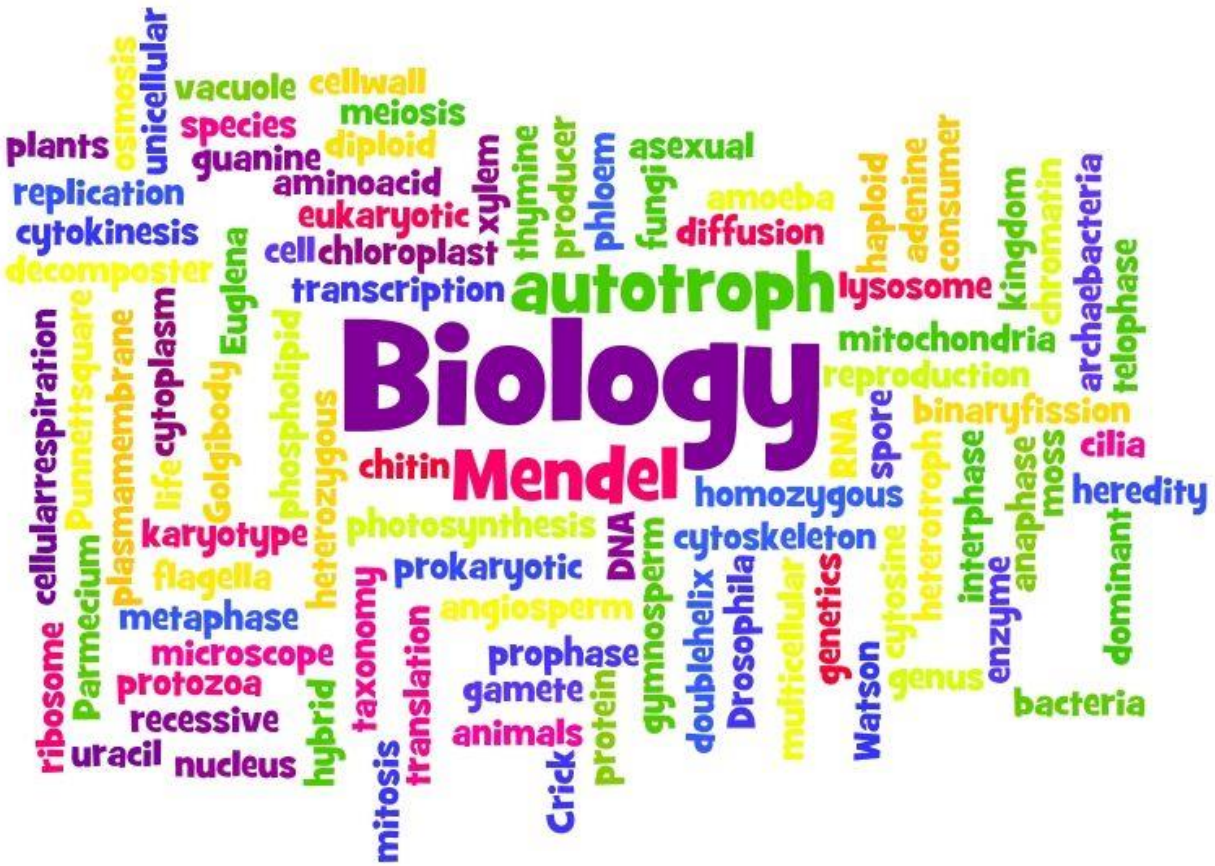
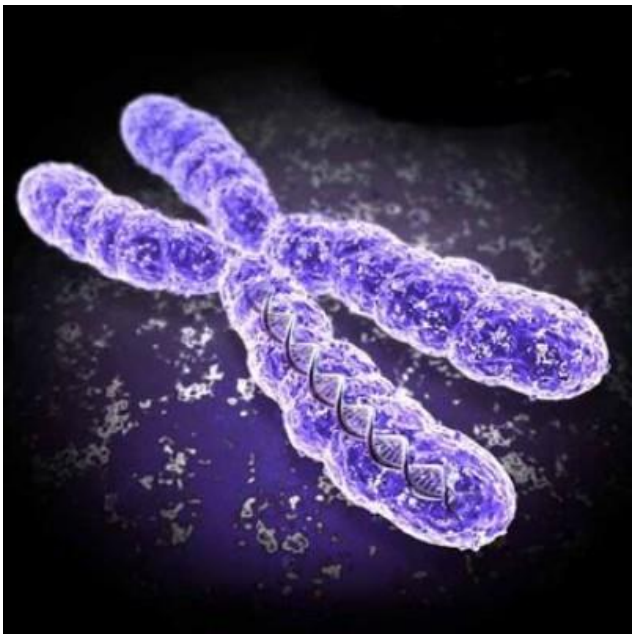
ST JOSEPH'S COLLEGE

# Transition Pack for A Level Biology



# So you are considering A level Biology?

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



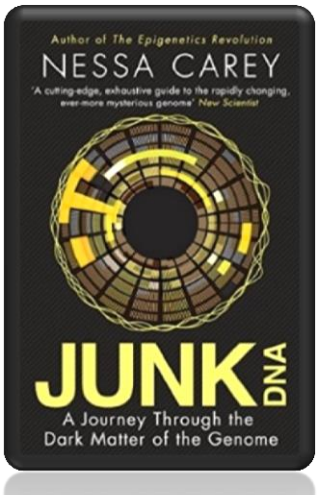
It consists of two sections:

1. **Recommendations** – These activities will all help to develop your scientific thinking skills for your future studies and should be dipped into as time allows
2. **Tasks** – These are very important in your preparation for September and should be completed before you start the course

# 1. Recommendations

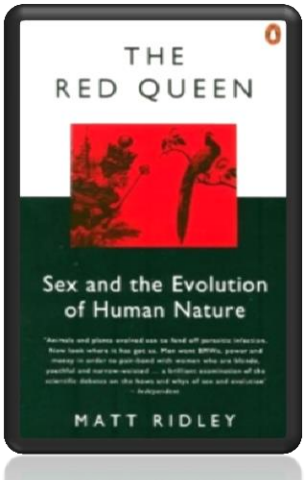
# Book Recommendations

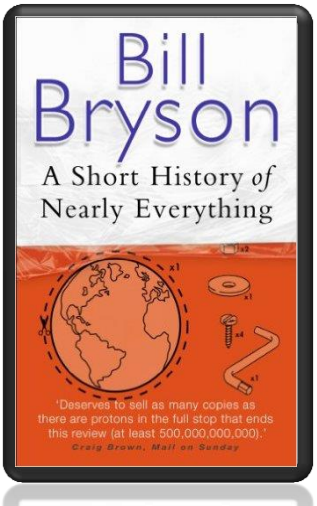
Kick back this summer with a good read. The books below are all popular science books and great for extending your understanding of Biology




**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

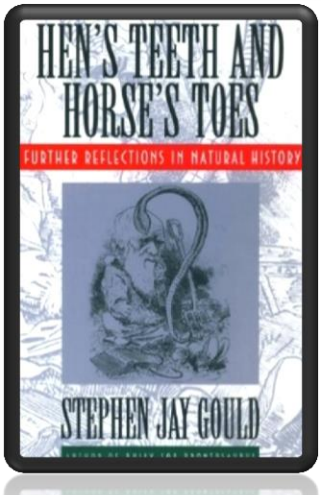
**The Red Queen**
Its all about sex. Or sexual selection at least. This book will really help your understanding of evolution and particularly the fascinating role of sex in evolution. Available at amazon.co.uk

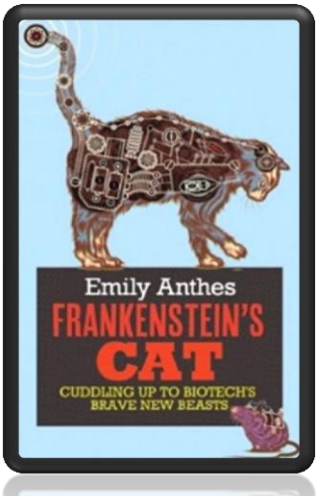



**A Short History of Nearly Everything**
A whistle-stop tour through many aspects of history from the Big Bang to now. This is a really accessible read that will re-familiarise you with common concepts and introduce you to some of the more colourful characters from the history of science! Available at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

Studying Geography as well?
**Hen's teeth and horses 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

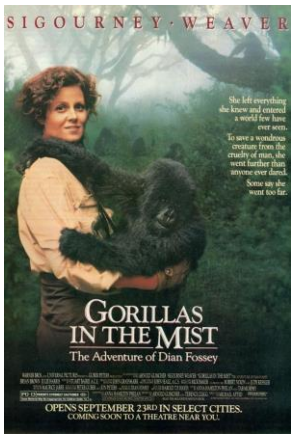



An easy read..
**Frankenstein's cat**
Discover how glow in the dark fish are made and more great Biotechnology breakthroughs. Available at amazon.co.uk

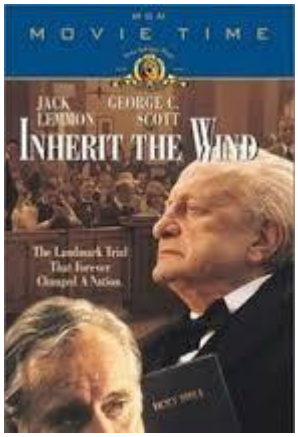
# Movie Recommendations

Everyone loves a good story and everyone loves some great science. Here are some of the picks of the best films based on real life scientists and discoveries. You wont find Jurassic Park on this list, we've looked back over the last 50 years to give you our top 5 films you might not have seen before. Great watching for a rainy day.



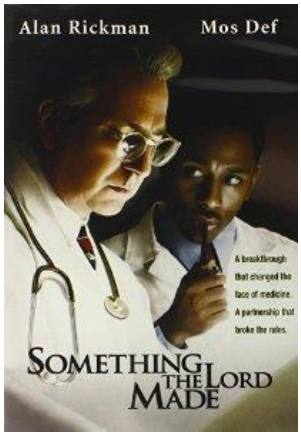

**Gorillas in the Mist (1988)**
An absolute classic that retells the true story of the life and work of Dian Fossey and her work studying and protecting mountain gorillas from poachers and habitat loss. A tear jerker.

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




**Andromeda Strain (1971)**
Science fiction by the great thriller writer Michael Cricthon (he of Jurassic Park fame). Humans begin dying when an alien microbe arrives on Earth.

**Lorenzo's Oil (1992)**
Based on a true story. A young child suffers from an autoimmune disease. The parents research and challenge doctors to develop a new cure for his disease.




**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.

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

# Movie Recommendations

If you have 30 minutes to spare, 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 to view:

**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?

**Why 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.

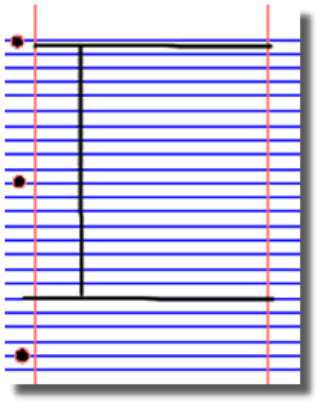
**Growing New Organs**
Available at :
http://www.ted.com/talks/anthony_atala_growing_organs_engineering_tissue?language=en
Anthony Atalla's state-of-the-art lab grows human organs — from muscles to blood vessels to bladders, and more.

**Biology of gender**
Available at :
https://www.ted.com/talks/karissa_sanbonmatsu_the_biology_of_gender_from_dna_to_the_brain
How exactly does gender work? It's not just about our chromosomes, says biologist Karissa Sanbonmatsu. In a visionary talk, she shares new discoveries from epigenetics, the emerging study of how DNA activity can permanently change based on social factors like trauma or diet. Learn how life experiences shape the way genes are expressed -- and what that means for our understanding of gender.

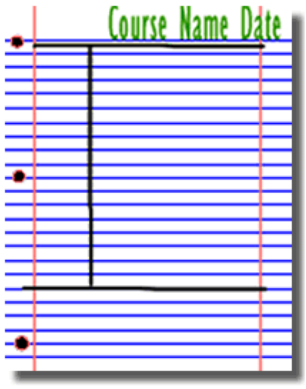
## Research activities

Research, reading and note making are essential skills for A level Biology study. It is useful to learn how to produce 'Cornell Notes' to summarise your learning. Why not try this using one of the TED talks on the previous page?

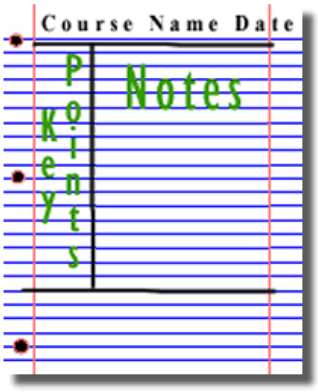
1. Divide your page into three sections like this



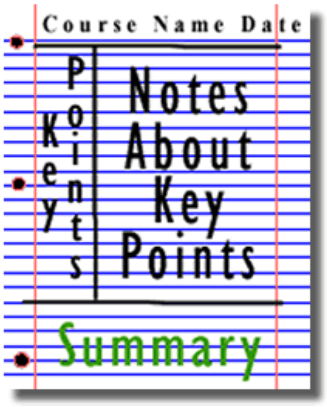
2. Write the name, date and topic at the top of the page



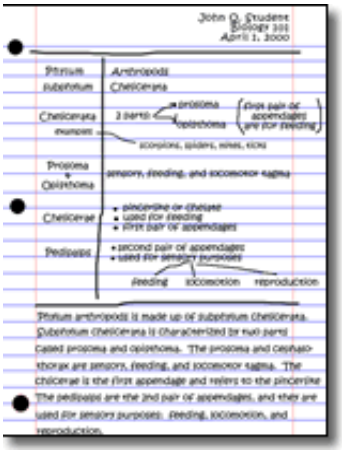

3. Use the large box to make notes. Leave a space between separate idea. Abbreviate where possible.




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




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



# Research activities

The Big Picture is an excellent resource from the Wellcome Trust. The company produces posters, videos and other resources aimed at students studying for GCSEs and A level.

For each of the following topics, you can use the resources to produce one page of Cornell style notes. Use the links to take you to the resources.

**Topic 1: The Cell**
Available at:
https://www.stem.org.uk/resources/elibrary/resource/34589/cell-suitable-home-teaching
The cell is the building block of life. Each of us starts from a single cell, a zygote, and grows into a complex organism made of trillions of cells. In this issue, we explore what we know – and what we don't yet know – about the cells that are the basis of us all and how they reproduce, grow, move, communicate and die.

Topic 2: Epidemics and immunity
Available at:
https://www.stem.org.uk/resources/elibrary/resource/26576/epidemics
How do we stop new diseases emerging or re-emerging infections getting out of hand?How does this happen in a world of such global economic imbalance, where countries vary greatly in the resources they can put into fighting disease? How do we balance individual rights with the need to protect public health?

Topic 3: Exercise, Energy and Movement
Available at:
https://www.stem.org.uk/resources/elibrary/resource/29835/exercise-energy-and-movement
All living things move. Whether it's a plant growing towards the sun, bacteria swimming away from a toxin or you walking home, anything alive must move to survive. For humans though, movement is more than just survival – we move for fun, to compete and to be healthy. In this issue we look at the biological systems that keep us moving and consider some of the psychological, social and ethical aspects of exercise and sport.

Topic 4: Proteins
Available at:
https://www.stem.org.uk/resources/elibrary/resource/34569/proteins-suitable-home-teaching
This explores proteins by their different function, with examples of how they give structure to living things, carry messages and molecules around our bodies, support the immune system, catalyse chemical reactions, and their use in industry and medicine:

Topic 5: Possible careers
Available at:
https://www.stem.org.uk/resources/elibrary/resource/31153/careers-biology
This resource explores some of the careers that are available to students who have studied biological science. It goes beyond the doctors, vets and other science-related careers typically described to include people working in a wide variety of sectors. Case studies include the work of:
* molecular biologist
* arthritis researcher
* health visitor
* radiography practitioner
* science editor
* camera assistant
* policy officer
* entrepreneur
* environmental engineer
* brewer

# Science on Social Media

Science communication is essential in the modern world and all the big scientific companies, researchers and institutions have their own social media accounts. Here are some of our top tips to keep up to date with developing news or interesting stories:

Follow on Twitter:
Commander Chris Hadfield – former resident aboard the International Space Station @cmdrhadfield

Tiktaalik roseae – a 375 million year old fossil fish with its own Twitter account!
@tiktaalikroseae

NASA's Voyager 2 – a satellite launched nearly 40 years ago that is now travelling beyond our Solar System
@NSFVoyager2

Neil dGrasse Tyson – Director of the Hayden Planetarium in New York
@neiltyson

Sci Curious – feed from writer and Bethany Brookshire tweeting about good, bad and weird neuroscience
@scicurious

The SETI Institute – The Search for Extra Terrestrial Intelligence, be the first to know what they find!
@setiinstitute

Carl Zimmer – Science writer Carl blogs about the life sciences
@carlzimmer

Phil Plait – tweets about astronomy and bad science
@badastronomer

Virginia Hughes – science journalist and blogger for National Geographic, keep up to date with neuroscience, genetics and behaviour
@virginiahughes

Maryn McKenna – science journalist who writes about antibiotic resistance
@marynmck

Find on Facebook:
Nature - the profile page for nature.com for news, features, research and events from Nature Publishing Group

Marin Conservation Institute – publishes the latest science to identify important marine ecosystems around the world.

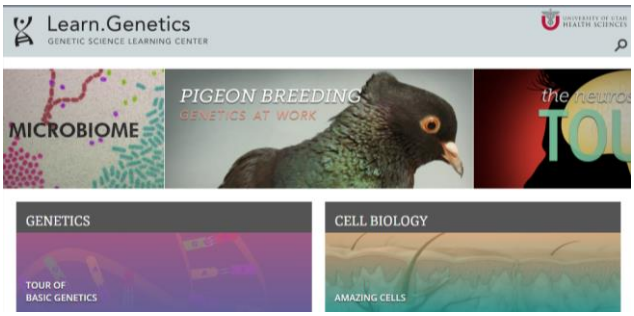
National Geographic - since 1888, National Geographic has travelled the Earth, sharing its amazing stories in pictures and words.

Science News Magazine - Science covers important and emerging research in all fields of science.

BBC Science News - The latest BBC Science and Environment News: breaking news, analysis and debate on science and nature around the world.

# Science websites

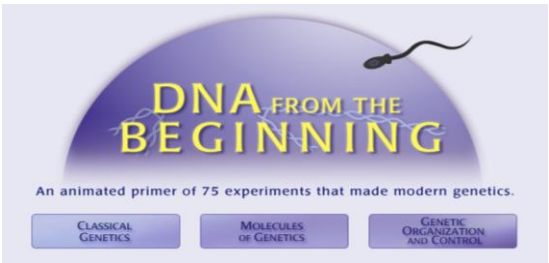
These websites all offer an amazing collection of resources that you should use again and again throughout your course.




Probably the best website on Biology….
Learn Genetics from Utah University has so much that is pitched at an appropriate level for you and has lots of interactive resources to explore, everything from why some people can taste bitter berries to how we clone mice or make glow in the dark jelly fish.
http://learn.genetics.utah.edu/

In the summer you will most likely start to learn about Biodiversity and Evolution. Many Zoos have great websites, especially London Zoo. Read about some of the case studies on conservation, such as the Giant Pangolin, the only mammal with scales.
https://www.zsl.org/conservation

ZSL
LIVING CONSERVATION




DNA from the beginning is full of interactive animations that tell the story of DNA from its discovery through to advanced year 13 concepts. One to book mark!
http://www.dnaftb.org/

# Science: Things to do!

Day 4 of the holidays and boredom has set in?
There are loads of citizen science projects you can take part in either from the comfort of your bedroom, out and about, or when on holiday. Wikipedia does a comprehensive list of all the current projects taking place. Google 'citizen science project'

Bumblebee Conservation Trust

OPAL
EXPLORE NATURE

big butterfly count
15th July - 7th August

eoceans
www.eoceans.org

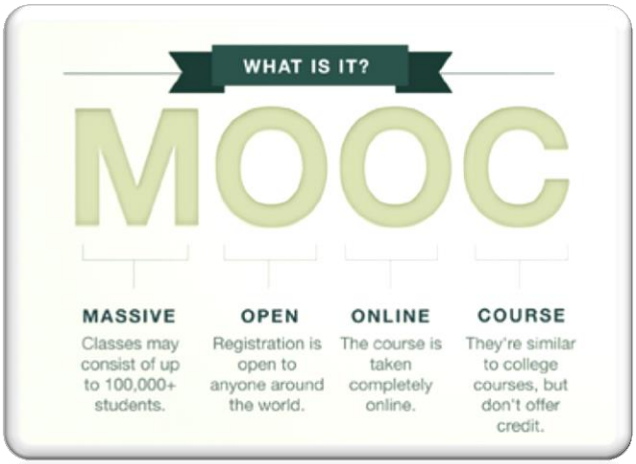
THE SHORE THING
GET INVOLVED!

WildlifeLog
SPOT IT - SHARE IT - SAVE IT

The Big Moss Map

# MOOC

**Want to stand above the rest when it comes to UCAS? Now is the time to act. MOOCs are online courses run by nearly all Universities. They are short FREE courses that you take part in. They are usually quite specialist, but aimed at the public, not the genius!**
**There are lots of websites that help you find a course, such as edX and Future learn. You can take part in any course, but there are usually start and finish dates. They mostly involve taking part in web chats, watching videos and interactives.**




Completing a MOOC will look great on your Personal statement and they are easy to take part in!

# 2. Tasks

In order for you to be armed and ready for the Biology course you will be embarking on, we would like you to refresh your knowledge and clear up doubts before you arrive. **You are expected to read through the resources and complete all of the activities on pages 17-30.** Many of the topics are GCSE topics which you should have already covered. You will need secure knowledge of these topics before you start the course in September.

In addition to this you may need to carry out further research on the topics so that you become familiar with new vocabulary and concepts.

**What we expect you to come with:**

- A well organised lever arch A4 folder and A4 lined paper, plastic wallets and a copy of the specification (see next page)
- A calculator – bring to every lesson!
- A textbook (see next page)

**Key to your success will be:**

- Good attendance
- Doing your best at all times – active participation in class
- The ability to be self-driven and becoming an independent learner
- Independent learning / making notes on the day's lessons and weekly reviews
- Keeping up with home learning
- Responding to feedback to enable you to make progress
- Ask if you are stuck – DON'T leave it for later!
- To use resources available – peers, books, internet, staff when needed
- To set out work neatly – be proud of your work

**Useful websites:**

http://vbio.weebly.com/aqa-unit-1-revision-pack.html
http://www.s-cool.co.uk/a-level/biology
http://www.biologymad.com

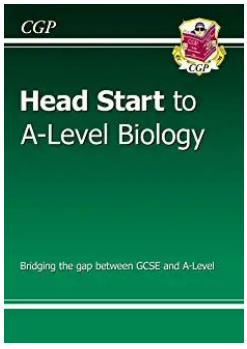
**All you need to know about the course:**

https://www.aqa.org.uk/subjects/science/as-and-a-level/biology-7401-7402

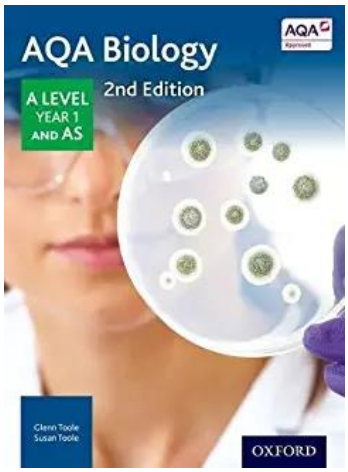
- print off the specification!

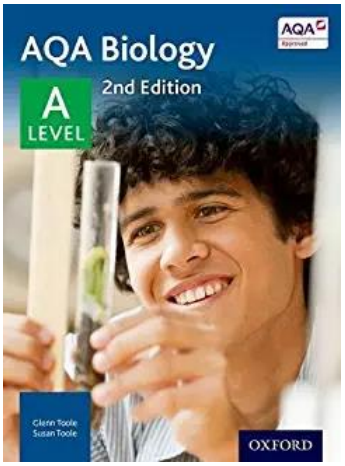
**Transition preparation book**:
Head Start to AS Biology Published by CGP [ISBN: 978 1 78294 279 5]

- Optional – might be useful to use before September




**Text book**: AQA Biology A Level Student Book ISBN: 9780198351771
- Please buy either the 1 year or 2 year version



## Specification at a glance

### AS and first year of A-level

1 Biological molecules.

2 Cells.

3 Organisms exchange substances with their environment.

4 Genetic information, variation and relationships between organisms.

### A-level only

5 Energy transfers in and between organisms.

6 Organisms respond to changes in their internal and external environments.

7 Genetics, populations, evolution and ecosystems.

8 The control of gene expression.

In September you will have 5 hours a week of Biology and you will be taught by 2 different members of the department.
The topics that you will start with are

1. Biological molecules (with one teacher)
2. Cells (with the other teacher)

**In the remainder of this pack are activities that we would like you to complete before September. Write on lined paper. Please email the Head of the Biology department:**
**Mrs L Snape - lsnape@stjosephsmail.com**
**when you have completed all of the activities and you will be sent the answers in order to self – assess your work.**

# Activities:

## SI units

Every measurement must have a size (eg 2.7) and a unit (eg metres or ℃). Sometimes, there are different units available for the same type of measurement. For example, ounces, pounds, kilograms and tonnes are all used as units for mass.

To reduce confusion, and to help with conversion between different units, there is a standard system of units called the SI units which are used for most scientific purposes.

These units have all been defined by experiment so that the size of, say, a metre in the UK is the same as a metre in China.

The seven SI base units are:

| Physical quantity | Usual quantity symbol | Unit | Abbreviation |
|---|---|---|---|
| mass | $m$ | kilogram | kg |
| length | $l$ or $x$ | metre | m |
| time | $t$ | second | s |
| electric current | $I$ | ampere | A |
| temperature | $T$ | kelvin | K |
| amount of substance | $N$ | mole | mol |
| luminous intensity | (not used at A-level) | candela | cd |

All other units can be derived from the SI base units.

For example, area is measured in square metres (written as $\mathrm{m}^2$) and speed is measured in metres per second (written as $\mathrm{ms}^{-1}$).

It is not always appropriate to use a full unit. For example, measuring the width of a hair or the distance from Manchester to London in metres would cause the numbers to be difficult to work with.

Prefixes are used to multiply each of the units. You will be familiar with centi (meaning 1/100), kilo (1000) and milli (1/1000) from centimetres, kilometres and millimetres.

There is a wide range of prefixes. The majority of quantities in scientific contexts will be quoted using the prefixes that are multiples of 1000. For example, a distance of 33 000 m would be quoted as 33 km.

The most common prefixes you will encounter are:

| Prefix | Symbol | Multiplication factor | | |
|---|---|---|---|---|
| Tera | T | $10^{12}$ | 1 000 000 000 000 | |
| Giga | G | $10^{9}$ | 1 000 000 000 | |
| Mega | M | $10^{6}$ | 1 000 000 | |
| kilo | k | $10^{3}$ | 1000 | |
| deci | d | $10^{-1}$ | 0.1 | 1/10 |
| centi | c | $10^{-2}$ | 0.01 | 1/100 |
| milli | m | $10^{-3}$ | 0.001 | 1/1000 |
| micro | μ | $10^{-6}$ | 0.000 001 | 1/1 000 000 |
| nano | n | $10^{-9}$ | 0.000 000 001 | 1/1 000 000 000 |
| pico | p | $10^{-12}$ | 0.000 000 000 001 | 1/1 000 000 000 000 |
| femto | f | $10^{-15}$ | 0.000 000 000 000 001 | 1/1 000 000 000 000 000 |

## Activity 1

Which SI unit and prefix would you use for the following quantities?

1. The time between heart beats
2. The length of a leaf
3. The distance that a migratory bird travelled each year
4. The width of a cheek cell
5. The mass of a rabbit
6. The mass of iron in the body
7. The volume of the trunk of a large tree

Sometimes, there are units that are used that are not combinations of SI units and prefixes.

These are often multiples of units that are helpful to use. For example, one litre is 0.001 $m^3$, or one day is 86 400 seconds.

## Activity 2

Choose the most appropriate unit, and estimate the size of each of the following.

1. The mass of an elephant
2. The mass of an earthworm
3. The volume of water in a teardrop
4. The volume of water in a pond
5. The time taken for a sunflower to grow
6. The temperature difference between the blood in the heart and in the ear on a cold day
7. The width of a hair
8. The length that your fingernails grow each day
9. The total length of each of the hairs on your head

## Activity 3

Put the following in order of size:

height of an elephant; length of DNA strand; width of a hair; height of a tree; width of a sodium ion; length of a nerve cell; length of a heart; width of a red blood cell; size of a virus; length of a finger; length of a mosquito; length of a human digestive system; width of a field; length of a water molecule.

## Important vocabulary for practical work

You will have come across most of the words used in practical work in your GCSE studies. It is important that you use the right definition for each word.

### Activity 4

Join the boxes to link the word to its definition.

| | |
|---|---|
| Accurate | A statement suggesting what may happen in the future. |
| Data | An experiment that gives the same results when a different person carries it out, or a different set of equipment or technique is used. |
| Precise | A measurement that is close to the true value. |
| Prediction | An experiment that gives the same results when the same experimenter uses the same method and equipment. |
| Range | Physical, chemical or biological quantities or characteristics. |
| Repeatable | A variable that is kept constant during an experiment. |
| Reproducible | A variable that is measured as the outcome of an experiment. |
| Resolution | This is the smallest change in the quantity being measured (input) of a measuring instrument that gives a perceptible change in the reading. |
| Uncertainty | The interval within the true value can be expected to lie. |
| Variable | The spread of data, showing the maximum and minimum values of the data. |
| Control variable | Measurements where repeated measurements show very little spread. |
| Dependent variable | Information, in any form, that has been collected. |

## Cells

All life on Earth exists as cells. These have basic features in common.

### Activity 5

Complete the table.

| Structure | Function |
|---|---|
| Cell-surface membrane | |
| Chloroplast | |
| Cell vacuole | |
| Mitochondria | |
| Nucleus | |
| Cell wall | |
| Chromosomes | |
| Ribosomes | |

Draw the structure of a plant cell and an animal cell.

On each cell, add labels showing each of the structures in the table, if they exist.

## Photosynthesis and respiration

Two of the most important reactions that take place in living things are photosynthesis and respiration. They both involve transfer of energy.

### Activity 6

Complete the table.

| | Photosynthesis | Aerobic respiration |
|---|---|---|
| Which organisms carry out this process? | | |
| Where in the organisms does the process take place? | | |
| Energy store at the beginning of the process | Sun | |
| Energy store at the end of the process | | In cells |
| Reactants needed for the process | | |
| Products of the process | | |
| Overall word equation | | |
| Balanced symbol equation for the overall process | | |

Which of the answers for aerobic respiration would be different for anaerobic respiration? Add these answers to the table in a different colour.

## Principles of moving across boundaries

In biology, many processes involve moving substances across boundaries.

### Activity 7

Match the examples to the principle(s) involved. For each, give a brief description of why it is relevant.

**Osmosis**

**Diffusion**

**Active transport**

**Changing surface area or length**

**Examples**

- Drinking a sports drink after exercise
- Gas exchange in the lungs
- Absorbing nutrients from food into the body
- Moving ions into cells
- The effect of salt on slugs
- Penguins huddling together to keep warm
- Potato pieces get heavier when put in pure water
- Potato pieces get lighter when put in very salty water
- Cacti do not have thin, large leaves

## Activity 8

Huntington's disease is an example of a disease where the mutation causing the disease is dominant.

h: normal (recessive)

H: mutation (dominant)

| | | Paternal alleles | |
|---|---|---|---|
| | | H | h |
| Maternal alleles | h | | |
| | h | | |

Cystic fibrosis is an example of a disease where the mutation causing the disease is recessive.

F: normal (recessive)

f: mutation (dominant)

| | | Paternal alleles | |
|---|---|---|---|
| | | F | f |
| Maternal alleles | F | | |
| | f | | |

For each of the Punnett squares:

1. Complete the diagrams to show the alleles for each child.
2. State which parent and child is:
    - healthy
    - has the disease
    - a carrier.

## Activity 8 (continued)

Each of the following statements is false. Re-write each one so that it becomes true.

1. The first Punnett square shows that one in every four children from this couple will have Huntington's disease.

2. The second Punnett square shows that there is a one in three chance that a child born to this couple will have cystic fibrosis.

3. All children of the second couple will either be carriers or suffer from cystic fibrosis.

4. The percentage of children who are sufferers on the diagram is the same as the percentage of children each couple will have who are sufferers.

5. Having one child who is born with cystic fibrosis means that the next three children will not have the disease.

6. A 50:50 chance is the same as a 0.25 probability.

## Analysing data

Biological investigations often result in large amounts of data being collected. It is important to be able to analyse this data carefully in order to pick out trends.

### Activity 9: Mean, media, mode and scatter graphs

A student investigated an area of moorland where succession was occurring. She used quadrats to measure the area covered by different plant species, bare ground and surface water every 10 metres along a transect. She also recorded the depth of soil at each quadrat. Her results are shown in the table.

| | Area covered in each quadrat A to E in $cm^2$ | | | | |
|---|---|---|---|---|---|
| | A | B | C | D | E |
| Bog moss | 55 | 40 | 10 | – | – |
| Bell heather | – | – | – | 15 | 10 |
| Sundew | 10 | 5 | – | – | – |
| Ling | – | – | – | 15 | 20 |
| Bilberry | – | – | – | 15 | 25 |
| Heath grass | – | – | 30 | 10 | 5 |
| Soft rush | – | 30 | 20 | 5 | 5 |
| Sheep's fescue | – | – | 25 | 35 | 30 |
| Bare ground | 20 | 15 | 10 | 5 | 5 |
| Surface water | 15 | 10 | 5 | – | – |
| Soil depth / cm | 3.2 | 4.7 | 8.2 | 11.5 | 14.8 |

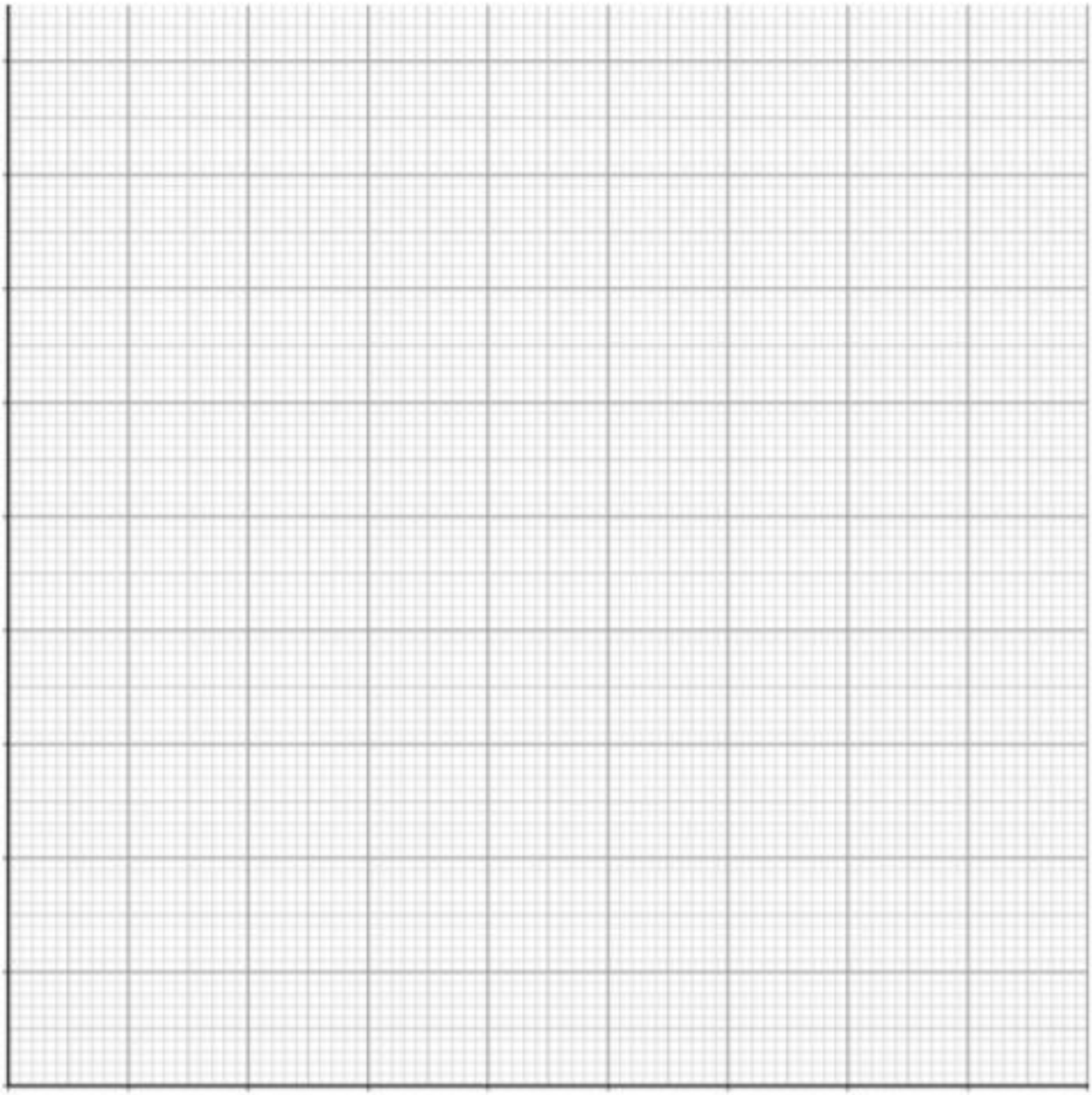
– indicates zero cover.

Calculate:

1. the mode area of soft rush in the sample
2. the mean soil depth
3. the median amount of bare ground in the sample.

## Activity 9: Mean, media, mode and scatter graphs (continued)

Use the data from the table to plot a scatter graph of soil depth against the area covered by bare ground, soft rush and bog moss (use different colours or markers for each).



## Activity 9: Mean, media, mode and scatter graphs (continued)

4. What conclusions does your graph suggest?

5. How confident are you in these conclusions?

## Activity 10: Analysing tables

Lung cancer, chronic bronchitis and coronary heart disease (CHD) are associated with smoking. Tables 1 and 2 give the total numbers of deaths from these diseases in the UK in 1974.

Table 1 Men

| Age/years | Number of deaths (in thousands) | | |
|---|---|---|---|
| | lung cancer | chronic bronchitis | coronary heart disease |
| 35-64 | 11.5 | 4.2 | 31.7 |
| 65-74 | 12.6 | 8.5 | 33.3 |
| 75+ | 5.8 | 8.1 | 29.1 |
| Total (35-75+) | 29.9 | 20.8 | 94.1 |

Table 2 Women

| Age/years | Number of deaths (in thousands) | | |
|---|---|---|---|
| | lung cancer | chronic bronchitis | coronary heart disease |
| 35–64 | 3.2 | 1.3 | 8.4 |
| 65–74 | 2.6 | 1.9 | 18.2 |
| 75+ | 1.8 | 3.5 | 42.3 |
| Total (35–75+) | 7.6 | 6.7 | 68.9 |

## Activity 10: Analysing tables (continued)

1. Of the men who died aged 35-64 from one of these three causes, what percentage of them died of lung cancer?

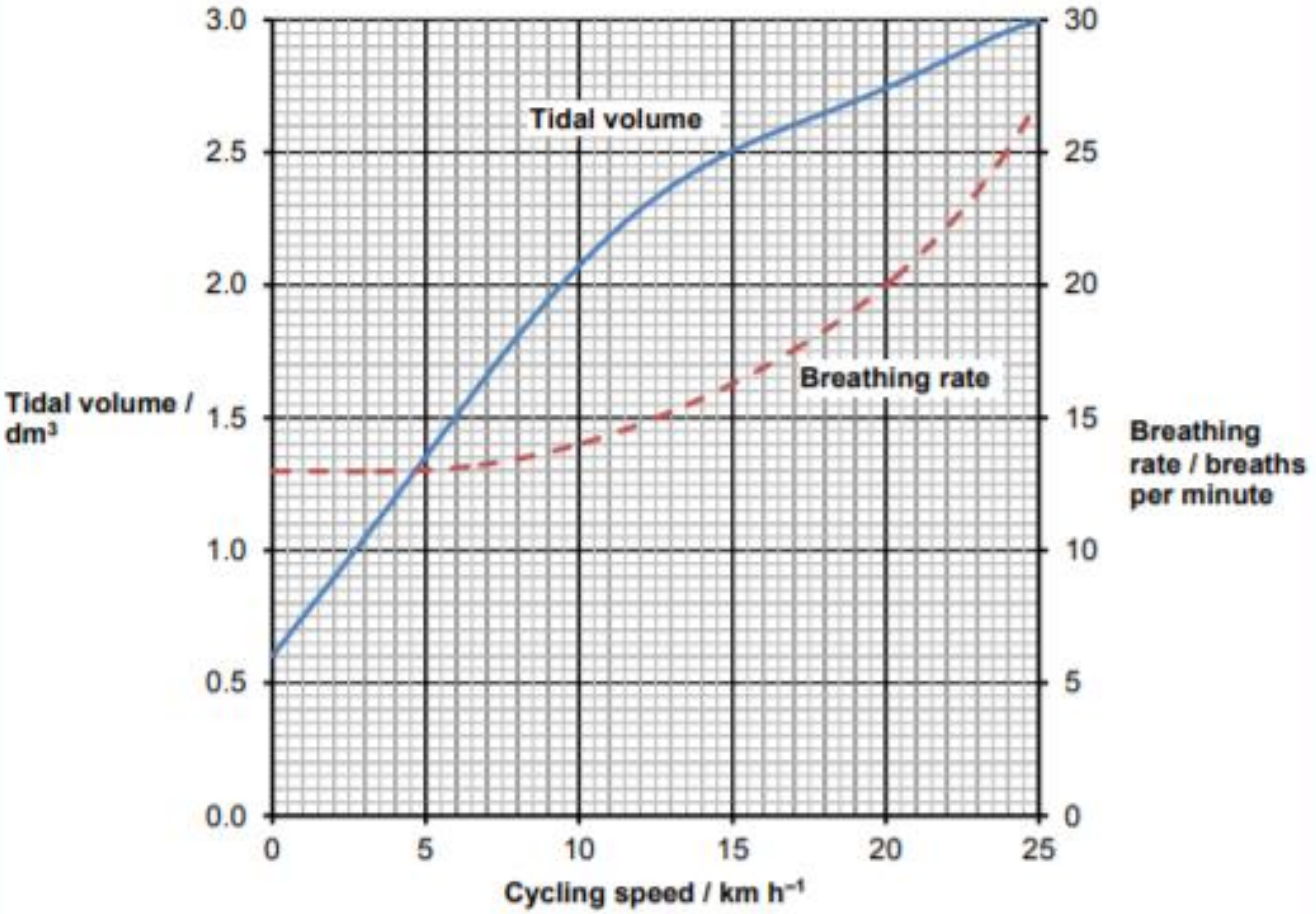
2. What percentage of deaths from chronic bronchitis in women happened to women aged 65-74?

3. Deaths from lung cancer drop as people get older. Is there a bigger percentage difference for men or women from 35-64 to 75+?

4. What fraction of coronary heart disease deaths of men over 34 are in the 75+ bracket? What about for women?

## Activity 11: Analysing complex graphs

The volume of air breathed in and out of the lungs during each breath is called the tidal volume. The breathing rate and tidal volume were measured for a cyclist pedaling at different speeds. The graph shows the results.




1. What was the tidal volume when the cycling speed was 17 km $h^{-1}$?
2. What was the breathing rate when the cycling speed was 8 km $h^{-1}$?
3. What was the change in breathing rate when the cyclist changed from 10 to 20 km $h^{-1}$? Express this as a percentage.
4. At what speed did the breathing rate start to increase?
5. The tidal volume increased linearly with cycling speed up to about 10 km $h^{-1}$. Calculate the increase in volume for each increase in speed of 1 km $h^{-1}$.
6. For this initial linear section, what is the equation of the tidal volume line?

   Hint: use $y=mx+c$