dry site’) | | | |  |
| Rule 3 – Make all empty cells a minus sign (so we know it is meant to be empty) | | | |  |

Table 1 – Data formatting requirements

Check your progress

|  |  |
| --- | --- |
| Have you…? | |
| Downloaded the files to work on? |  |
| Checked all the data to verify the quality? |  |
| Rectified errors to ensure quality? |  |
| Does your work look like the example above? |  |

Figure 3 – How your sheet should look at the end of Task 2 [© TAFE NSW]

#### Part 3 – Descriptive statistics

*Now that the data sheet has been updated and checked for quality, we can start to analyse the data using descriptive statistics.*

1. Open the spreadsheet named G1S1
2. At the end of every column of data, use the appropriate functions to find their values.
3. Use the cell format function to ensure each statistical value you calculate has significant figures consistent with the data.

|  |  |  |
| --- | --- | --- |
| Statistical measure | Function in Excel | Comments |
| Mean (Average) | =AVERAGE(data range) |  |
| Median | =MEDIAN(data range) |  |
| Mode | =MODE(data range) |  |
| Max | =MAX(data range) |  |
| Min | =MIN(data range) |  |
| Range | =MAX cell – MIN cell | Manual calculation – no function! |
| Standard Deviation (sample) | =STDEV(data range) |  |
| Variance | =VAR(data) |  |

Table 2 – List of statistical measures required to determine and the function in Excel.

Check your progress

|  |  |
| --- | --- |
| Have you…? | |
| Located the file to work on? |  |
| Saved (stored) your work? |  |
| Checked that your work look like the example below? |  |

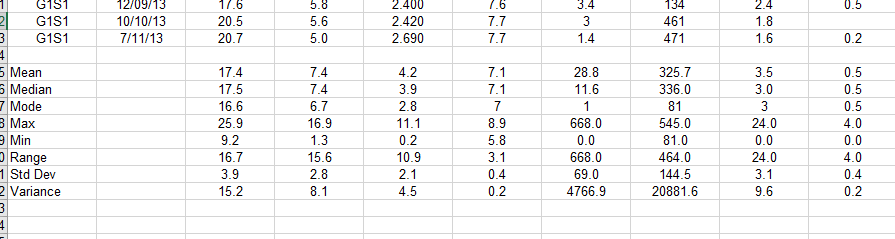


Figure 4 – What your worksheet should like upon completion of Part 4 (note that the values are wrong, so don’t trust them). © TAFE NSW

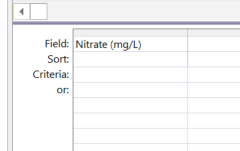
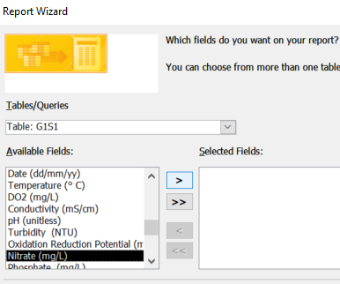
#### Part 4 – Reporting

*With the data from the field record sheets now stored in the database, you now need to generate a report using the databases built in reporting wizard (or similar if not using Access database software). Reports are incredibly useful (if you spend a lot of time creating them properly), but we will only go through the cursory actions to show you how the default reports are created.*

**Task**

The New South Wales Environmental Protection Authority (EPA) sets a business owners license limit for nitrate ions being released into a receiving body of water at 5 mg/L. Generate a report of the data that equals or exceeds this legal limit.

Use the following procedure to complete the task:

1. Open the **G1S1** table from your database
2. Select the Nitrate column by clicking the column header
3. From the **Home** menu, choose the ‘**Advanced’** filter in the **Sort & Filter** group.
4. Choose **Advanced Filter/Sort** from the dropdown menu. A new tab appears called ‘**G1S1Filter1**’. Nitrate should already be displayed in the lower part of the screen, but you should see the following;
5. Type ‘**>5**’ (without the apostrophes) into the ‘**Criteria**’ cell.
6. From the Home menu, choose **Advanced** again and select the ‘**Apply Filter/Sort**’ option. You should see that the data has been significantly reduced and you still see *all* the measurand, not just Nitrate.
7. From the **Create** menu, choose the **Report Wizard** option in the **Reports** group.
8. Click ‘**Yes**’ to save the table. This will display the wizard’s first dialogue box.
9. Choose **Nitrate** from the list and then click the ‘**>**’ button, and then click Next
10. Ignore the Sort options and choose Next
11. Ignore the **Layout** and **Orientation** options and choose **Next**
12. Change the title to ‘**Nitrate results**’ and keep ‘**Preview the report**’ option checked.
13. Click **Finish** button to create the report.
14. Save your work and close the Preview window.

You have now created the report inside the database. You now need to export the report in a format that can be used by anyone.

1. Open the Nitrate report from Objects pane (left side of screen).
2. On the **External Data** menu tab, click the **PDF or XPS** button from the **Export** group
3. Choose the file location you want save the file to.
4. Click the Publish button to create your file as a PDF
5. Submit for marking☺

#### Part 5 – Calculating scientific quantities

*This part of the assessment is about performing laboratory related calculations using common formulas. This Part of the assessment is broken into 5 parts, Part A – Part E) to complete. All parts must be completed.*

**Part 5A – Ratio and percentage**

*In this task, you are required to perform a variety of ratio and percentage calculations. The typical work here is simply expressing an analytical result as a percentage. Consider the following scenarios application and answer the questions below.*

1. Determine the dilution factor (DF) used in a dilution using the data below. Express your answer as a ratio to 1 significant figure. Write your answer in the space below;

C1 = 1000 mg/L

V1 = 10 mL

C2 = 100 mg/L

V2 = 100 mL

1. Express 5 grams of substance dissolved in 100 mL of water as a percentage (include appropriate unit).
2. During the preparation of a solution of diluted ethanol, 20 mL of ethanol was added to a 100 mL volumetric flask and made to volume. Calculate the percentage of ethanol in the flask. Express your answer as a whole number.
3. What size volumetric flask was used in the preparation of a 25% ethanol solution if 50 mL of ethanol was transferred and the flask made up to volume with water?
4. What volume of ethanol was used in making 0.5 L of a 15% ethanol solution?
5. Calculate the percentage of salt if 5 g of salt is dissolved into a 250 mL volumetric flask. Express to 1 significant figure with appropriate unit.

**Part 5B – Solution preparation**

*Regardless of the specific laboratory industry, the preparation of working solutions is a critical task. In this task, you are required to perform a variety of calculations to determine solution characteristics and express results in different units and forms, ensuring significant figures and results formats are expressed correctly.*

*To analyse nitrate ions (NO3-) in a solution, special solutions of a known nitrate concentration (termed standard solutions) need to be prepared. In this scenario, you have been provided with the following data about a standard solution:*

* *Volume = 500 mL*
* *Concentration = 1 g/L NaNO3*
* *Formula weight NaNO3 = 85 amu*

*Use your skills and knowledge to perform the calculations requested below.*

1. Calculate the mass of the salt used to make up the solution. Express your answer to 2 significant figures.

2. Calculate how many moles of NaNO3 the mass is equivalent to. Express your answer to 2 significant figures.

3. Calculate the molarity of the solution. Express your answer to 2 significant figures.

4. Express the concentration as %w/v to 2 significant figures.

**Part 5C – Moisture and ash determination**

*There are many substances that require the determination of moisture and ash content including biological samples, food materials, environmental samples and the like. In this scenario, you are provided with a common workplace form used in these determinations.*

1. A laboratory technician has performed a moisture analysis on fruit sample. Using the data from the table below, calculate the missing values. Assume all weighing was repeated until a constant mass was achieved.

|  |  |
| --- | --- |
| **Sample** | **Value (g), (%)** |
| Before drying in the oven | |
| a) Mass of container | 6.4106 |
| b) Mass of container + sample | 16.4652 |
| c) Mass of sample [=b-a] |  |
| After drying in the oven | |
| d) Mass of container + sample | 8.6542 |
| e) Mass of sample [=d-a] |  |
| f) Mass of moisture lost [=c-e] |  |
| g) % moisture |  |

1. Another technician performed an ash analysis on the sample. Undertake the appropriate calculations and complete the table below.

|  |  |
| --- | --- |
| **Sample** | **Value (g), (%)** |
| Before drying in the furnace | |
| a) Mass of crucible + lid | 16.4487 |
| b) Mass crucible + lid + sample | 21.8764 |
| c) Mass of sample [=b-a] |  |
| After drying in the furnace | |
| d) Mass crucible + lid + sample | 16.4899 |
| e) Mass of ash [=d-a] |  |
| f) Mass of sample lost [=c-e] |  |
| g) % Ash |  |

**Part 5D - Process control calculations**

*Many laboratories service the manufacturing industry as part of their Quality Assurance. In these processes, various calculations need to be performed. In this example, you are required to calculate process variables such as dilution, flowrates and change calculations involving proportionality equations.*

*A chemical manufacturing process produces disinfection agents for the laboratory industry. Perichlor has an active ingredient concentration of 0.12% chlorhexidine gluconate.*

Figure 5 - Example of an industrial chemical process. (Copied under s113P, [Madden Manufacturing](https://www.maddenmfg.com/pump-products/chemical-feed-mixing-systems-madden-manufacturing/chemical-feed-systems.cfm), accessed 26 March 2019)

1. If the initial 1000L tank of product has a chlorhexidine concentration of 4.8%, calculate the **transfer volume** of initial product required to ensure a final concentration of 0.12%.

C1 = 4.8%

V1 = ?

C2 = 0.12%

V2 = 1000L

1. Calculate the dilution factor for this prepared solution. Express this as a ratio.
2. If the volume you calculated in question 1 above took 40 seconds to transfer, calculate the flowrate of the pump in L/min?

**Part 5E – Error and uncertainty**

*Expressing error and uncertainty is a basic requirement in laboratory work. In this part of the, assessment you will be determining the errors and uncertainties associated with repeated measurements of standard materials. Use the data set below to calculate the required values.*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Measurand | Reading 1 | Reading 2 | Reading 3 | Reading 4 | True value |
| Conductivity | 6.64 | 6.59 | 6.68 | 6.67 | 6.67 mS.cm-1 |
| Nitrate | 3.9 | 3.8 | 3.9 | 3.9 | 4.0 mg/L |
| E.Coli (CRM) | 72 | 84 | 69 | 73 | 50-80 cfu |
| pH | 6.9 | 6.9 | 6.9 | 7.0 | pH 7.0 |
| DO (% sat) | 84 | 116 | 95 | 108 | 100 % |

Table # - Data set for calculating errors in task below. NOTE: ‘cfu’ stands for ‘colony forming units’.

**Task**

1. Complete the following table of results by performing the calculations required.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Measurand | Average (reported value) | Absolute error | Relative error | Range | Absolute precision | Relative precision |
| Conductivity |  |  |  |  |  |  |
| Nitrate |  |  |  |  |  |  |
| E.Coli (CRM) |  |  |  |  |  |  |
| pH |  |  |  |  |  |  |
| DO (% sat) |  |  |  |  |  |  |

1. Which measurand exhibits the best accuracy? How did you determine this?
2. Which measurand exhibits the best precision? How did you determine this?
3. Which measurand has the lowest range?

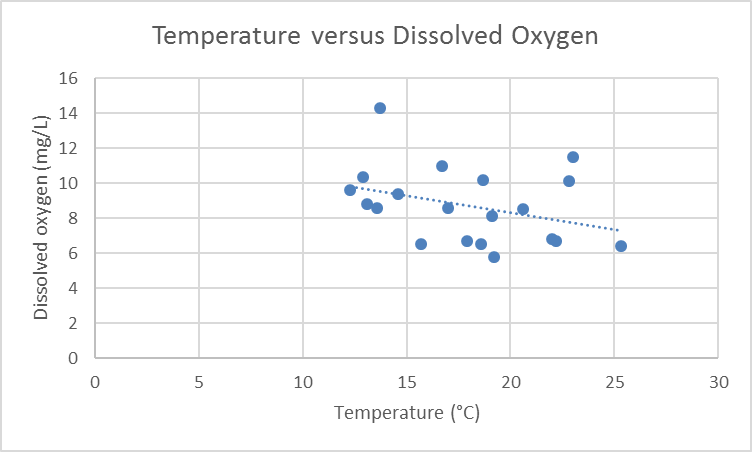
#### Part 6 – Graphs and interpretation

Now that we have summarised the data statistically, we can use this data to perform further analysis. In this task, you will use the data to perform further data analysis.

1. Complete the following table using the turbidity data. You can do this ‘by eye’ or you can use Excel functions to perform the same task.
2. Produce a tally from the data table below and plot the frequency histogram of the data

|  |  |
| --- | --- |
| Bin | Frequency |
| <50 |  |
| 51-100 |  |
| 101-150 |  |
| 151-200 |  |
| 201-250 |  |
| 251-300 |  |
| 351-400 |  |
| 401-450 |  |
| 451-500 |  |
| 501-550 |  |
| >551 |  |

1. In Excel or in the graph below, create **one** line chart of Temperature **and** Dissolved oxygen data (both lines on the one graph) for the years of 2003 and 2004. Ensure you apply the following formatting;
   1. Chart title “Plot of Temperature (°C) versus Dissolved Oxygen (mg/L)”. Use different lines (that is, different colours or line styles (dashes, dots)) to differentiate between the lines.
   2. X axis title of “Date”
   3. Y axis title of “Measurement”
   4. Legend, position at bottom of chart
   5. Put in appropriate ‘scales’ for the y-axis
2. Take a close look at the graph you made in Question 3 (above).
   1. Is there a trend? If so, briefly describe the trend.
   2. Is there a pattern? If so, briefly describe how the pattern repeats.
3. Based on the graph’s appearance, provide a brief interpretation of the relationship between temperature and dissolved oxygen. What happens to one measurement when the other measurement changes?
4. The scatterplot below uses the same data as you used in the line graph above. How does this graph help you confirm or reject your answer to question 5 above?



# Appendix A – Field Record Sheets

## Record 1

## Record 2



## Record 3



## Record 4



## Assessment Feedback

*NOTE: This section* ***must*** *have the assessor signature and student signature to complete the feedback.*

### Assessment outcome

Satisfactory

Unsatisfactory

### Assessor Feedback

Was the assessment event successfully completed?

If no, was the resubmission/re-assessment successfully completed?

Was reasonable adjustment in place for this assessment event?  
*If yes, ensure it is detailed on the assessment document.*

Comments:

### Assessor name, signature and date:

### Student acknowledgement of assessment outcome

Would you like to make any comments about this assessment?

### Student name, signature and date

***NOTE: Make sure you have written your name at the bottom of each page of your submission before attaching the cover sheet and submitting to your assessor for marking.***