BTEC Level 3 Applied Science Transition Work

Welcome to BTEC Science. This is a unique subject which gives you the opportunity to develop many key skills such as report writing, practical skills, analytical investigation skills alongside learning key scientific content for Biology, Chemistry and Physics. The tasks below cover a range of these skills to get you started. Please print and complete these fully and bring them with you to your first lesson in September.

What you will study	Preparation work
Unit 1 – Principles and Applications of Science I **Section A - Chemistry** Structure and bonding in applications of science Production and uses of substances in relation to properties **Section B - Biology** Cell structure and function Cell specialisation Tissue structure and function **Section C – Physics** Working with waves Waves in communication Use of electromagnetic waves in communication	Complete the following activities: Transition work Biology
Unit 2 – Practical scientific procedures and techniques **Learning Aim A** – Undertake titration and colorimetry to determine the concentration of solutions **Learning Aim B** – Undertake calorimetry to study cooling curves **Learning Aim C** – Undertake chromatographic techniques to identify components in mixtures **Learning Aim D** – Review personal development of skills for laboratory work	Complete the following activities: BTEC Skills sheet 1 BTEC Skills sheet 2 BTEC Skills sheet 3
Unit 3 – Science Investigation skills **Section A** – Planning a scientific investigation **Section B** – Data collection, processing, analysis and interpretation **Section C** – Drawing conclusions and evaluation **Section D** – Enzymes in action **Section E** – Diffusion of molecules **Section F** – Plants and their environment **Section G** – Energy content of fuels **Section H** – Electrical circuits	Produce a glossary for the following key words: accuracy, anomaly, calibration, causal link, chance, confounding variable, control experiment, control group, control variable, correlation, dependent variable, errors, evidence, fair test, hypothesis, independent, null hypothesis, precision, probability, protocol, random distribution, random error, raw data, reliability, systematic error, true value, validity, zero error,
Additional Unit – to be confirmed	

Transition from GCSE to A Level

Moving from GCSE Science to A Level can be a daunting leap. You'll be expected to remember a lot more facts, equations, and definitions, and you will need to learn new maths skills and develop confidence in applying what you already know to unfamiliar situations.

This worksheet aims to give you a head start by helping you:

- to pre-learn some useful knowledge from the first chapters of your A Level course
- understand and practice of some of the maths skills you'll need.

Learning objectives

After completing the worksheet you should be able to:

- define practical science key terms
- recall the answers to the retrieval questions
- perform maths skills including:
    - converting between units, standard form, and prefixes
    - using significant figures
    - rearranging formulae
    - magnification calculations
    - calculating percentages, errors, and uncertainties
    - drawing and interpreting line graphs.

Retrieval questions

You need to be confident about the definitions of terms that describe measurements and results in A Level Biology.

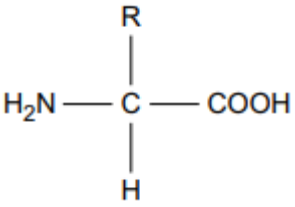
Learn the answers to the questions below then cover the answers column with a piece of paper and write as many answers as you can. Check and repeat.

Practical science key terms

When is a measurement valid?	when it measures what it is supposed to be measuring
When is a result accurate?	when it is close to the true value
What are precise results?	when repeat measurements are consistent/agree closely with each other
What is repeatability?	how precise repeated measurements are when they are taken by the *same* person, using the *same* equipment, under the *same* conditions
What is reproducibility?	how precise repeated measurements are when they are taken by *different* people, using *different* equipment
What is the uncertainty of a measurement?	the interval within which the true value is expected to lie
Define measurement error	the difference between a measured value and the true value
What type of error is caused by results varying around the true value in an unpredictable way?	random error
What is a systematic error?	a consistent difference between the measured values and true values
What does zero error mean?	a measuring instrument gives a false reading when the true value should be zero
Which variable is changed or selected by the investigator?	independent variable
What is a dependent variable?	a variable that is measured every time the independent variable is changed
Define a fair test	a test in which only the independent variable is allowed to affect the dependent variable
What are control variables?	variables that should be kept constant to avoid them affecting the dependent variable

Biological molecules

Learn the answers to the questions below then cover the answers column with a piece of paper and write as many answers as you can. Check and repeat.

What are monomers?	smaller units from which larger molecules are made
What are polymers?	molecules made from a large number of monomers joined together
What is a condensation reaction?	a reaction that joins two molecules together to form a chemical bond whilst eliminating of a molecule of water
What is a hydrolysis reaction?	a reaction that breaks a chemical bond between two molecules and involves the use of a water molecule
What is a monosaccharide?	monomers from which larger carbohydrates are made
How is a glycosidic bond formed?	a condensation reaction between two monosaccharides
Name the three main examples of polysaccharides.	glycogen, starch, cellulose
Describe Benedict's test for reducing sugars	gently heat a solution of a food sample with an equal volume of Benedict's solution for five minutes, the solution turns orange/brown if reducing sugar is present
Name the two main groups of lipids	phospholipids, triglycerides (fats and oils)
Give four roles of lipids	source of energy, waterproofing, insulation, protection
What is an ester bond?	a bond formed by a condensation reaction between glycerol and a fatty acid
Describe the emulsion test for lipids	mix the sample with ethanol in a clean test tube, shake the sample, add water, shake the sample again, a cloudy white colour indicates that lipid is present
What are the monomers that make up proteins?	amino acids
Draw the structure of an amino acid	
How is a peptide bond formed?	a condensation reaction between two amino acids
What is a polypeptide?	many amino acids joined together
Describe the biuret test for proteins	mix the sample with sodium hydroxide solution at room temperature, add very dilute copper(II) sulfate solution, mix gently, a purple colour indicates that peptide bonds are present
How does an enzyme affect a reaction?	it lowers the activation energy
Give five factors which can affect enzyme action.	temperature, pH, enzyme concentration, substrate concentration, inhibitor concentration
What is a competitive inhibitor?	a molecule with a similar shape to the substrate, allowing it to occupy the active site of the enzyme
What is a non-competitive inhibitor?	a molecule that changes the shape of the enzyme by binding somewhere other than the active site.

Maths skills

1 Numbers and units

1.1 Units and prefixes

A key criterion for success in biological maths lies in the use of correct units and the management of numbers. The units scientists use are from the *Système Internationale* – the SI units. In biology, the most commonly used SI base units are metre (m), kilogram (kg), second (s), and mole (mol). Biologists also use SI derived units, such as square metre (m^2), cubic metre (m^3), degree Celsius (°C), and litre (l).

To accommodate the huge range of dimensions in our measurements they may be further modified using appropriate prefixes. For example, one thousandth of a second is a millisecond (ms). Some of these prefixes are illustrated in the table below.

Multiplication factor	Prefix	Symbol
10^9	giga	G
10^6	mega	M
10^3	kilo	k
10^{-2}	centi	c
10^{-3}	milli	m
10^{-6}	micro	μ
10^{-9}	nano	n

Practice questions

1 A burger contains 4 500 000 J of energy. Write this in:
a kilojoules **b** megajoules.

2 HIV is a virus with a diameter of between 9.0×10^{-8} m and 1.20×10^{-7} m.
Write this range in nanometres.

1.2 Powers and indices

Ten squared = 10 × 10 = 100 and can be written as 10^2. This is also called 'ten to the power of 2'.

Ten cubed is 'ten to the power of three' and can be written as $10^3 = 1000$.

The power is also called the index.

Fractions have negative indices:

one tenth = $10^{-1} = 1/10 = 0.1$
one hundredth = $10^{-2} = 1/100 = 0.01$
Any number to the power of 0 is equal to 1, for example, $29^0 = 1$.

If the index is 1, the value is unchanged, for example, $17^1 = 17$.

When multiplying powers of ten, you must *add* the indices.

So 100 × 1000 = 100 000 is the same as $10^2 \times 10^3 = 10^{2+3} = 10^5$

When dividing powers of ten, you must *subtract* the indices.

So 100/1000 = 1/10 = 10^{-1} is the same as $10^2/10^3 = 10^{2-3} = 10^{-1}$

But you can only do this when the numbers with the indices are the same.

So $10^2 \times 2^3 = 100 \times 8 = 800$

And you can't do this when adding or subtracting.

$10^2 + 10^3 = 100 + 1000 = 1100$

$10^2 - 10^3 = 100 - 1000 = -900$

Remember: You can only add and subtract the indices when you are multiplying or dividing the numbers, not adding or subtracting them.

Practice questions

3 Calculate the following values. Give your answers using indices.

a $10^8 \times 10^3$ **b** $10^7 \times 10^2 \times 10^3$

c $10^3 + 10^3$ **d** $10^2 - 10^{-2}$

4 Calculate the following values. Give your answers with and without using indices.

a $10^5 \div 10^4$ **b** $10^3 \div 10^6$

c $10^2 \div 10^{-4}$ **d** $100^2 \div 10^2$

1.3 Converting units

When doing calculations, it is important to express your answer using sensible numbers. For example, an answer of 6230 µm would have been more meaningful expressed as 6.2 mm.

If you convert between units and round numbers properly, it allows quoted measurements to be understood within the scale of the observations.

To convert 488 889 m into km:

A kilo is 10^3 so you need to divide by this number, or move the decimal point three places to the left.

488 889 ÷ 10^3 = 488.889 km

However, suppose you are converting from mm to km: you need to go from 10^3 to 10^{-3}, or move the decimal point six places to the left.

333 mm is 0.000 333 km

Alternatively, if you want to convert from 333 mm to nm, you would have to go from 10^{-9} to 10^{-3}, or move the decimal point six places to the right.

333 mm is 333 000 000 nm

Practice question

5 Calculate the following conversions:

a 0.004 m into mm **b** 130 000 ms into s

c 31.3 ml into µl **d** 104 ng into mg

6 Give the following values in a different unit so they make more sense to the reader.

Choose the final units yourself. (Hint: make the final number as close in magnitude to zero as you can. For example, you would convert 1000 m into 1 km.)

a 0.000 057 m **b** 8 600 000 µl **c** 68 000 ms **d** 0.009 cm

2 Decimals, standard form, and significant figures

2.1 Decimal numbers

A decimal number has a decimal point. Each figure *before* the point is a whole number, and the figures *after* the point represent fractions.

The number of decimal places is the number of figures *after* the decimal point. For example, the number 47.38 has 2 decimal places, and 47.380 is the same number to 3 decimal places.

In science, you must write your answer to a sensible number of decimal places.

Practice questions

1 New antibiotics are being tested. A student calculates the area of clear zones in Petri dishes in which the antibiotics have been used. List these in order from smallest to largest.

0.0214 cm^2 0.03 cm^2 0.0218 cm^2 0.034 cm^2

2 A student measures the heights of a number of different plants. List these in order from smallest to largest.

22.003 cm 22.25 cm 12.901 cm 12.03 cm 22 cm

2.2 Standard form

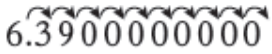
Sometimes biologists need to work with numbers that are very small, such as dimensions of organelles, or very large, such as populations of bacteria. In such cases, the use of scientific notation or standard form is very useful, because it allows the numbers to be written easily.

Standard form is expressing numbers in powers of ten, for example, 1.5×10^7 microorganisms.

Look at this worked example. The number of cells in the human body is approximately 37 200 000 000 000. To write this in standard form, follow these steps:

Step 1: Write down the smallest number between 1 and 10 that can be derived from the number to be converted. In this case it would be 3.72

Step 2: Write the number of times the decimal place will have to shift to expand this to the original number as powers of ten. On paper this can be done by hopping the decimal over each number like this:



until the end of the number is reached.

In this example that requires 13 shifts, so the standard form should be written as 3.72×10^{13}.

For very small numbers the same rules apply, except that the decimal point has to hop backwards. For example, 0.000 000 45 would be written as 4.5×10^{-7}.

Practice questions

3 Change the following values to standard form.

a 3060 kJ **b** 140 000 kg **c** 0.000 18 m **d** 0.000 004 m

4 Give the following numbers in standard form.

a 100 **b** 10 000 **c** 0.01 **d** 21 000 000

5 Give the following as decimals.

a 10^6 **b** 4.7×10^9 **c** 1.2×10^{12} **d** 7.96×10^{-4}

2.3 Significant figures

When you use a calculator to work out a numerical answer, you know that this often results in a large number of decimal places and, in most cases, the final few digits are 'not significant'. It is important to record your data and your answers to calculations to a reasonable number of significant figures. Too many and your answer is claiming an accuracy that it does not have, too few and you are not showing the precision and care required in scientific analysis.

Numbers to 3 significant figures (3 s.f.):

7.88 25.4 741

Bigger and smaller numbers with 3 significant figures:

0.000 147 0.0147 0.245 39 400 96 200 000 (notice that the zeros before the figures and after the figures are *not* significant – they just show you how large the number is by the position of the decimal point).

Numbers to 3 significant figures where the zeros *are* significant:

207 4050 1.01 (any zeros between the other significant figures *are* significant).

Standard form numbers with 3 significant figures:

9.42×10^{-5} 1.56×10^8

If the value you wanted to write to 3.s.f. was 590, then to show the zero was significant you would have to write:

590 (to 3.s.f.) or 5.90×10^2

Remember: For calculations, use the same number of figures as the data in the question with the lowest number of significant figures. It is not possible for the answer to be more accurate than the data in the question.

Practice question

6 Write the following numbers to **i** 2 s.f. and **ii** 3 s.f.

a 7644 g

b 27.54 m

c 4.3333 g

d 5.995×10^2 cm^3

7 The average mass of oxygen produced by an oak tree is 11800 g per year.

Give this mass in standard form and quote your answer to 2 significant figures.

3 Working with formulae

It is often necessary to use a mathematical formula to calculate quantities. You may be tested on your ability to substitute numbers into formulae or to rearrange formulae to find specific values.

3.1 Substituting into formulae

Think about the data you are given in the question. Write down the equation and then think about how to get the data to substitute into the equation. Look at this worked example.

A cheek cell has a 0.06 mm diameter. Under a microscope it has a diameter 12 mm. What is the magnification?

magnification = image size (mm) ÷ object size (mm) or $M = \frac{I}{O}$

Substitute the values and calculate the answer:

M = 12 mm/0.06 mm = 12/0.06 = 200

Answer: magnification = ×200 (magnification has no units)

Sometimes an equation is more complicated and the steps need to be carried out in a certain order to succeed. A general principle applies here, usually known by the mnemonic BIDMAS. This stands for **B**rackets, **I**ndices (functions such as squaring or powers), **D**ivision, **M**ultiplication, **A**ddition, **S**ubtraction.

Practice questions

1 Calculate the magnification of a hair that has a width of 6.6 mm on a photograph. The hair is 165 µm wide.

2 Estimate the area of a leaf by treating it as a triangle with base 2 cm and height 9 cm.

3 Estimate the area of a cell by treating it as a circle with a diameter of 0.7 µm. Give your answer in µm^2.

4 An *Amoeba* population starts with 24 cells. Calculate how many *Amoeba* cells would be present in the culture after 7 days if each cell divides once every 20 hours. Use the equation $N_t = N_0 \times 2^n$ where N_t = number after time t, N_0 = initial population, n = number of divisions in the given time t.

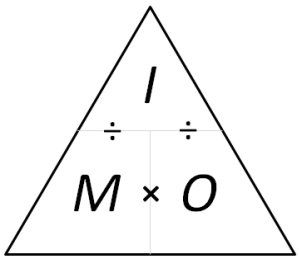
5 In a quadrat sample, an area was found to contain 96 aphids, 4 ladybirds, 22 grasshoppers, and 3 ground beetles. Calculate the diversity of the site using the equation $D = 1 - \Sigma\left(\frac{n}{N}\right)^2$ *where* n = number of each species, N = grand total of all species, and D = diversity.

Remember: In this equation there is a part that needs to be done several times then summed, shown by the symbol Σ.

3.2 Rearranging formulae

Sometimes you will need to rearrange an equation to calculate the answer to a question. For example, the relationship between magnification, image size, and actual size of specimens in micrographs usually uses the equation $M = \frac{I}{O}$, where M is magnification, I is size of the image, and O = actual size of the object.

You can use the algebra you have learnt in Maths to rearrange equations, or you can use a triangle like the one shown.



Cover the quantity you want to find. This leaves you with either a fraction or a multiplication:

$M = I \div O$ $O = I \div M$ $I = M \times O$

Practice questions

6 A fat cell is 0.1 mm in diameter. Calculate the size of the diameter seen through a microscope with a magnification of ×50.

7 A Petri dish shows a circular colony of bacteria with a cross-sectional area of 5.3 cm^2. Calculate the radius of this area.

8 In a photograph, a red blood cell is 14.5 mm in diameter. The magnification stated on the image is ×2000. Calculate the real diameter of the red blood cell.

9 Rearrange the equation $34 = 2a/135 \times 100$ and find the value of *a.*

10 The cardiac output of a patient was found to be 2.5 $dm^3\,min^{-1}$ and their heart rate was 77 bpm. Calculate the stroke volume of the patient.

Use the equation: cardiac output = stroke volume × heart rate.

11 In a food chain, efficiency = $\frac{\text{biomass transferred}}{\text{biomass taken in}} \times 100$

A farmer fed 25 kg of grain to his chicken. The chicken gained weight with an efficiency of 0.84. Calculate the weight gained by the chicken.

4 Magnification

To look at small biological specimens you use a microscope to magnify the image that is observed. The microscope was developed in the 17th century. Anton van Leeuwenhoek used a single lens and Robert Hooke used two lenses. The lenses focus light from the specimen onto your retina to produce a magnified virtual image. The magnification at which observations are made depends on the lenses used.

4.1 Calculating the magnifying power of lenses

Lenses each have a magnifying power, defined as the number of times the image is larger than the real object. The magnifying power is written on the lens.

To find the magnification of the virtual image that you are observing, multiply the magnification powers of each lens used. For example, if the eyepiece lens is ×10 and the objective lens is ×40 the total magnification of the virtual image is 10 × 40 = 400.

Practice questions

1 Calculate the magnification of the virtual image produced by the following combinations of lenses:

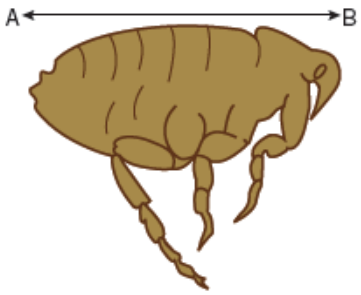
a objective ×10 and eyepiece ×12 **b** objective ×40 and eyepiece ×15

4.2 Calculating the magnification of images

Drawings and photographs of biological specimens should always have a magnification factor stated. This indicates how much larger or smaller the image is compared with the real specimen.

The magnification is calculated by comparing the sizes of the image and the real specimen. Look at this worked example.

The image shows a flea which is 1.3 mm long. To calculate the magnification of the image, measure the image (or the scale bar if given) on the paper (in this example, the body length as indicated by the line A–B).



For this image, the length of the image is 42 mm and the length of the real specimen is 1.3 mm.

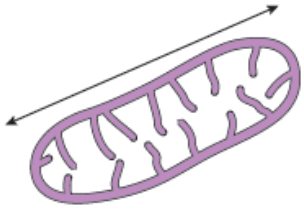
$$\text{magnification} = \frac{\text{length of image}}{\text{length of real specimen}} = 42/1.3 = 32.31$$

The magnification factor should therefore be written as ×32.31

Remember: Use the same units. A common error is to mix units when performing these calculations. Begin each time by converting measurements to the same units for both the real specimen and the image.

Practice question

2 Calculate the magnification factor of a mitochondrion that is 1.5 µm long.



4.3 Calculating real dimensions

Magnification factors on images can be used to calculate the actual size of features shown on drawings and photographs of biological specimens. For example, in a photomicrograph of a cell, individual features can be measured if the magnification is stated. Look at this worked example.

The magnification factor for the image of the open stoma is ×5000.

This can be used to find out the actual size of any part of the cell, for example, the length of one guard cell, measured from A to B.

Step 1: Measure the length of the guard cell as precisely as possible. In this example the image of the guard cell is 52 mm long.

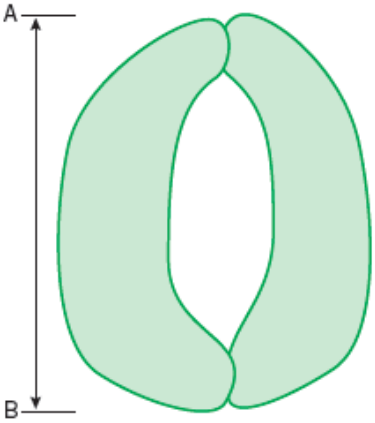
Step 2: Convert this measurement to units appropriate to the image. In this case you should use µm because it is a cell.

So the magnified image is 52 × 1000 = 52 000 µm

Step 3: Rearrange the magnification equation (see Topic 3.2) to get:

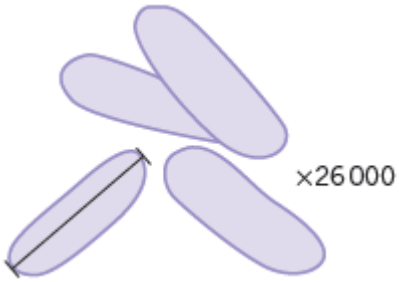
real size = size of image/magnification = 52 000/5000 = 10.4

So the real length of the guard cell is 10.4 µm.



Practice question

3 Use the magnification factor to determine the actual size of a bacterial cell.



5 Percentages and uncertainty

A percentage is simply a fraction expressed as a decimal. It is important to be able to calculate routinely, but is often incorrectly calculated in exams. These pages should allow you to practise this skill.

5.1 Calculating percentages as proportions

To work out a percentage, you must identify or calculate the total number using the equation:

$$\text{percentage} = \frac{\text{number you want as a percentage of total number}}{\text{total number}} \times 100\%$$

For example, in a population, the number of people who have brown hair was counted.

The results showed that in the total population of 4600 people, 1800 people had brown hair.

The percentage of people with brown hair is found by calculating:

$$\frac{\text{number of people with brown hair}}{\text{total number of people}} \times 100$$

$$= \frac{1800}{4600} \times 100 = 39.1\%$$

Practice questions

1 The table below shows some data about energy absorbed by a tree in a year and how some of it is transferred.

Energy absorbed by the tree in a year	3 600 000 kJ/m^2
Energy transferred to primary consumers	2240 kJ/m^2
Energy transferred to secondary consumers	480 kJ/m^2

Calculate the percentage of energy absorbed by the tree that is transferred to

a primary consumers **b** secondary consumers.

2 One in 17 people in the UK has diabetes.

Calculate the percentage of the UK population that have diabetes.

5.2 Calculating the percentage change

When you work out an increase or a decrease as a percentage change, you must identify, or calculate, the total original amount:

$$\%\ \text{increase} = \frac{\text{increase}}{\text{original amount}} \times 100$$

$$\%\ \text{decrease} = \frac{\text{decrease}}{\text{original amount}} \times 100$$

Remember: When you calculate a percentage change, use the total *before* the increase or decrease, not the final total.

Practice questions

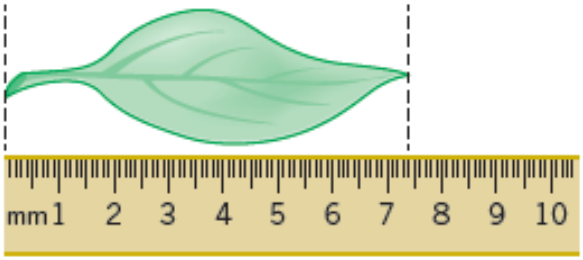
3 Convert the following mass changes as percentage changes.

Sucrose conc. / mol dm^{-3}	Initial mass / g	Final mass / g	Mass change / g	Percentage change in mass
0.9	1.79	1.06		
0.7	1.86	1.30		
0.5	1.95	1.70		
0.3	1.63	1.76		
0.1	1.82	2.55		

5.3 Measurement uncertainties

When you measure something, there will always be a small difference between the measured value and the true value. This may be because of the size of the scale divisions on your measuring equipment, or the difficulty of taking the measurement. This is called an uncertainty.

To estimate the uncertainty of a measurement with an instrument with a marked scale such as a ruler, a good rule of thumb is to let the uncertainty be equal to half the smallest division on the scale being used.



Using a ruler with a mm scale, the length of the leaf seems to be 74 mm. The smallest division is 1 mm, so the uncertainty is 0.5 mm.

The true length is therefore 74 mm +/− 0.5 mm.

Practice question

4 Give the uncertainty for the following pieces of equipment:

a large measuring cylinder with 2 cm^3 divisions

b digital stopwatch timer measuring to the nearest hundredth of a second

c thermometer with 0.1 °C divisions.

5.4 Calculating percentage uncertainties

The uncertainty is the range of possible error either side of the true value due to the scale being used, so the value recorded for the measurement = closest estimate +/− uncertainty.

The difference between the true value and the maximum or minimum value is called the **absolute error**.

Once the absolute error has been established for a particular measurement, it is possible to express this as a percentage uncertainty or **relative error**. The calculation to use is:

$$\text{relative error} = \frac{\text{absolute error}}{\text{measured value}} \times 100\%$$

In the leaf example above, the absolute error is +/−0.5 mm.

The relative error is therefore:

0.5/74 × 100% = 0.7%

Practice questions

5 Complete the table to show the missing values in the last two columns.

Measurement made	Equipment used	Absolute error	Relative error
Length of a fluid column in a respirometer is 6 mm	mm scale	0.5 mm	
Volume of a syringe is 12 cm^3 of liquid	0.5 cm^3 divisions		
Change in mass of 1.6 g	balance with 2 d.p.		

6 Scatter graphs and lines of best fit

The purpose of a scatter graph with a line of best fit is to allow visualisation of a trend in a set of data. The graph can be used to make calculations, such as rates, and also to judge the correlation between variables. It is easy to draw such a graph but also quite easy to make simple mistakes.

6.1 Plotting scatter graphs

The rules when plotting graphs are:

- Ensure that the graph occupies the majority of the space available:
  - In exams, this means more than half the space
  - Look for the largest number to help you decide the best scale
  - The scale should be based on 1, 2, or 5, or multiples of those numbers

- Ensure that the dependent variable that you measured is on the *y*-axis and the independent variable that you varied is on the *x*-axis
- Mark axes using a ruler and divide them clearly and equidistantly (i.e. 10, 20, 30, 40 not 10, 15, 20, 30, 45)
- Ensure that both axes have full titles and units are clearly labelled
- Plot the points accurately using sharp pencil 'x' marks so the exact position of the point is obvious
- Draw a neat best fit line, either a smooth curve or a ruled line. It does not have to pass through all the points. Move the ruler around aiming for:
    - as many points as possible on the line
    - the same number of points above and below the line
- If the line starts linear and then curves, be careful not to have a sharp corner where the two lines join. Your curve should be smooth
- Confine your line to the range of the points. Never extrapolate the line beyond the range within which you measured
- Add a clear, concise title.

Remember: Take care, use only pencil and check the positions of your points.

Practice questions

1 Use your calculated data in Topic 5.2 question 3 to plot a graph of % mass change against sucrose concentration.

2 For each of the tables of data:

a Plot a scatter graph

b Draw a line of best fit

c Describe the correlation

Turbidity of casein samples at different pH	
pH	**% transmission (blue light)**
9.00	99
8.00	99
6.00	87
5.00	67
4.75	26
4.50	30
4.00	24
3.75	43
3.50	64

Sodium bicarbonate concentration / %	**Rate of oxygen production by pondweed / $mm^3\ s^{-1}$**
6.5	1.6
5.0	2.1
3.5	1.2
2.0	0.8
1.0	0.5
0.5	0.2

6 Researching, analysing and noting information

Knowledge is constantly changing as advances are made in science, technology and our understanding of the world in general. New developments emerge in print both in books and on-screen. As a learner, you'll need to interact with this wide range of source material. You'll learn to be selective about the resources you find and then read. Once you're confident about the soundness of the material, which means that it is accurate, honest and reliable, you need to select and record information carefully as you prepare your assignments.

Why is researching, analysing and noting information important to you?

For BTEC study: you'll take a more independent learning approach to your assignments. Although you may be given handouts for certain things, you'll have to find out information for yourself in others. Your projects, assignments and other assessed work will rely on a variety of resources. Knowing how and where to look for that material, and what to do with it in your work will make research, analysis and note-making easier.

For work: your employer is unlikely to give you a list of resources to consult before you write a report, meet a new client, help formulate a bid for a contract or buy a major item. Employees who can search out information from a wide range of sources and can ensure that the data are trustworthy, accurate and up to date will be highly valued by employers, and save a business money.

What can you do to develop your researching, analysing and note-making skills?

Know why you are researching material

You'll have to research in different ways or follow different routes for different tasks. For example, are you preparing to write an essay, make a presentation, create a poster or participate in a debate? All are different; all need relevant material. Your tutor may have given you a list of possible material to start you off but after that you may have to search out material for yourself. You may choose to work with hard copy or online resources. The approach to both is similar.

Know the types of resource available

Hard copy sources can be varied and include:

- **recommended textbooks** specific to your course, may be available in e-format
- **books from the library** relevant to particular assignments, may be able to be borrowed
- **journal articles,** which provide specialist analysis and information, found in academic libraries and sometimes online
- **reference books,** which may further include general dictionaries and thesauri, subject-specific dictionaries, encyclopaedia, year books and directories, found online and in libraries
- **official documents** like Acts of Parliament, government papers, annual reports
- **other specialist media** relevant for some BTEC courses, for example visual media – television and film, newspapers, periodicals catering to particular professions
- **other people** who provide information when you conduct interviews or ask people to respond to a questionnaire. You'll then use their answers as data in your assignment.

Online sources can include material similar to that of hard copy sources but can often also be found on websites. This includes books, journals, government papers, regulations, for example that are publically available. Sometimes viewing material online can involve a fee so you need to be sure what is involved before you download material. Also, in some instances, there is a legal limit on the number of pages that can be printed out. It is best to check this out with your librarian or tutor, if you are in doubt.

As you'll be aware, there is a lot of material on the web that is unreliable. For example an enthusiastic amateur can post articles on the world financial situation, but it will take a professional economist to be able to present an informed and professionally researched analysis. You need to be selective and cautious about what web-based material you should consult.

Important to know

Sometimes for your assignment, you'll be asked to look at a **primary source**. This is a publication presenting information in its 'raw' form – for example the report of a Royal Commission or an academic research paper. From this type of document, you are expected to make your own judgements. A resource that provides someone else's interpretation of such a report or other issue is commonly called a **secondary source**. A book or review covering a particular issue would be an example of this.

When using primary sources, you have to think critically about the content; when using secondary sources, you need to be aware that you may be influenced by the author's interpretation of the content. This means you have to judge carefully whether a point of view expressed in the book is biased one way or another.

Develop the habit of 'mapping' a book or online resource

Knowing how text in hard copy or online is laid out will ensure that you use your reading time efficiently. It will also help you gather publication information for any reference list you need to compile.

Things to look for when you first open a book or a webpage onscreen:

- **title** and **author**(**s**): usually found on the first page in the book or at the top of the webpage
- **publication details**:
    - for a book, on the back of title page: date of publication, edition, location and name of the publisher
    - for a webpage, this may be at the end of the article as 'last updated on' or embedded in the URL
    - you'll need these details for citation and referencing (see Activity Sheet 7)
- **contents**: in a book, this page will list the numbered chapters and other components of the book: onscreen, this may appear under 'site map' or as a list on the sidebar of the webpage
- **glossary**: special terms used in the text, listed alphabetically at the end of the book or presented onscreen as a highlighted word that can be clicked to show meaning
- **reference list**: sometimes called a bibliography, gives publication details of source material cited by the author in the text, usually found at the end of a book or at the end of a webpage
- **index**: arranged alphabetically and found at the end of a book. Page numbers in bold indicate topic dealt with in detail: if in ordinary type, then topic only mentioned. In the case of a webpage, clickable links to special terms will be highlighted on screen.

Evaluate the reliability of material

Provenance

This means the trustworthiness of the book or site.
Who has published the text in hard copy or on the web?
Is it sponsored by a particular group or individual with a special interest in promoting a particular view?
Discriminate between good and flawed material. Is it biased?
Is the content accurate and truthful?

You'll often be able to make a judgement about the quality of a website from the URL (this is short for Uniform Resource Locator but it's easier to think of it as the reference that begins with http:// or www). The source of the organisation publishing the online material may be embedded in the URL or it may appear somewhere on the webpage.

In terms of evaluating books, you may find that the same authors keep cropping up in different sources and this is an indication that their work is highly regarded on that topic.

Date of origin

Sometimes it is difficult to identify how up to date the material is. This can be important if you are checking out regulations that may be updated regularly. Often old material is lurking around on the web as people often don't remove old material. Sometimes a webpage will give the date of the last edit at the end of the item; other times a date will be found embedded in the URL. Books will usually have the date of publication printed on the underside of the title page.

Know where to obtain resource material

Sources of specialist information available include:

- **librarians**, who are expert in resourcing knowledge. They may work in partnership with your BTEC tutors and can direct you to recommended/subject-specific materials
- **reference lists or bibliographies.** These can be a starting point for finding the titles and web details of information and material related to your topic.

Start with reference sources as reading relevant entries in hard copy or online reference books can provide an overview of a topic. This can save valuable time. Then you can go on to more detailed sources to expand your knowledge and understanding. Trusted sites will give you genuine and accurate information. These include: Encyclopaedia Britannica online, the CIA World Factbook and other online reference sources. For meanings and how words are used you could use www.thefreedictionary.com and www.thesaurus.com. Some libraries may have free access to online reference material.

TIP	**Note-making from sources.** Developing note-making techniques will be essential so that you do not end up copying out everything in the book. Make sure you keep a note of all the publication details as well as the pages that you read. Activities 6.6 and 6.7 will help you to be more discriminating about what you note down **after** you've completed your reading rather than starting out with a pen in your hand as soon as you open the book or screen page. Some widely used note-making techniques include spider diagrams, positive/negative grids, numbered notes – use decimal numbers for points beneath a heading to save time. Add your own thoughts to your notes as you create them – do this in pencil and this will identify your ideas later on. For quotations, note exact words from the text and the page number on which these appeared. If you write these in colour, you'll find them more easily when you need them for your assignments (where appropriate).

What can you do to develop other research techniques?

You may find some of your assignments are based less on writing and more on observation, record-keeping and reflection. To research successfully, ensure that

- any interviews you conduct, for example to gather data (often numerical information) are ethically conducted. This means that your interviews are not harmful and are voluntary and the information is anonymised to ensure confidentiality. How you gather information will depend on your subject. You may be given guidance on this aspect, especially on maintaining anonymity of those you interviewed (the interviewees are sometimes called subjects).
- you keep careful notes of what people said, and of countable responses they provided
- your observations are truly accurate and based on what people actually saw/experienced NOT what they **think** they saw
- evidence you select, in whatever format it takes, is sound and supports your assignment.

Checklist for developing your researching and note-making skills

- ☐ Be sure that your resources are accurate and up to date
- ☐ Be sure to make a note of all the hard copy or online publication details, including page numbers for citation
- ☐ Choose source material that covers different viewpoints, usually from more than one source
- ☐ Choose evidence that is beyond reproach and is not biased
- ☐ Your records, diaries, logs and other data are kept consistently over the project time.

Learning activities

Case study on understanding researching, analysing and noting information
Omar is doing a BTEC in Construction and the Built Environment. He is an excellent mathematician, but has a little problem with the calculations that form a major part of his course. In addition, he's often told that he can come up with some brilliant ideas in discussion. However, his weakness lies in his inability to provide solid reasoning backed by evidence to support the points at issue. He's not good at working out where to go for information. He tends to rely on Wikipedia or the local newspaper for most of his evidence. This material is not always reliable. He tends to rely on the first couple of points he reads about. He usually fails to use more professional source material. This lack of expert evidence pulls his potential grade down from a merit to a pass. For his next assignment, he has to make a presentation about regulations relating to railway network expansion in the UK.

Activity 6.1. Using relevant research sources

Using your common sense and general knowledge, suggest two resources from the list below that might be better suited to Omar's research than an incomplete, unverified Wikipedia source.

Book (online)	Social capital and the built environment: the importance of walkable routes
Quarterly journal (online)	Built Environment: High speed rail, shrinking spaces, shaping places
Journal (online)	International Journal of the Built Environment: article 'Road versus rail.'
Recommended Book	Architecture for the 21st century
Course textbook	A history of the built environment
Reference book (online)	Encyclopaedic dictionary of landscape and the urban environment
Reference book (online)	Land-use planning encyclopaedia published by 'Green Association'
Official publication (online)	Codes and standards for the built environment

Activity 6.2. Analysing the value of everyday resources

Omar seems to rely on what he reads in hard copy newspapers or online versions as well as on television programmes and Twitter. What advantages/disadvantages can you see in his strategy?

	Advantages	Disadvantages
Newspapers		
Online news		
Television/radio		
Twitter feed		

Activity 6.3. Making notes effectively

Omar tends to makes notes from his reading on scraps of paper that he loses later on. Based on your own experience and the suggestions in the information box on note-taking above, list three tips that might help Omar to keep his researched information efficiently.

1 _____

2 _____

3 _____

TIP	Work up your personal glossary as this will help your subject learning. Specialist words are often uncommon rather than difficult. To find out more about words and their use, consult (i) a dictionary or (ii) a thesaurus. **Dictionaries** are organised alphabetically and will give you information about the part of speech (e.g. noun, verb), the meaning(s) and sometimes sample sentences that use the word(s). A useful online resource is www.thefreedictionary.com A **thesaurus** can be organised in a number of ways. An alphabetical one is easier to navigate and gives lists of words similar in meaning (synonyms), and those opposite in meaning (antonyms). Online www.thesaurus.com gives a range of alternative words and covers different meanings or uses of the same word.

Reflective activities

Activity 6.4. Developing your understanding

Your BTEC course will introduce you to many new expressions and words that may be unfamiliar to you. List two new words or expressions that have been introduced to you in your course.

1 _____ 2 _____

Meanings

Work with a partner to compare lists for similarities and accuracy of meaning. Next, consult a standard dictionary or www.thefreeditionary.com to confirm the meanings. If the terms are specific to your subject, then check a specialist dictionary – available in your academic rather than a public library and sometimes available online.

_____
_____

_____
_____

Activity 6.5. Compiling a glossary

Using the Glossary Frame in the appendix to this activity sheet, begin to compile a glossary list for one of the units on your BTEC course. Over a week or so this will build up into a useful checklist and possible revision aid.

Activity 6.6. Mapping a book or online source

Choose **one** book that has been recommended to you. Look back at page 2 of this activity sheet to remind yourself of what to look for. 'Map' the book or website and list three things you like about your chosen source. At this stage don't look at the content, just the mapping points.

1 2 3

Write one sentence about why you think this book or website has been recommended to you:

Activity 6.7. Analysing a chapter or section of an online resource

Using the same book or online source as in Activity 6.6, read the first paragraph and the last paragraph of one chapter/section of the webpage. This is a good technique for getting an overview of a text. From this reading, write one or two sentences outlining the aspects covered in that chapter/section.

Next, write down key points that you can now guess might be covered in the main body of the text.

This is a good exercise because knowing what the text is about (the introduction) and what it says (the conclusion) will mean that:

- you have a better understanding of what to expect in the main text
- for this reason, you'll read the main text more quickly.

Now, compare your points with a partner. Take some time to read the whole text to see if your guesses are correct.

Action points

Learning effective researching, analysing and note-making techniques takes time and requires experience. Note below personal action points that will help you to develop these techniques further.

How you can develop your research, analysis and noting-making skills further
1
2
3
4
5

Link
To help develop your Skills for Learning and Work further, look also at: • Activity Sheet 7 on Citing and referencing to avoid plagiarism • Activity Sheet 8 on Understanding the writing process.

APPENDIX

Glossary Frame for learning on _____

Add new words as they come up in class or you find when reading. Keep a note of meanings on the other side of the sheet. You could create your own glossary 'app' on your mobile using the 'Notes' function so that your glossary keeps expanding as you learn. This way you could keep checking it in odd moments to help you fix these words in your mind.

A	F	K	P	U
B	G	L	Q	V
C	H	M	R	W
D	I	N	S	X
E	J	O	T	YZ

7 Citing and referencing to avoid plagiarism

In your written work, you'll need to show that you have read about, understood and analysed key ideas. To do this, you'll have to integrate those ideas into your text by quoting, summarising or paraphrasing. This technique is called 'citation.' You'll also need to give details of these published sources within your text and in a listing at the end of the text. This is called 'referencing.'

Why are citing, referencing and avoidance of plagiarism important to you?

For BTEC study: you'll have to follow the academic conventions of citing and referencing correctly. At later stages in your education, you may have to follow these conventions again. This is an opportunity to learn how to do it all properly.

By citing and referencing sources correctly, you'll show that you can:

- explain your ideas honestly by giving credit to the authors whose work you have used
- evaluate material and recognise different views on a topic as presented by others.

You'll also be able to sign a declaration that your assignment is your own work.

For work: in the workplace, you'll continue to follow these techniques when you use different resource materials to support ideas in your professional writing. For example, this could include reports, discussion documents and any other kind of writing that relies on the work of others.

What is citation?

A citation is an acknowledgement that the source of content has not originated from you. Citation requires you to select the material you want to mention and why you want to mention it. You can do this by:

- **quoting** – using exact words from the original text (page number after quote)
- **summarising** – outlining the key points from the original article using your own words
- **paraphrasing** – providing a general explanation of the theme or idea in your own words.

You'll also need to use appropriate language to introduce any citations in your text. The following situations and examples show when and how you might cite the work of others.

Why you might cite work of others	Examples of how to introduce an idea in your work using reporting words
• to support your own point or discussion	X stated that… X observed that…
• to give a contrast to your specific points or discussion	X questioned the view that… X offered an alternative view that…
• to give a new development in the topic area	X claimed that… X surmised that…
• to give a philosophical or theoretical platform for your work	X suggested that… X believed that …

What is referencing?

Referencing is a technique that involves two stages:

1 giving 'short' publication details of sources you want to cite in your text (for example author and date)

2 listing the full publication information in a reference list (sometimes called a 'Bibliography' or 'Works cited') at the end of your work.

Many referencing systems exist. The more commonly used include the Chicago, Harvard, Modern Languages (MLA) and Vancouver styles. They use different layout styles for references in the text and in the reference list at the end of the document. Your tutor will guide you on the recommended style and order for your course. Typical reference information you will need about your source material is listed below.

Who wrote it	The format used for different sources	About the publication
• Author(s): Surname and initials	• For books: full title	• Date of publication • Place of publication • Publisher These details are usually found on the reverse of the title page in a printed book.
	• For journal articles: article title	• The journal title, volume, issue and relevant page numbers
• Author(s) of online material (if given)	• For online resources: article title	• For online resources: URL and date accessed

A typical layout: Harvard style

Example of original text from a source on reflective learning
All learning should develop from personal reflection on experience or observation. Only then can learners develop their understanding and progress to new levels of knowledge and practice.
Alternative examples of citation and reference within your text
Milne (2015) identifies reflection by individuals of their experiences as a means of developing their own learning. OR Reflection on personal experience by learners promotes their development (Milne, 2015).
Reference list entry (at the end of your text)
Milne, C., 2015. The power of reflection in learning. York: Elfin Press. [Ordered as: author, date of publication, title, place of publication and publisher]
Citation of a website source
Learners can develop their understanding and knowledge by reflecting on their own experiences (Milne, 2009)
Reference list entry (at the end of your text) – online example
Milne, C., 2009. Reflection and learning for the individual. Newsletter of the Third Age. Available from www.thirdagenews.co.uk [Accessed 1.4.15].

TIP	As you do your reading, make it part of your routine to note author(s), date of publication, titles, place of publication and the publisher for each resource. You should also note the volume, issue and page numbers (as relevant, for example for quotations) or the URL for quick retrieval if you need to re-read the particular text. **Note**: you need to record the full URL and the date on which you accessed it.

What is plagiarism?

Plagiarism, at its most basic, occurs if someone has used the work of another without showing that it is the 'intellectual property' of the original author (their unique ideas).

Important to know
What happens if a learner submits work that is plagiarised?
Firstly, plagiarism is serious; it is dishonesty. Plagiarism can be easily detected because tutors can access text-monitoring software that detects text misuse or unacknowledged material. If this shows up in written assignments, learners will be penalised for plagiarism; this means that their marks can be disallowed and the instance of plagiarism will remain on their academic record. Secondly, plagiarism is stealing in the same way as illegally downloading music from the internet. In some professions, for example nursing, plagiarism is regarded as a mark of dishonesty and a trainee learner who has plagiarised could be suspended from the course or prevented from working as a nurse by the Nursing and Midwifery Council.

Learners are often unaware of what plagiarism is and so are surprised to find that their work has been labelled as plagiarism.

Plagiarism occurs when:

- more than 10% of a text is a direct quotation from the source(s)
- some words are substituted for words similar in meaning (synonyms)
- sentences or words are reordered
- exact words are copied from text without quotation marks or source information (citation)
- the source is given but the exact words are used without quotation marks
- material from the internet is copied and pasted without acknowledgement or download dates given
- work created together with other learners is submitted without acknowledging their contribution
- identical work authored by the same person is submitted for different assignments
- copying and submitting the work of another learner with or without their permission
- different source ideas are given without clear analysis of content or importance which indicates a lack of deeper thinking about the topic and related content.

Learning activity

Case study on citation and referencing and related plagiarism

In the next activity, you will see examples of text from Logan, a learner. He has selected a number of ideas drawn from his reading to support his essay on how reflecting on experiences helps to improve learning, recognise challenges and determine action points.

His sources are presented in different referencing styles and he needs to modify these to make them uniformly follow the Harvard style required for his course. His last piece of work was criticised as he had used too much quotation and had not shown clearly, why the ideas in the quotes were relevant to his essay.

His tutor told him that he had only just managed to get a pass, but Logan wants to improve enough to achieve a merit for his next piece of work. Following the Harvard style, he will need to make sure that he balances quotation with the use of his own words. Source material should link more appropriately to the theme of his discussion. How can he refine his work?

Activity 7.1. Avoiding plagiarism

An excerpt of Logan's draft text is given below. The sample is weak and, if the full text followed a similar style, it would be heavily penalised as plagiarism, especially as Logan shows very little of his own thinking in his writing.

1 Identify any quotations – underline these.

2 Work out the percentage of text that is quotation. Remember that if this is more than 10% of the total, this is plagiarism. What figure did you calculate?

3 Identify the different 'reporting' words Roger has used to introduce ideas from his reading. These are usually verbs (often called 'doing words'); mark these as 'reporting verbs.'

A. Logan's original excerpt: Reflecting on learning is essential for progress (Milne, 2015). Smith (2010) stated that 'learning is entirely intuitive and independent of reflection' (p.54). This view is not supported by Jones (2000) who believed 'intuitive learning is a contributor to reflection' (p.30), but he also claimed that 'some students find it difficult to analyse their experiences' (p.47). However, Jones does not explain how students can become more analytical. Other writers offer some suggestions. Gray (1788) said that they should 'be given training in analysis when they are as young as five years of age' (p.17). In addition, Green (2005) suggested that analytical training should be given to them when they are as young as in nursery school, 'at the first contact with the education system' (p.27).

1 Read the **revised** version of Logan's text on the next page.

2 Discuss Logan's original version with a partner and compare it with the revised version. Reflect on the similarities and differences. What has Logan done in the revised version to show his own understanding of the topic?

Here is an example using Logan's material but without plagiarising.

B. Logan's <u>revised</u> excerpt: There are different opinions about how learning takes place. On the one hand, some writers consider that 'learning is entirely intuitive and independent of reflection' (Smith, 2010, p.54). On the other hand, Milne (2015) has claimed that reflecting on learning is essential for progress. For example, some writers suggest that learning how to analyse should begin at preschool level, that is, as soon as children become involved in the educational system at age five or younger (Gray 1778; Green 2005). These ideas appear to be sympathetic to the view that learning is instinctive but requires to be developed by other interventions. In particular, Jones (2000, p.30) asserted that 'intuitive learning is a contributor to reflection.'

Checklist for citing and referencing correctly

- ☐ Check with your tutor about the referencing style you have to follow
- ☐ Ensure that you know how to use that style for citation in text and for the reference list
- ☐ If you consult sources other than your recommended textbooks, then ensure that any material you are reading is up to date.

Reflective activities

Activity 7.2. Referencing

From your own experience write down two examples of source material that have helped you develop your learning and understanding for one unit in your BTEC. You should follow the Harvard style to record these details (see page 3).

1 _____

2 _____

Activity 7.3. Developing your citation and referencing skills

From the options below, choose the two best approaches you might use to develop your citation and referencing skills and to avoid plagiarism.

Seeking help	Developing yourself independently
☐ Consult your BTEC documents for the recommended style	☐ Analyse texts you read to find good models of citing sources
☐ Seek information on citation and referencing from the library	☐ Make a list of the 'reporting words' used by other writers to introduce the work of others
☐ Discuss with your BTEC tutor how you can improve your citation and referencing skills	☐ Analyse your earlier assignments to check for any plagiarism features these might include

Activity 7.4. Where are you now in relation to understanding citation, referencing and plagiarism?

Shade in the progress table below to record your development in understanding and confidence about citation, referencing and avoiding plagiarism after completing this activity sheet.

Confidence	Low									High
	1	2	3	4	5	6	7	8	9	10
Before ➔										
Now ➔										

Action points

Think about how you can continue developing the skills covered in this activity sheet.

How you can develop your citation and referencing skills to avoid plagiarism

Link
To help you to develop your Skills for Learning and Work, look also at: • Activity Sheet 8 on Understanding the writing process.

10 Understanding report writing

Formal reports take several forms, depending on context. The format and writing style of many types of BTEC reports echo those used professionally, such as business reports and safety reports.

Why is report writing important to you?

For BTEC study: you'll need to write reports as assessed exercises. These will probably follow a recommended format and will contain information about a process or experience you've had as part of your course learning. Report writing will help you to develop a formal writing style.

For work: you'll use this practice for reports required in the workplace. These reports place your work on record and allow others to gain from the work you have done.

What can you do to develop your skills in report writing?

Carrying out the report writing required in your BTEC course will give you valuable experience and feedback. The tips given in this activity sheet assume that you have been given a task that requires a report as an end product, that you have carried out the necessary information gathering and research, and are ready to start writing.

1. Double check your task and the format required for your report

Having spent time carrying out an investigation or study, you should return to the description of the task that was set **before you start writing**. Ensure that you understand what is expected of you and the way in which it should be presented. If you fail to meet expectations in either of these areas, your mark may be downgraded.

Regarding formats, the report sections and their order may differ. Typically, some or all of the following elements will be present:

Title	a concise description of the investigation/study and the content of the report
Preliminary material	such as acknowledgements, contents list and abbreviations used
Abstract (or Summary)	an outline of the approach taken and the report's main findings
Introduction	the background and rationale for the work and the approach taken
Literature review	this may be included in the Introduction or it may be the report's main focus
Methods (or Methodology)	a precise description of the way the investigation or study was done, with enough detail to allow someone to repeat it
Results (or Investigation)	a description of results or findings
Discussion	your thoughts about the meaning and significance of the results (sometimes present in a 'Results and Discussion' section)
Conclusions	a summary of the main points arising from the investigation (sometimes final part of the Discussion). You may be asked to give a set of recommendations
References	details of the publications you may have cited in the report
Appendix (plural: Appendices)	additional material that relates to the study and which would explain this relationship, e.g. a survey questionnaire or data graphs.

In some cases, a glossary section may be required defining key terms. You **must** adopt the precise titles used for these sections in your instructions also in their exact sequence.

2. Plan your writing

Given that report writing can be a lengthy and demanding process, you'll need to plan carefully so that you submit the best-possible quality report on time. You should divide the available time among the different sections you will have to write and allow some time for slippage in your plans.

Don't put things off – get started as soon as possible. Computers allow you to change text and its order at a later stage. You do not need to write the sections in the sequence in which they will appear in the final report. This may give you a chance to get started during the investigation or study itself. You can also use small scraps of time usefully, for example by adding and formatting individual references in the Reference section.

TIP	Review progress as you go along and be prepared to change your plans if necessary.

3. Adopt an appropriate writing style

A report writing style should be:

- relatively formal in nature and must be grammatically correct
- concise and accurate
- easy for the reader to understand
- sound in logic and argument
- supported by references for quotations and ideas taken from your reading.

Above all, report writing should be objective in nature. This means

- using an impersonal tone (avoid, for example first-person phrasing such as 'I conclude …')
- adopting a succinct, accurate vocabulary (which may be technical in nature)
- avoiding slang and other informal expressions
- using the 'passive voice,' focusing on the 'action' rather than the 'actor.' So, for example in a Methods section you might write 'the machine was switched on for 30 minutes before results were taken' (passive voice) rather than 'I always switched on the machine …' (active voice).

In addition, the specific content should be wholly relevant to the aims of the investigation (and the report). Ideally, it would include original thoughts about the topic. It must be balanced, taking account of different views on the issues. It should also acknowledge that conclusions are rarely certain.

The last two of these points mean that 'hedging' language is often necessary. This avoids certainty and allows you to present scenarios without committing to a single position. Examples might include 'It appears that …' or 'This suggests that …' Similarly, using the words 'may', 'might' or 'could' can indicate your neutrality and avoid bias.

4. Review and edit your writing

Include in your plan ample time for reviewing your draft report. With technical writing of this nature, it is essential to proofread and edit to ensure your meaning is clear and your writing concise and precise. You may also need to check that your text is within any word limits that have been given.

Checklist for report writing

- ☐ Know what the aim of your report should be
- ☐ Know what the format of your report should be
- ☐ Have a plan for the writing phase
- ☐ Understand the writing style you need to adopt

Learning activities

Activity 10.1. Structuring a report

The attached sheet shows the sections of a sample report arranged randomly. Following the structure of a report outlined on page 2 of this activity sheet, identify the sections and place them in correct order.

	The sections are:
A	
B	
C	
D	
E	
F	

Their correct capital letter order should be:					

Activity 10.2. Analysing the report content for the abstract

In your own words, briefly summarise:

1 What the report is about:

2 The purpose (aim) of the report:

3 How the work was done:

4 What the findings were:

5 What the outcome was:

Activity 10.3. Analysing the presentation of the report content

Within each section of the sample report in Activity 10.1, particular words and phrases are used that indicate the purpose of the section. Underline or highlight these words and compare your choices with those of another learner. These words or words similar in meaning (synonyms) might be useful when writing your own reports.

Activity 10.4. Structuring an abstract

Based on your restructured version of the report, devise a title for the report and, in no more than 55 words, write an Abstract (Summary) of the report. The writing you did in Activity 10.2 and the words and phrases you identified in Activity 10.3 will help you construct your Abstract. Compare your Abstract with that of another learner and comment on how effective your Abstracts are as concise reflections of the content of the report.

Reflective activities

Activity 10.5. Reflect on reports from your subject

One of the reasons you'll be asked to write a report may be that this is a normal practice in your subject area. From your learning materials or by searching online, find a report related to your subject. Identify the component parts and what they are called. Match these against the list presented on page 2. Discuss your report choice with another learner and the nature of other reports you've encountered in your placements or other BTEC activities.

Activity 10.6. Reflect on previous reports completed as BTEC assignments

For this activity, either:

- consider a report written by another learner; or
- select a piece of report writing that you yourself have carried out.

Read or re-read the report. Compare this with the format you discovered in Activity 10.4. Now, in the table below, summarise your thoughts about what was well structured and written and what could be improved in your report.

Aspects that were well structured/written	**Aspects that could be improved**
1.	1.
2.	2.
3.	3.

TIP	Everyone's writing technique can be improved. Indeed, learning about writing is a process that will continue throughout your life. Ways in which you can develop your skills include reading books and newspapers (in each case observing good phrasing and expression of ideas) or reading style guides for good English (these are not as dull as they may sound). You may have other thoughts about how you can do this.

Action points

In relation to this activity sheet, consider an aspect of report writing relevant to your course.

How you can develop your report writing skills further?

1.

2.

3.

4.

5.

Link
To help you develop your Skills for Learning and Work further, look also at: • Activity Sheet 4 on Planning for study and work • Activity Sheet 7 on Citing and referencing to avoid plagiarism • Activity Sheet 8 on Understanding the writing process.

Activity 10.1. Structuring a report – randomised sections of a sample report

A.	In line with the existing research, falls were thought to be avoidable in some cases. The evidence from this study suggests that there are people who would welcome 'low level' intervention to avoid the onset of complications from a fall. However, in general, the survey group agreed that falls could be reduced with better printed information and guidance on television about fall prevention and general home safety related to mobility.
B.	Injuries to limbs arising from accidents in the home are common. Reports suggest that they can be attributed to a variety of causes that include falling down stairs, running on wet floors, tripping on protruding furniture or slipping on rugs. In 2015, home accidents accounted for 37% of all accidental injuries. It is thought that many people simply do not pay any attention to either their own common sense or the extensive health education advertising campaigns sponsored by the Department of Health. This surmise is based on a recent survey of home accident victims. However, it is among the elderly that reports of home accidents are highest. Yet little work has been done to establish the frequency of unreported falls in the home among people of pension age. The aim of this study is to establish the frequency of unreported falls, their cause and the reasons for not reporting the incident. It is anticipated that these data will contribute to more effective accident prevention measures being put in place for this group of the population.
C.	The collected data (Appendix 2) showed that in this investigation only two out of five people could recollect seeing or hearing any warning advice about home-related injuries. Furthermore, they had received no specific information about fall prevention. Only one person was aware of any help available in the event of a fall. The reasons for falls were principally attributed to muscle weakness in the limbs, lack of space between items of furniture and tripping on rugs. Reasons given for not reporting falls to health professionals or family members included not regarding the event as important enough, not wanting to show weakness, 'not wanting to be a bother' and wanting to avoid 'official interference' in their lives. However, all said that they would value more information about how to avoid falls and of 'low level' assistance available including the installation of a fall alarm buzzer in their homes that would allow them to choose to summon help if they felt it was required.
D.	The outcomes of this study suggest a multiple approach to raising awareness about falls in the home. Those consulted should be groups representing the elderly, health professionals in the disciplines of Physiotherapy and Occupational Health and member of the Institute Social Work.
E.	The Society of Physiotherapists conducted research that showed that 80% of their patients acknowledge that they knew that they were taking risks when they suffered accidental injury (Walker, 2014). Work done by the Society of Occupational Therapists (Reilly, 2010) suggested that 85% of accidents in the home could have been prevented by the use of walking aids. Their investigations showed that no needs analysis of fall victims had been conducted among those patients reported as suffering more than three falls in a three-month period. In a report commissioned by the Institute of Social Workers (Tripp, 2011), evidence showed that in more than 50% of cases, people suffering unreported falls were unknown to the social work services in their area. Tripp (2011) also noted that victims had been alone at the time of their fall.
F.	Volunteer investigators visited places where people in the target groups were perceived together: lunch clubs, sports clubs particularly golf and bowling clubs, and public libraries. Their role was to canvass the opinions and experiences of those in the 65–85 group about falls in the home. Information was obtained by administering a series of set questions in a 15-minute interview (Appendix 1) with 60 individuals. This was collated and several recurring themes were identified.

Activities 10.1–10.3 (for tutor use only)

Words identified for Activity 10.2 are highlighted in red.

B. Introduction

Injuries to limbs arising from accidents in the home are common. Reports suggest that they can be attributed to a variety of causes that include falling down stairs, running on wet floors, tripping on protruding furniture or slipping on rugs. In 2015, home accidents accounted for 37 per cent of all accidental injuries. It is thought that many people simply do not pay any attention to either their own common sense or the extensive health education advertising campaigns sponsored by the Department of Health. This surmise is based on a recent survey of home accident victims. However, it is among the elderly that reports of home accidents are highest. Yet little work has been done to establish the frequency of unreported falls in the home among people of pension age. The aim of this study is to establish the frequency of unreported falls, their cause and the reasons for not reporting the incident. It is anticipated that these data will contribute to more effective accident prevention measures being put in place for this group of the population.

E. Literature review

The Society of Physiotherapists conducted research that showed that 80 per cent of their patients acknowledge that they knew that they were taking risks when they suffered accidental injury (Walker, 2014). Work done by the Society of Occupational Therapists (Reilly, 2010) suggested that 85 per cent of accidents in the home could have been prevented by the use of walking aids. Their investigations showed that no needs analysis of fall victims had been conducted among those patients reported as suffering more than three falls in a three-month period. In a report commissioned by the Institute of Social Workers (Tripp, 2011), evidence showed that in more than 50 per cent of cases people suffering unreported falls were unknown to the social work services in their area. Tripp (2011) also noted that victims had been alone at the time of their fall.

F. Methods (or Methodology)

Volunteer investigators visited places where people in the target groups were perceived to gather: lunch clubs, sports clubs particularly golf and bowling clubs, and public libraries. Their role was to canvass the opinions and experiences of those in the 65–85 group about falls in the home. Information was obtained by administering a series of set questions in a 15-minute interview (Appendix 1) with 60 individuals. This was collated and several recurring themes were identified.

C. Results (or Investigation)

The collected data (Appendix 2) showed that in this investigation, only two out of five people could recollect seeing or hearing any warning advice about home-related injuries. Furthermore, they had received no specific information about fall prevention. Only one person was aware of any help available in the event of a fall. The reasons for falls were principally attributed to muscle weakness in the limbs, lack of space between items of furniture, and tripping on rugs. Reasons given for not reporting falls to health professionals or family members included not regarding the event as important enough, not wanting to show weakness, 'not wanting to be a bother' and wanting to avoid 'official interference' in their lives. However, all said that they would value more information about how to avoid falls and of 'low level' assistance available including the installation of a fall alarm buzzer in their homes that would allow them to choose to summon help if they felt it was required.

A. Discussion

In line with the existing research, falls were thought to be avoidable in some cases. The evidence from this study suggests that there are people who would welcome 'low level' intervention to avoid the onset of complications from a fall. However, in general, the survey group agreed that falls could be reduced with better printed information and guidance on television about fall prevention and general home safety related to mobility.

D. Conclusion

The outcomes of this study suggest a multiple approach to raising awareness about falls in the home. Those consulted should be groups representing the elderly, health professionals in the disciplines of Physiotherapy and Occupational Health and member of the Institute Social Work.