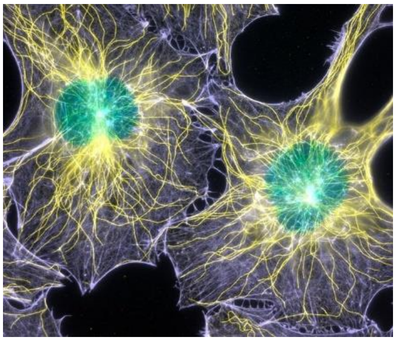
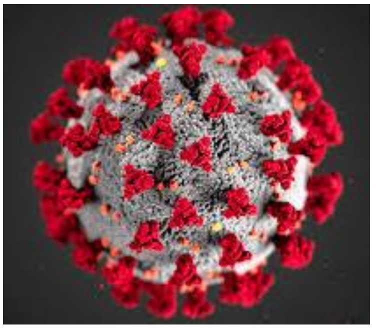
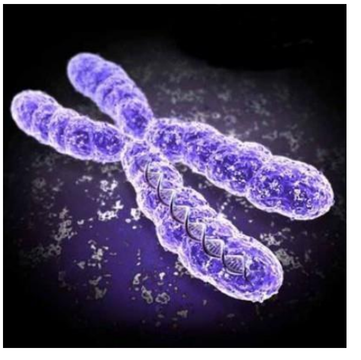
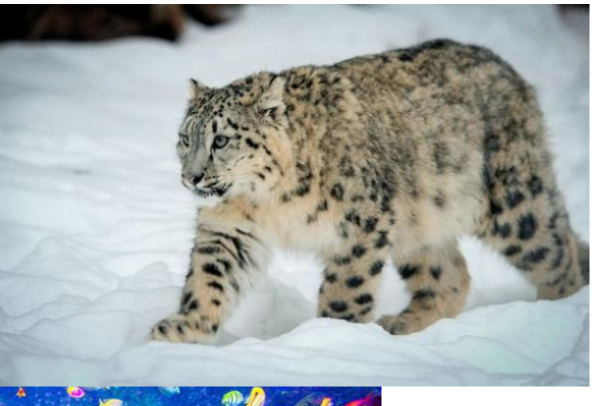
Transition Work for A level Biology




So you are considering A level Biology?

This pack contains a programme of activities to prepare you to start A level Biology in September. It is aimed to be used throughout the remainder of the summer term and over the summer holidays to ensure you are ready to start your course in September.

Checklist: Due Completed September 2020

YOU NEED TO BRING THE EVIDENCE OF ALL THE TASKS ON YOUR FIRST BIOLOGY LESSON IN SEPTEMBER

TASK		Student Check (tick when compete)	Teacher check
Bring in evidence showing completion of:			
	Write name of a book/ books your read in the next box:		
	Write film(s) linked with Biology/Science you watched in the next box:		
TASK 1	Cornell notes on the Teds talks		
TASK 2	Write a letter (enzymes)		
TASK 3	Write a letter (Biodiversity)		
TASK 4	Recall Practical key terms		
TASK 5	Maths skills: Practice Questions		
TASK 6	Ultrastructure of an animal Cell		
TASK 7	**Produce a Presentation inspired from an article you read, an exhibition you saw, a scientist or a current Biology topic you are interested in It needs to be written by you and not copied from the internet (you can use pictures and you need to be able to talk about it with me in September!)**		

EXTRA LINKS FOR EXTRA BIOLOGY

BBC Radio four Science podcast/programmes (in our time)

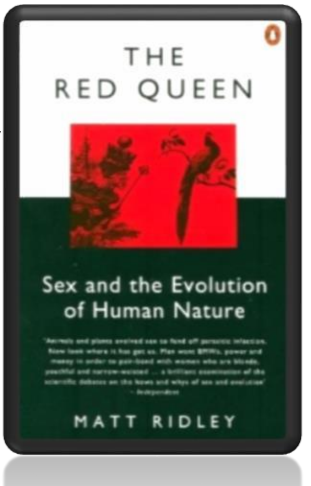
- **e.g :** Podcast - *'In Our Time - Microscopes'* https://www.bbc.co.uk/programmes/b03jdy3p
- Podcast - '*In Our Time - Enzymes'* https://www.bbc.co.uk/programmes/b08rp369

Mutation https://www.bbc.co.uk/programmes/b008drvm

Book Recommendations

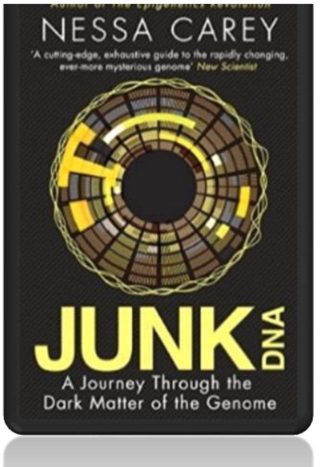
Kick back this summer with a good read. The books below are all popular science books and great for extending your understanding of Biology.

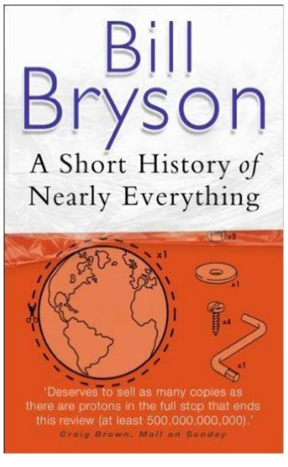
The Red Queen
It's all about sex. Or sexual selection at least. This book will really help your understanding of evolution and particularly the fascinating role of sex in evolution. Available at amazon.co.uk



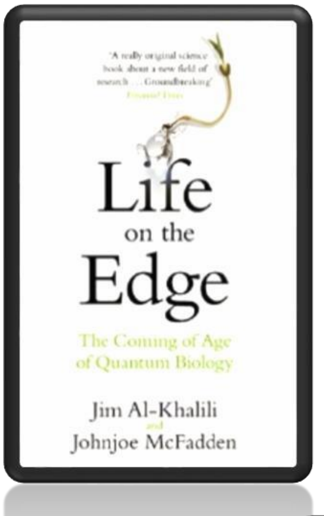
Junk DNA

Our DNA is so much more complex than you probably realize, this book will really deepen your understanding of all the work you will do on genetics. Available at amazon.co.uk



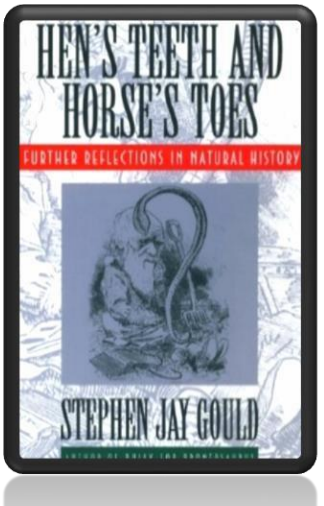


A Short History of Nearly Everything
A whistle-stop tour through many aspects of history from the Big Bang to now. This is a really accessible read that will re-familiarise you with common concepts and introduce you to some of the more colourful characters from the history of science! Available at amazon.co.uk

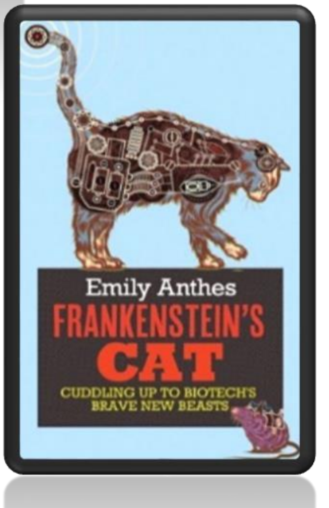


Studying Geography as well? **Hen's Teethand Horse's Toes**

Stephen Jay Gould is a great evolution writer and this book discusses lots of fascinating stories about geology and evolution.
Available at amazon.co.uk



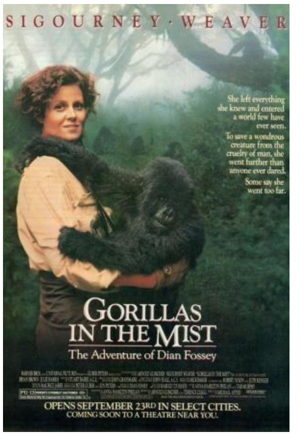
An easy read..
Frankenstein's Cat
Discover how glow in the dark fish are made and more great biotechnology breakthroughs. Available at amazon.co.uk



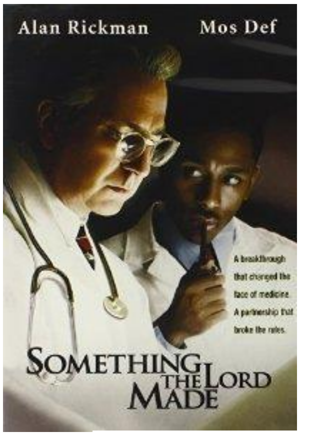
Everyone loves a good story and everyone loves some great science. Some of these films are based on real life scientists and discoveries. Some like Gattaca and Contagion are linked with Biology. You won't find Jurassic Park on this list but if you have never seen "Gorillas in the mist" based on a true story, this is the time!

Gattaca (1997) Science fiction with Ethan Hawkes, Uma Thurman and Jude Law. Vincent, a genetically inferior man who always aspired to travel in space, assumes the identity of a paraplegic in order to accomplish his goal.

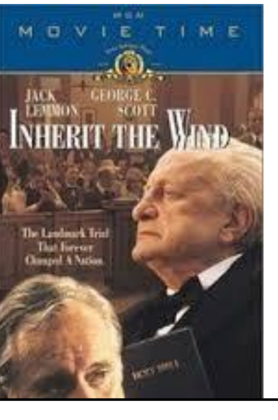
Gorillas in the Mist (1988) An absolute classic that retells the true story of the life and work of Dian Fossey and her work studying and protecting mountain gorillas from poachers and habitat loss. A tear jerker.



Something the Lord Made (2004) Professor Snape (the late great Alan Rickman) in a very different role. The film tells the story of the scientists at the cutting edge of early heart surgery as well as issues surrounding racism at the time.



CONTAGION (2011) The death of Beth Emhoff and her son leads to the discovery of a deadly virus. While the US Centers for Disease Control struggles to curb its spread, a worldwide panic ensues.



Inherit The Wind (1960) Great if you can find it. Based on a reallife trial of a teacher accused of the crime of teaching Darwinian evolution in school in America. Does the debate rumble on today?

There are some great TV series and box sets available too, you might want to check out: **Blue Planet, Planet Earth I and II, Icarus, Blackfish, The Ascent of Man, Catastrophe, Frozen Planet, Life Story, The Hunt and Monsoon.**

Task 1 : Here are some great presentations (and free!) from world leading scientists and researchers on a variety of topics. They provide some interesting answers and ask some thought-provoking questions. Use the link or scan the QR code to view. Research, reading and note making are essential skills for A level Biology study. For the following task you are going to produce 'Cornell Notes' to summarise what they talked about (1 Cornell notes page for each talk). This technique is explained in the next page.

A New Superweapon in the Fight Against Cancer
Available at :
http://www.ted.com/talks/paula_hammond_a_new_superweapon_in_the_fight_against_cancer?language=en
Cancer is a very clever, adaptable disease. To defeat it, says medical researcher and educator Paula Hammond, we need a new and powerful mode of attack.

Why Bees are Disappearing
Available at : http://www.ted.com/talks/marla_spivak_why_bees_are_disappearing?language=en Honeybees have thrived for 50 million years, each colony 40 to 50,000 individuals coordinated in amazing harmony. So why, seven years ago, did colonies start dying en-masse?

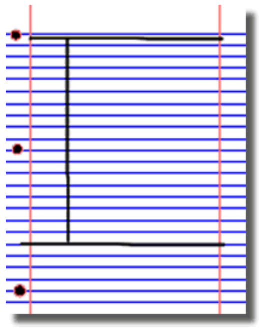
What Doctors Don't Know About the Drugs They Prescribe

Available at :
http://www.ted.com/talks/ben_goldacre_what_doctors_don_t_know_about_the_drugs_they_prescribe?language=en
When a new drug gets tested, the results of the trials should be published for the rest of the medical world — except much of the time, negative or inconclusive findings go unreported, leaving doctors and researchers in the dark.

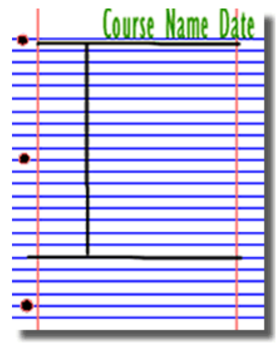
Growing New Organs
Available at :
http://www.ted.com/talks/anthony_atala_growing_organs_engineering_tissue?language=en
Anthony Atalla's state-of-the-art lab grows human organs — from muscles to blood vessels to bladders, and more.

Use ‘Cornell Notes’ to summarise information

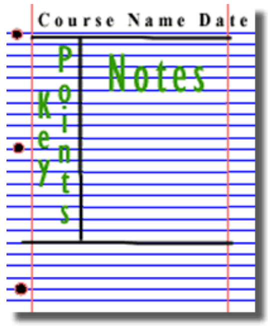
1. Divide your page into three sections like this



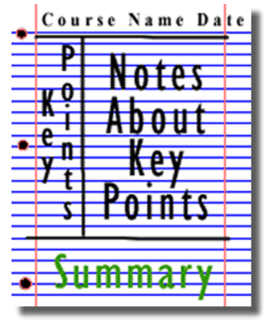
2. Write the name, date and topic at the top of the page



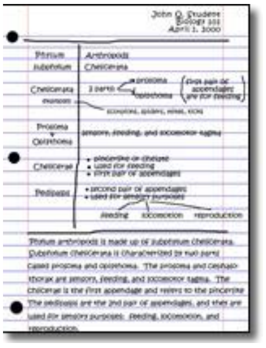
3. Use the large box to make notes. Leave a space between separate ideas. Abbreviate where possible.



4. Review and identify the key points in the left hand box



5. Write a summary of the main ideas in the bottom space



What Will You Study at A-Level BIOLOGY?

Biology OCR A –Year 1

- Module 1 – Development of practical skills in biology
- Skills of planning, implementing, analysis and evaluation
- Module 2 – Foundations in biology
- Cell structure; Biological molecules; Nucleotides and nucleic acids; Enzymes; Biological membranes; Cell division, cell diversity and cellular organisation
- Module 3 – Exchange and Transport
- Exchange surfaces
- Transport in animals
  Transport in plants
  Module 4 – Biodiversity, evolution and disease
- Communicable diseases, disease prevention and the immune system
- Biodiversity
- Classification and evolution.

Biology OCR A –Year 2

Module 5 – Communications, homeostasis and energy

- Communication and Homeostasis , Excretion as an example of homeostatic control , Neuronal communication, Hormonal communication, Plant and animal responses, Photosynthesis, Respiration.
  Module 6 – Genetics, evolution and ecosystems
- Cellular control, Patterns of inheritance, Manipulating genomes, Cloning and biotechnology, Ecosystems, Populations and sustainability.

Task 2:

Krabbe disease occurs when a person doesn't have a certain enzyme in their body. The disease effects the nervous system. Write a letter to a GP or a sufferer to explain what an enzyme is.

Your letter should:

- Describe the structure of an enzyme
- Explain what enzymes do inside the body

Task 3 : **Write a persuasive letter to an MP, organisation or pressure group promoting conservation to maintain biodiversity.**

Your letter should:

- Define what is meant by species and classification
- Describe how species are classified
- Explain one way scientists can collect data about a habitat, giving an example
- Explain adaptation and how habitat change may pose a threat to niche species.

MATHEMATICAL SKILLS

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.

After completing the worksheet you should be able to:

Task 4 • recall the answers to the retrieval questions (Practical Science key terms)

• perform some maths skills:

Task 5 :

1) Number and units
2) Decimals, standard form, and significant figures
3) Working with formulae

Task 4 :

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

YOU WILL BE ASKED ABOUT THESE DEFINTIONS IN SEPTEMBER

Task 5 : Study and complete the practice questions

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.

$488\,889 \div 10^3 = 488.889$ 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 questions

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 cm² 0.03 cm² 0.0218 cm² 0.034 cm²

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:

$$6.3900000000$$

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 questions

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?

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

Substitute the values and calculate the answer:

$$M = 12 \text{ mm}/0.06 \text{ mm} = 12/0.06 = 200$$

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.

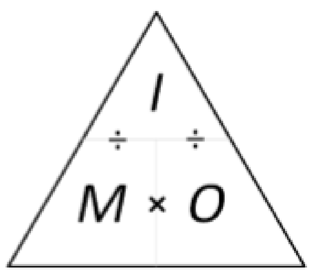
3.2 Rearranging formulae

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:

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



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.

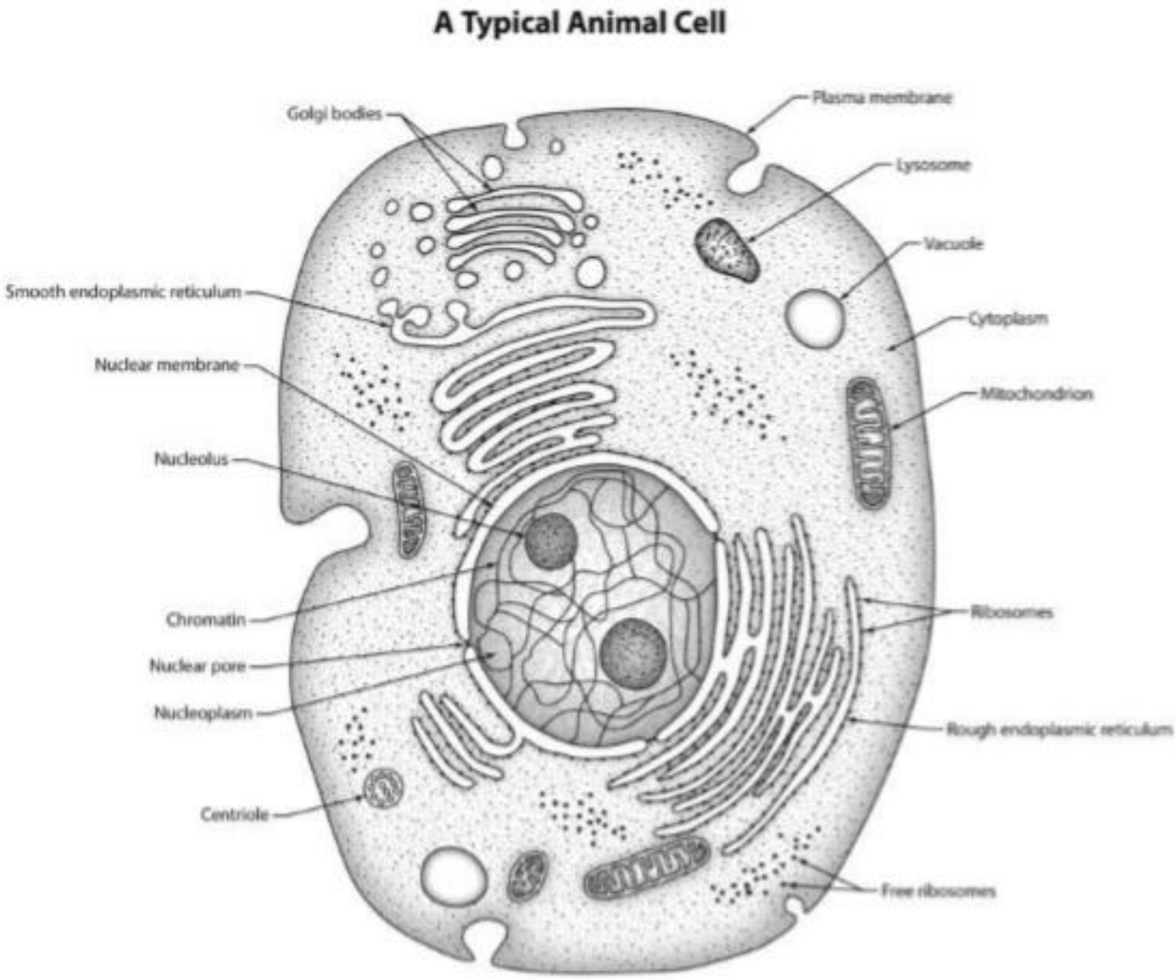
11 In a food chain, efficiency = $\dfrac{\text{biomass transferred}}{\text{biomass taken in}} \times 100$

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.

Task 6 :

Ultrastructure of Animal cells as seen under the Electron Microscope

- The electron microscope reveals more intricate detail about the structure of cells. This is often termed the ultrastructure.
- Below is a labelled diagram showing the ultrastructure of an animal cell:



- For A Level, you need to know about the structure and role of the different components or organelles of a cell.
- Use the internet to complete the table on the next page of the different organelles found in an animal cell. However…try to keep it simple!! Just sufficient information to complete the table!!!!!

The following websites may be useful with your research:

www.s-cool.co.uk

www.biologymad.com

www.mrothery.co.uk

YOU CAN ADD ANY OTHER FEATURES YOU'D LIKE TO FROM THE TABLE IN THE NEX T PAGE

Name of Organelle	Description	Function
Mitochondria		
Ribosomes		
Rough Endoplasmic Reticulum		
Smooth Endoplasmic Reticulum		
Golgi Body (Apparatus)		
Lysosome		
Nucleolus		
Centrioles		
Plasma Membrane		