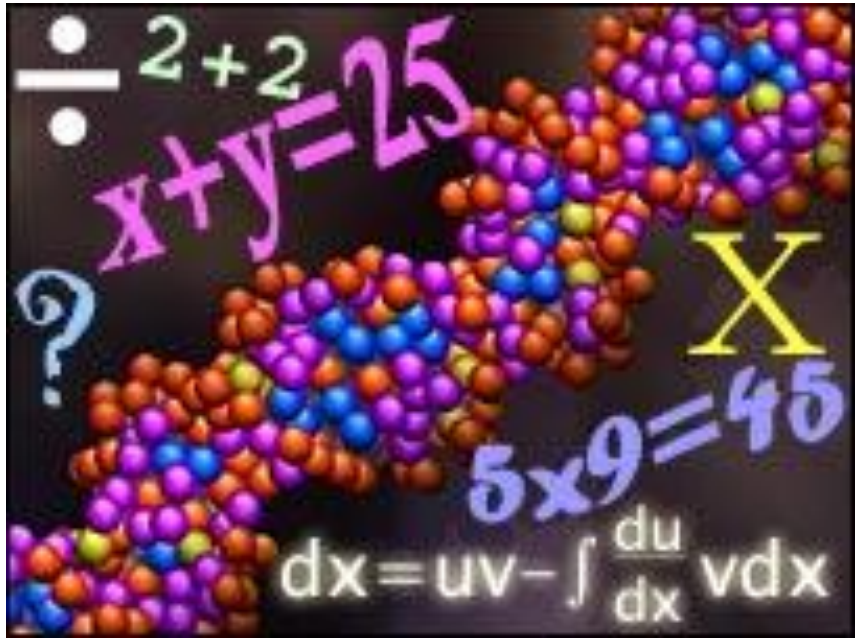
Essential Knowledge for A Level Biology

A Level Biology builds on your GCSE knowledge.

Everyone finds the A Level Biology course difficult, but it is incredibly rewarding so stick at it!

This lesson summarises some of the key concepts from GCSE Biology which will help form the foundation of your study of the advanced material in A-Level.

Essential Maths for Biology



At least **10% of the marks** for assessments in Biology will require the use of mathematical skills. These will be applied in the context of Biology and will be at least the standard of **higher tier GCSE Mathematics**.

You need to be able to demonstrate a range of mathematical skills across the A Level course.

Here we will explore some of the mathematical skills that you will need to use that you might be less familiar with from your GCSE studies.

Essential Standard Form

Standard form is used when numbers are very small, or very large. For example: the nucleus of an atom is 1×10^{-15}m and Earth is 1.49×10^{11}m from the Sun.

These numbers would be too great to write out in full all the time, so standard form helps to communicate this effectively.

Here are some more examples of standard form being used:

Decimal	Standard Form
0.000000286	2.86×10^{-7}
16 500 000 000	1.65×10^{10}
0.00005978	5.948×10^{-5}
89620	8.962×10^{4}
0.29	2.9×10^{-1}

Task: Construct a list of rules for converting numbers to standard form

Essential Statistical Tests

Statistical tests are used in Biology to determine whether or not results have been due to chance, or have been caused by another factor.

There are three tests that you may be required to use or apply:

1. **Chi squared**: used with categoric data to see if differences in frequencies are the same as what would be expected, e.g. in a blood sample, is the ratio of red to white blood cells healthy?
2. **Students t-test or t-test**: used to determine whether continuous data has a normal distribution and whether there is any difference between two sets of data, e.g. have boys performed better in their exams than girls?
3. **Correlation coefficient or Spearman Rank**: used to test whether there is a relationship between two variables, e.g. is a persons weight related to their height?

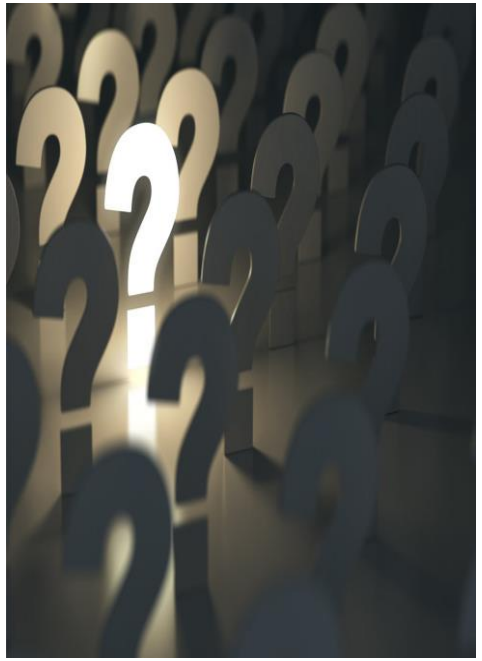
Essential Statistical Tests TASK

Which statistical test would you use for the following experiments/data sets?

1. The number of yellow and white daffodils that come from bulbs where I would expect a ratio of 1:1.
2. Do people who drink energy drinks have a higher blood sugar?
3. Is there a difference in the number of girls in Y9 and Y10?
4. The yield of crop from two different fertilisers.
5. The number of males and females born in a litter of pups.

Essential Statistical Tests

You will need to know some common features of each of these tests:



Hypothesis: the relationship you expect to find or are investigating, e.g. there is a significant difference in the number of lung cancers developed by non-smokers compared to smokers.

Null hypothesis: the opposite of the hypothesis, e.g. there is no significant difference in the number of lung cancers developed by non-smokers compared to smokers.

Degrees of freedom: the number of categories (classes) being tested.

Critical value: the value at which you accept or reject the hypothesis.

Essential Probability

Probability tells us how likely something is or the chances of something occurring.

Probability is used in Biology to judge whether data has been caused by chance, and to make predictions about expected outcomes.

You will use probability in relation to statistical tests as well as in predicting the genetic makeup of populations.

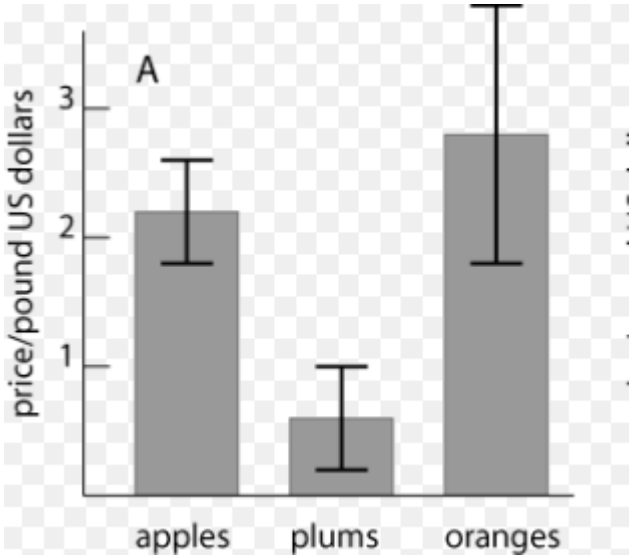
Probabilities can be expressed as a **percentage, decimal or fraction** e.g. 50%, 0.5 or ½.

Essential Standard Deviation

Standard deviation measures the 'spread' of data.

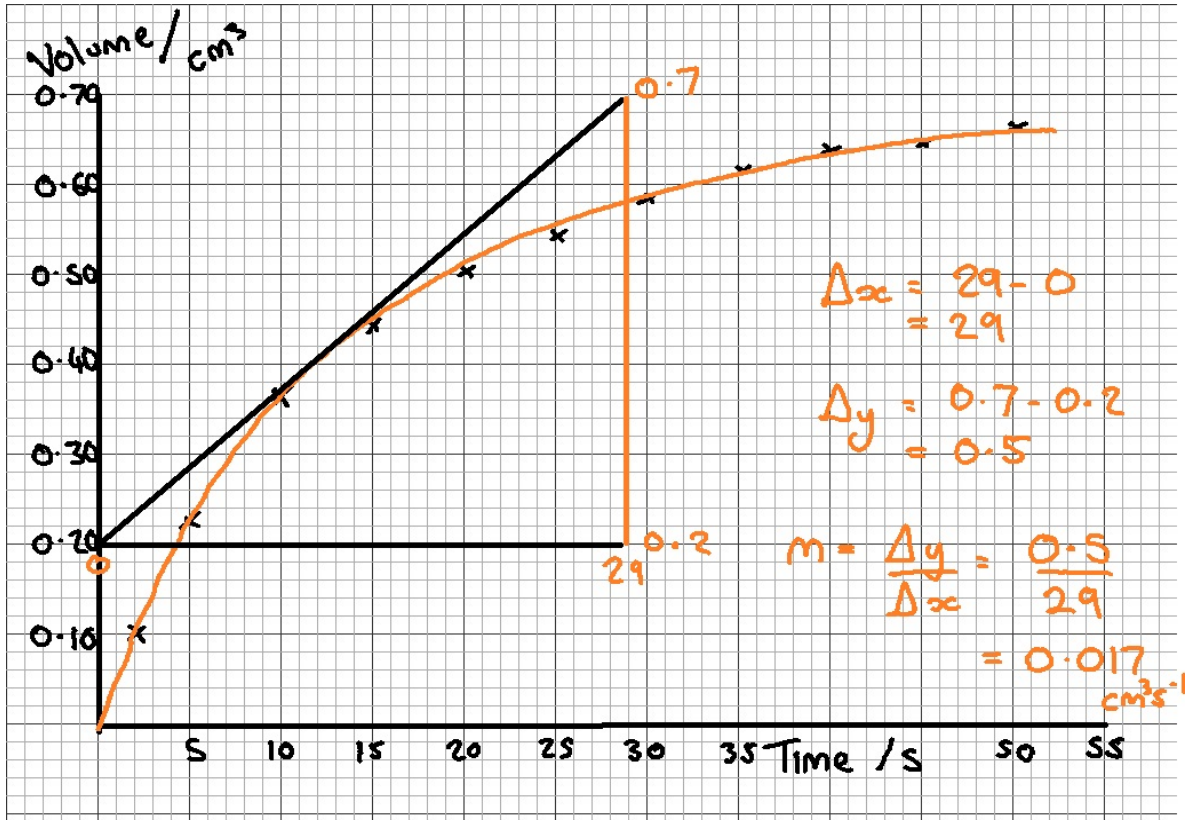
In Biology this can be used to determine whether there is a **significant difference** between groups, e.g. between species of animals, or the efficacy of different drugs on patient symptoms.

You will **not be required to calculate standard deviation** in your exams, but you can be asked to interpret graphs and tables that use it.



The example on the right shows the price of 3 different fruit. The bars show the mean price. The bars show +/- one standard deviation from the mean. This tells us that there is a **significant difference** in the price of plums compared to apples and oranges, but that there is **no significant difference** between the apples and oranges.

Essential Finding the Gradient of a Line



To find the gradient 'm' of a line always show your working and always draw a triangle.
The hypotenuse of the triangle must be at least as big as half of the line of best fit.
If the line of best fit is a curve, draw a tangent to the curve at the point where the gradient is required.
The gradient 'm' can be calculated by:

m = change in y / change in x
= Δy / Δx

The unit for the gradient is the unit for the y-values divided by the unit for the x-values.