

Cambridge TECHNICALS LEVEL 3

LABORATORY SKILLS

Cambridge
TECHNICALS
2016

Unit 3 – Scientific analysis and reporting

RESOURCE LINKS

Version 2

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INTRODUCTION

Resource Links is an e-resource, provided by OCR, for teachers of Cambridge Technicals. It provides descriptions of, and links to, a variety of teaching and learning resources that you may find helpful.

Where appropriate, we have mapped the resources to this OCR unit/learning outcomes (LOs) and provided information about their cost and format.

If you know of other resources you would like to see included here, or discover broken links, please let us know. We would also like to hear from you if have any feedback about your use of these, or other, OCR resources. Please contact us at resources.feedback@ocr.org.uk

To find out more about this qualification, go to: <http://www.ocr.org.uk/qualifications/cambridge-technicals-science-for-technicians-level-3-introductory-diploma-foundation-diploma-diploma-05847-05849-2016-suite>



Cambridge
TECHNICALS
2016

2016 Suite

- New suite for first teaching September 2016
- Externally assessed content
- Eligible for Key Stage 5 performance points from 2018
- Designed to meet the DfE technical guidance

TYPES OF RESOURCE

OCR Produced Resources

These are resources devised and produced directly by the Resources Development Team at OCR.

Publisher Partner Resources

For many subjects OCR works with a publisher partner to ensure that good quality resources such as textbooks are available for first teaching.

Whilst the publisher partner has access to our subject experts and we quality check and endorse these resources they are produced by, and remain the property of, the publisher partner. There is no financial link between OCR and its publisher partners and we do not pay for the development of, or receive any royalties from, these resources.

Endorsed Resources

These resources were produced entirely independently of OCR, but we have quality checked them for their suitability as a resource to support our qualifications.

Other Resources

Unless specifically stated these resources are completely independently produced and are not endorsed by OCR. We have looked at them though, and we think they could be useful in supporting our specifications.

We leave it to you, as a professional educator, to decide if any of these resources are right for you and your students, and how best to use them.

LINKS

Mathematical Order (BODMAS)

An explanation of the importance of performing mathematical operations in the correct order. Website shows the use of the acronym BODMAS (Brackets, Order, Divide, Multiply, Add, Subtract). Includes worked examples.

Supports: Common Misconceptions

Cost: Free

Format: Web page

<http://www.mathsisfun.com/operation-order-bodmas.html>

Mathematical Order (BIDMAS)

An explanation of the importance of performing mathematical operations in the correct order. Website shows the use of the acronym BIDMAS (Brackets, Indices, Divide, Multiply, Add, Subtract).

Supports: Common Misconceptions

Cost: Free

Format: Web page

http://www.bbc.co.uk/bitesize/ks3/maths/number/order_operation/revision/2/

Straight Line Equation

An explanation of the equation of a straight line. Shows gradient and intercept and equation of the form $y = mx + c$

Supports: Common Misconceptions

Cost: Free

Format: Web page

http://www.mathsisfun.com/equation_of_line.html

Accuracy and Precision

An explanation with examples of the difference between accuracy and precision.

Supports: Common Misconceptions

Cost: Free

Format: Web page

<http://www.mathsisfun.com/accuracy-precision.html>

Uncertainty

A PDF poster explaining the term uncertainty. Includes examples.

Supports: Common Misconceptions

Cost: Free

Format: PDF

<http://www.npl.co.uk/upload/pdf/Understanding%20uncertainty.pdf>

Standard Deviation

An explanation with examples.

Supports: Common Misconceptions

Cost: Free

Format: PDF

<http://www.mathsisfun.com/data/standard-deviation.html>

Maths for Science, by Jordan, Ross and Murphy

Comprehensive textbook covering a wide range of applications of maths in science. Includes numerous worked examples, and sample exercises. This text could be useful throughout the whole unit.

Supports: LO1 to LO5

Cost: £29.69

Format: Book

http://www.amazon.co.uk/Maths-Science-Sally-Jordan/dp/0199644969/ref=sr_1_1?s=books&ie=UTF8&qid=1439708717&sr=1-1

Association for Science Education, School Science Review

The Association for Science Education (ASE) is the largest subject association in the UK. It is a professional body for all those involved in science education from pre-school to higher education. Website includes a number of guides that can be purchased relevant to teaching science.

Supports: LO1

Cost: Free (guides must be purchased)

Format: Web page

<http://www.ase.org.uk/journals/school-science-review/>

Measurement Units

National Physical Laboratory's (NPL) definition of the seven base SI units. Also defines SI derived quantities. Includes links explaining each of the units in detail – including videos.

Supports: LO1

Cost: Free

Format: Web page

<http://www.npl.co.uk/reference/measurement-units/>

Standard Form

An explanation of how to put numbers and equations into standard form. Also includes further explanation of scientific notation. The Maths is Fun website also includes many other aspects of maths explained in easy to follow tutorials.

Supports: LO1

Cost: Free

Format: Web page

<http://www.mathsisfun.com/algebra/standard-form.html>

Convert Fractions to Decimals

A series of tutorials explaining how to convert numbers between different forms (decimal to fractions, fractions to decimal and standard form). Includes worked examples and practice activities.

Supports: LO1

Cost: Free

Format: Web page

<http://www.mathsisfun.com/converting-fractions-decimals.html>

Significant Figures Made Easy!

A series of video tutorials explaining how to use significant figures in science.

Supports: LO1

Cost: Free

Format: Video

<http://www.youtube.com/watch?v=5UjwJ9PIUvE&list=PL3hPm0ZdYhy0PQUQ1ka94hxVOPdYGS9m>

Mean, Median, Mode, and Range

An explanation of mean, mode and median with worked examples.

Supports: LO1

Cost: Free

Format: Web page

<http://www.purplemath.com/modules/meanmode.htm>

Rounding Numbers

An interactive tutorial with worked examples and practice exercises on how to round decimals.

Supports: LO1

Cost: Free

Format: Web page

<http://www.mathsisfun.com/rounding-numbers.html>

How To Find The Mean, Median, Mode and Range Of A Series Of Numbers

Another explanation of mean, mode and median. Website includes a number of worked problems relevant to chemistry.

Supports: LO1

Cost: Free

Format: Web page

<http://chemistry.about.com/od/workedchemistryproblems/a/Mean-Median-Mode-And-Range.htm>

Algebra – Substitution

A tutorial showing how to substitute values into an equation (in place of letters)

Supports: LO1

Cost: Free

Format: Web page

<http://www.mathsisfun.com/algebra/substitution.html>

Ordering Mathematical Operations – BODMAS

Tutorial explaining the importance of performing mathematical operations in the correct order (BODMAS). Includes worked and practice examples.

Supports: LO1

Cost: Free

Format: Web page

<http://www.skillsyouneed.com/num/bodmas.html>

Percentage Error

A comprehensive tutorial explaining the term 'error' and how to calculate percentage error.

Supports: LO1

Cost: Free

Format: Web page

<http://www.mathsisfun.com/numbers/percentage-error.html>

Percentage yield calculations

A tutorial explaining how to calculate percentage yield with worked examples. Relates percentage yield to chemical reaction – along with practice examples.

Supports: LO1

Cost: Free

Format: Web page

http://www.docbrown.info/page04/4_73calcs14other2a.htm

Surface area formula

A website showing the formula for the surface area of simple shapes. Also includes other maths resources.

Supports: LO1

Cost: Free

Format: Web page

<http://www.basic-mathematics.com/surface-area-formula.html>

Solid Geometry

A website which shows how to calculate the volume and surface area of simple shapes.

Supports: LO1

Cost: Free

Format: Web page

<http://www.mathsisfun.com/geometry/solid-geometry.html>

Surface area

An interactive web-based resource showing how to calculate surface area of simple shapes.

Supports: LO1

Cost: Free

Format: Web page

<http://www.mathopenref.com/surface-area.html>

Surface Area of Composite Shapes

Video illustrating how to calculate the surface area of a composite shape.

Supports: LO1

Cost: Free

Format: Video

<http://www.youtube.com/watch?v=6Na7dErsjE>

Surface area of composite solids

A basic introduction to how to determine the surface area of a composite solid.

Supports: LO1

Cost: Free

Format: Web page

http://www.bbc.co.uk/bitesize/standard/maths_ii/measure/surface_comp_solids/revision/2/

Volume of complex shapes

A video showing how to calculate the volume of a composite shape by splitting it into simpler shapes and adding volumes.

Supports: LO1

Cost: Free

Format: Video

<http://www.youtube.com/watch?v=z1Pm4dR0Vig>

Rat of reaction 1 – reaction times and rates

A basic introduction to how to calculate reaction rates.

Supports: LO1

Cost: Free

Format: Web page

http://www.bbc.co.uk/schools/gcsebitesize/science/add_ocr_gateway/chemical_economics/reaction1rev1.shtml

Determining Reaction Rates

An explanation of how to calculate average and instantaneous reaction rates. Example shows a negative rate of change as reactant is used up in a chemical reaction.

Supports: LO1

Cost: Free

Format: Web page

<http://www.chem.purdue.edu/gchelp/howtosolveit/Kinetics/CalculatingRates.html>

Gradient (Slope) of a Straight Line

A tutorial showing how to determine slope of a line (e.g. reaction rate). Also shows how to calculate equation of a straight line (including slope and intercept point)

Supports: LO1

Cost: Free

Format: Web page

<http://www.mathsisfun.com/gradient.html>

How To Change The Subject Of A Formula

A video showing how to change the subject of a formula.

Supports: LO1

Cost: Free

Format: Video

http://www.youtube.com/watch?v=cbKc_qilgzA

Equations and Formulas

A comprehensive tutorial explaining what an equation and formula are, and how to change the subject. Includes interactive practice questions.

Supports: LO1

Cost: Free

Format: Web page

<http://www.mathsisfun.com/algebra/equation-formula.html>

Serial Dilution

A simple experiment to prepare a serial dilution.

Supports: LO1

Cost: Free

Format: Web page

<http://sciencefair.math.iit.edu/techniques/SerialDilution/>

Serial Dilution Method Protocol Step Wise Explanation

A video with graphics explaining how to produce a serial dilution. Shows the steps involved including how these produce a geometric progression (logarithmic).

Supports: LO1

Cost: Free

Format: Video

<http://www.youtube.com/watch?v=MCrNjHcfcY>

A language for measurements

A set of useful definitions from the Institute of Physics. Includes definitions for terms relating to error and uncertainty.

Supports: LO1

Cost: Free

Format: Web page

<http://www.nuffieldfoundation.org/practical-physics/language-measurements>

Understanding uncertainty

A handy poster from the National Physical Laboratory (NPL) that explains the difference between error and uncertainty.

Supports: LO1

Cost: Free

Format: PDF

<http://www.npl.co.uk/upload/pdf/Understanding%20uncertainty.pdf>

Standard Deviation and Variance

A simple explanation of the meaning of variance and standard deviation including worked examples. Explains the difference between sample and population.

Supports: LO1

Cost: Free

Format: Web page

<http://www.mathsisfun.com/data/standard-deviation.html>

Standard Deviation

A YouTube video explaining standard deviation. Includes worked examples and student examples to calculate.

Supports: LO1

Cost: Free

Format: Video

<http://www.youtube.com/watch?v=09kiX3p5Vek>

Make Your Own Graphs

Interactive tools for making graphs.

Supports: LO2

Cost: Free

Format: Web page

<http://www.mathsisfun.com/data/graphs-index.html>

Scientific Variables

A video explaining the different types of variables (dependent and independent) in scientific experiments and data.

Supports: LO2 and LO4

Cost: Free

Format: Video

http://www.youtube.com/watch?v=nzfDvfoBv_g

Histograms

A tutorial showing how to construct and interpret histograms.

Supports: LO2

Cost: Free

Format: Web page

<http://www.mathsisfun.com/data/histograms.html>

Geographical Methods and Techniques

A teaching and learning resource that includes guidance on how to present data. Also includes details of how to produce kite diagrams. Examples shown relate to geography.

Supports: LO2

Cost: Free

Format: PDF

http://www.educationscotland.gov.uk/Images/GeographyUnit%201_tcm4-121619.pdf

Continuous and Discrete Functions

A useful summary of the difference between continuous and discrete data.

Supports: LO2

Cost: Free

Format: Web page

<http://mathbitsnotebook.com/Algebra1/FunctionGraphs/FNGContinuousDiscrete.html>

Tools: Error bars on graphs

Tutorial explaining how to add error bars to a graph using Excel. Technique can also be used to add error bars by hand.

Supports: LO2

Cost: Free

Format: Web page

<http://scienceblogs.com/dotphysics/2009/01/12/tools-error-bars-on-graphs/>

Error Bars

A tutorial explaining how to add error bars to an Excel graph. Website also includes further tutorials showing how to plot graphs and add features using Excel.

Supports: LO2

Cost: Free

Format: Web page

<http://www.excel-easy.com/examples/error-bars.html>

Outliers

An explanation of what is meant by the term 'outlier' along with examples of this can affect data.

Supports: LO2

Cost: Free

Format: Web page

<http://www.mathsisfun.com/data/outliers.html>

Identification of outliers

Example of how to identify outliers on graphs. Includes tutorial exercises and solutions.

Supports: LO2

Cost: Free

Format: Web page

<http://everythingmaths.co.za/maths/grade-11/11-statistics/11-statistics-06.cnxmlplus>

Equation of a Straight Line

Tutorial showing how to determine the equation of a straight line from a graph. Shows how to determine rate of change (gradient) and intercept point.

Supports: LO2

Cost: Free

Format: Web page

http://www.mathsisfun.com/equation_of_line.html

Scatter Plots

A tutorial explaining how graphs can be used to interpolate and extrapolate data.

Supports: LO2

Cost: Free

Format: Web page

<http://www.mathsisfun.com/data/scatter-xy-plots.html>

Interpolation and Extrapolation: Estimating Values from a Graphs

A video showing how to estimate data from graphs, including how to interpolate and extrapolate data. Video shows a straight line graph.

Supports: LO2

Cost: Free

Format: Video

http://www.youtube.com/watch?v=Y9HG8q_NuhU

Trendline (Excel)

A tutorial explaining how to add trendlines to graphs in Excel.

Supports: LO2

Cost: Free

Format: Web page

<http://www.excel-easy.com/examples/trendline.html>

Making and using keys

A basic introduction to how to use keys to collate specimens. Includes tutorial examples.

Supports: LO3

Cost: Free

Format: PDF

<http://www.saps.org.uk/attachments/article/560/SAPS%20Grouping%20&%20classification%20-%20PartE.pdf>

Primary vs. Secondary Sources

A short video explaining the difference between primary and secondary sources of data.

Supports: LO3

Cost: Free

Format: Video

<http://www.youtube.com/watch?v=g0plq2E9ZjQ>

Use a Simple Classification Key

A website with links to many resources showing how to use and produce keys, including classification and dichotomous keys.

Supports: LO3

Cost: Free

Format: Web page

http://www.internet4classrooms.com/grade_level_help/life_science_identify_organism_with_simple_key_eighth_8th_grade_science.htm

Living things and their habitats

A series of resources, including worksheets and videos, providing an explanation of classification.

Supports: LO3

Cost: Free

Format: Web page

<http://www.tigttagworld.co.uk/curriculum-england-year-6/>

Taxonomy

An interesting introduction to development and use of binomial nomenclature – the taxonomy used for classifying and identifying living organisms. Also includes links to other resources.

Supports: LO3

Cost: Free

Format: Web page

<http://biology.about.com/od/evolution/a/aa092304a.htm>

Binomial Nomenclature

A short video introduction to binomial nomenclature.

Supports: LO3

Cost: Free

Format: Video

<http://www.youtube.com/watch?v=CKHqO7x25VE>

Improving Practical Work in Science

A website containing resources for teachers from the Association for Science Education (ASE)

Supports: LO4

Cost: Free

Format: Web page

<http://www.gettingpractical.org.uk/>

The Language of Measurement

A useful guide to teaching science. Includes definitions and examples of technology used in measurement, including accuracy, precision, range and interval and many other terms. Website also includes further reference resources to purchase.

Supports: LO4

Cost: £13.50 (excerpts on website)

Format: Book

<http://www.gettingpractical.org.uk/Books.php>

Identify the Controls and Variables

A worksheet in which learners need to identify the control variables in a series of light-hearted experiments. Includes solutions.

Supports: LO4

Cost: Free

Format: Web page

<http://www.biologycorner.com/worksheets/controls.html> (worksheet)

<http://www.biologycorner.com/worksheets/controls333.html> (solutions)

Accuracy and Precision

A simple explanation of the terms accuracy and precision.

Supports: LO4

Cost: Free

Format: Web page

<http://www.mathsisfun.com/accuracy-precision.html>

Uncertainties in Measurements

A tutorial explaining uncertainty in experiments. Includes error terms, precision and accuracy, and methods for reducing error.

Supports: LO4

Cost: Free

Format: Web page

http://chemwiki.ucdavis.edu/Analytical_Chemistry/Quantifying_Nature/Significant_Digits/Uncertainties_in_Measurements

Random vs Systematic Error

An easy to understand guide to random and systematic errors in experimental data.

Supports: LO4

Cost: Free

Format: Web page

<http://www.physics.umd.edu/courses/Phys276/Hill/Information/Notes/ErrorAnalysis.html>

Common Sources of Error in Physics Lab Experiments

A list of common sources of error in experiments (random and systematic).

Supports: LO4

Cost: Free

Format: Web page

http://www2.southeastern.edu/Academics/Faculty/rallain/plab193/labinfo/ErrorAnalysis/06_Sources_of_Error.html

Errors in Measurement

A mathematical overview of errors in measurements – including degrees of accuracy, absolute, relative and percentage error. Includes worked examples and practice questions.

Supports: LO4

Cost: Free

Format: Web page

<http://www.mathsisfun.com/measure/error-measurement.html>

A language for measurements

A useful guide to terminology used in measurements – including the terms repeatability and reproducibility. Refers to ASE book The Language of Measurements. Printer friendly.

Supports: LO4

Cost: Free

Format: Web page

<http://www.nuffieldfoundation.org/practical-physics/language-measurements>

The scientific process: GCSE revision

A short revision tutorial explaining the scientific process. Includes key terms, including repeatability and reproducibility. Aimed at GCSE but provides a very useful overview.

Supports: LO4

Cost: Free

Format: Video

<http://www.youtube.com/watch?v=IX2NPyvYz3w>

Science and the Scientific Method: A Definition

A useful explanation of the scientific method – including how to test hypothesis. Includes a discussion on deductive and inductive reasoning including further related links.

Supports: LO5

Cost: Free

Format: Web page

<http://www.livescience.com/20896-science-scientific-method.html>

Studies are conflicting so I don't believe in scientific studies

An interesting article looking at the meaning of conflicting evidence in scientific studies – and how it might be avoided.

Supports: LO5

Cost: Free

Format: Web page

http://www.exercisebiology.com/index.php/site/articles/studies_are_conflicting_so_i_dont_believe_in_scientific_studies/

Distinguishing Science and Pseudoscience

An interesting article explaining what makes for a secure scientific conclusion, and what does not.

Supports: LO5

Cost: Free

Format: Web page

<http://www.quackwatch.com/01QuackeryRelatedTopics/pseudo.html>

MMR: a saga of bad science and scare stories that swayed health professionals

An explanation of the MMR vaccine scare – and how this relates to bad science.

Supports: LO5

Cost: Free

Format: Web page

<http://www.pharmaceutical-journal.com/opinion/comment/mmr-a-saga-of-bad-science-and-scare-stories-that-swayed-health-professionals/10996275.article>

Bad Science: Common Problems in Research Articles

An article demonstrating common problems in scientific research articles (e.g. bad science)

Supports: LO5

Cost: Free

Format: Web page

<http://timhuntley.com/bad-science-common-problems-in-research-articles/>

Permanent Slide Preparation

What is the best way to make permanent preparations for microscopic viewing?

Supports: LO6

Cost: Free

Format: Video Youtube, Hooke College

https://www.youtube.com/watch?v=xluxzReYp_k

Making wet and dry slides

An introduction in making wet and dry mount slides.

Supports: LO6

Cost: Free

Format: Video Youtube

<https://www.youtube.com/watch?v=ZjQVO8gT0A8>

UK Standards for microbiological investigations

Staining procedures for bacterial stains, fungal stains, parasite stains.

Supports: LO6

Cost: Free

Format: Pdf

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/457837/TP_39i2.1.pdf

Staining techniques

Introduction to staining techniques for microbiological investigations.

Supports: LO6

Cost: Free

Format: Web page

<http://www.cliffsnotes.com/study-guides/biology/microbiology/microscopy/staining-techniques>

Column chromatography

How the same principles used in thin layer chromatography can be applied on a larger scale to separate mixtures in column chromatography.

Supports: LO6

Cost: Free

Format: Web page

<http://www.chemguide.co.uk/analysis/chromatography/column.html>

Quantitative analysis

Quantitative chromatographic analysis by TLC

Supports: LO6

Cost: Free

Format: Web page

<http://www.chromatography-online.org/quant/Quantitative%20Analysis%20by%20TLC.php>

Chloride ion concentration

Determination of chloride ion concentration by titration (Mohr's Method).

Supports: LO6

Cost: Free

Format: Pdf

http://www.outreach.canterbury.ac.nz/chemistry/documents/chloride_mohr.pdf

Determination of chloride concentration

Video of the method to determine the concentration of chloride using Mohr's method.

Supports: LO6

Cost: Free

Format: Video Youtube

https://www.youtube.com/watch?v=-ZU_klxyC28

Redox titration

A redox titration example – titrating Fe(II) solution with potassium permanganate.

Supports: LO6

Cost: Free

Format: Web page

<https://www.khanacademy.org/science/chemistry/acid-base-equilibrium/titrations/v/redox-titration>

Titration information

A range of titrations including: magnesium, calcium, zinc, nickel, aluminium, water hardness.

Supports: LO6

Cost: Free

Format: Web page

<http://www.titrations.info/EDTA-titration>

Scientific report writing

How to write each section of a scientific report.

Supports: LO7

Cost: Free

Format: Web page

<http://writing.wisc.edu/Handbook/ScienceReport.html>

Scientific report

How to write a scientific report at university level.

Supports: LO7

Cost: Free

Format: Pdf

<http://www2.hull.ac.uk/li/pdf/Scientific%20Reports.pdf>

Quiz

Quiz on writing scientific methods.

Supports: LO7

Cost: Free

Format: Web page

<https://www.thatquiz.org/tq/previewtest?B/F/O/C/90551352322409>

Graph plotting

How to record data and plot a scientific graph.

Supports: LO7

Cost: Free

Format: Web page

<http://crescentok.com/staff/jaskew/isr/graph/graph.htm>

Scientific research

How to report scientific research to a general audience.

Supports: LO7

Cost: Free

Format: Web page

<http://scienceblogs.com/cognitivedaily/2007/02/01/how-to-report-scientific-resea/>

Reporting science

Professor Colin Blakemore outlines good practice in reporting science stories.

Supports: LO7

Cost: Free

Format: Web page

<http://www.bbc.co.uk/academy/journalism/article/art20130702112133767>

Peer Review – The nuts and bolts

The guide explains how peer review works.

Supports: LO7

Cost: Free

Format: Pdf

http://www.senseaboutscience.org/data/files/resources/99/Peer-review_The-nuts-and-bolts.pdf



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If you do not currently offer this OCR qualification but would like to do so, please complete the Expression of Interest Form which can be found here: www.ocr.org.uk/expression-of-interest

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resources.feedback@ocr.org.uk

Looking for a resource?

There is now a quick and easy search tool to help find **free** resources for your qualification:

www.ocr.org.uk/i-want-to/find-resources/

www.ocr.org.uk/science

OCR Customer Contact Centre

Vocational qualifications

Telephone 02476 851509

Facsimile 02476 851633

Email vocational.qualifications@ocr.org.uk

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