Sandringham School

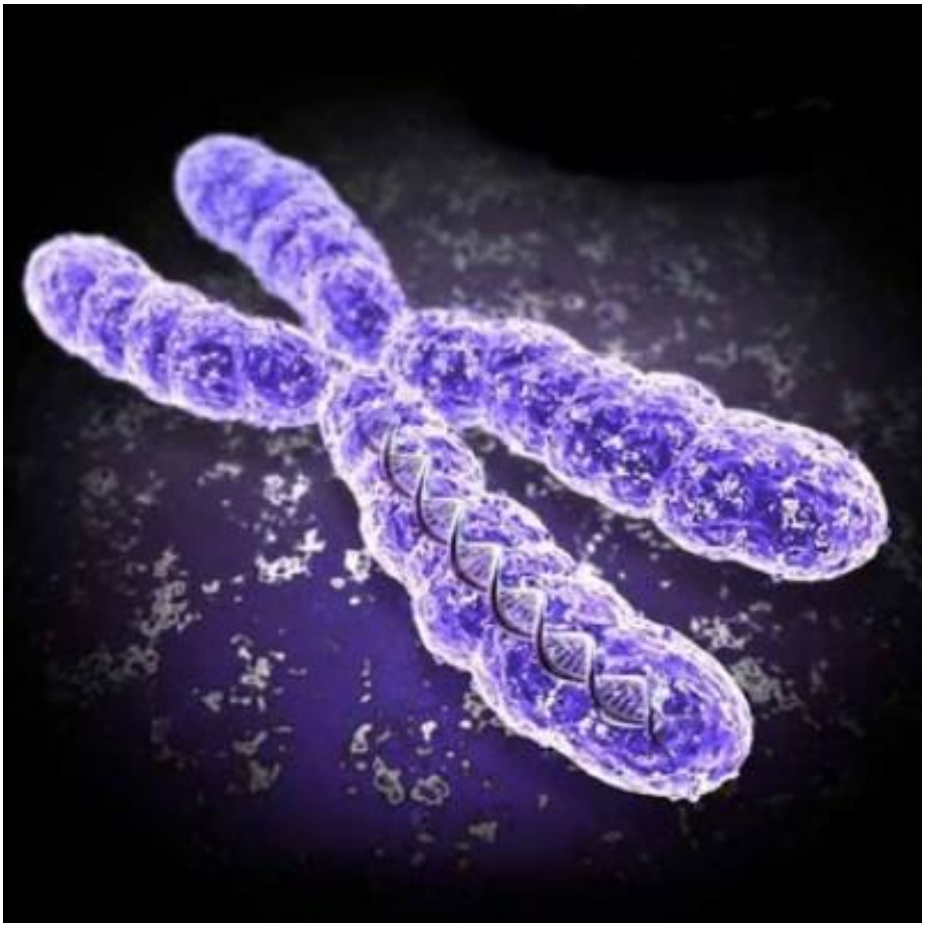
'Everybody can be Somebody'

A Level Biology Transition pack

Bridging the gap between GCSE and A Level

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

This work should be brought to your first lesson and will help to show us your strengths and weaknesses.



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Introduction

Congratulations on choosing the most interesting and challenging A-level course to study! You will have 5 hours of taught lessons a week, usually split into 2 double lessons and 1 single. You will be expected to spend at least the same amount of time outside of lessons, completing home based learning, pre-reading, independent study, making notes to consolidate learning and reading around the subject.

You will be following the AQA 7401/2 A-level Biology course.

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

In year 12 you will study

- Biological Molecules
- Cells
- How organisms exchange substances with their environment
- Genetic information and variation

In year 13 you will study

- Energy transfers in and between organisms
- Organisms respond to changes in the internal and external environments
- Genetics, populations, evolution and ecosystems
- The control of gene expression

These topics will be taught through a variety of theoretical and practical lessons, and your progress will be assessed at regular intervals, providing you with feedback on your current level of attainment and how to improve your grade.

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Biology Field Course down by the sea

In the summer term 2022 we propose to do a 3 day residential trip to Osmington Bay, Dorset to complete Ecology practical work and statistical analysis of the results. More details later in the year!



Practical work will be carried out throughout the year. You will be required to keep a lab book, and this will form part of the evidence for the Practical assessment. You will be awarded a pass or fail for your practical work, which will appear as a separate grade when you receive your A-level results. 15% of the questions on the final written exam papers will also be about practical work!

There are six required practicals in Year 12 and 6 in Year 13. However, you will complete far more than this.

Maths also makes up approximately 10% of marks in the final exams. Some tasks involving key maths skills form part of this transition pack.

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What resources do I need?

Lab coat - available to buy from the science technicians for £10

Lab book - school will provide this

Textbooks

AQA biology, 2nd edition A level year 1 and AS

Authors: Glenn Toole, Susan Toole

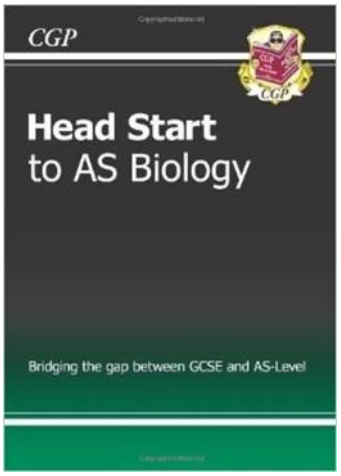
Publisher: Oxford University Press (including NelsonThornes)

ISBN-13: 978-0-19-835176-4

The book covers the 1st year of the course and then there is another version for year 2. The books are also available in a 2 year complete A-level format, which are cheaper overall than buying the 1 year books separately but it will be double the weight! You might want to factor that in before deciding which to get, as you are expected to bring your textbook to every lesson.

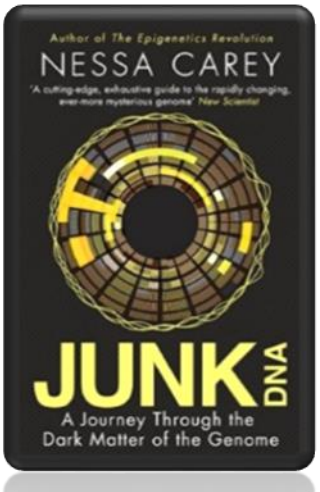
- A4 ring binder – one of your choice to bring to lessons
- Dividers to go in the ring binder
- Lever arch folder to keep all your biology notes in once topics are finished
- A4 lined paper
- Calculator
- Ruler, pens, pencils
- Bring your own device

For those who can't wait to get started why not buy Head start to AS Biology by CGP!!!!!



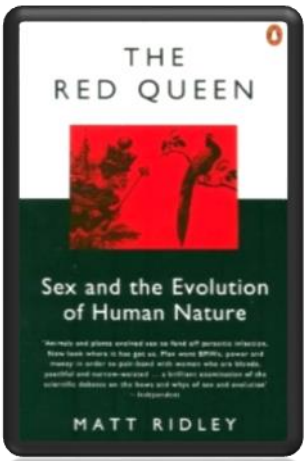
Book Recommendations

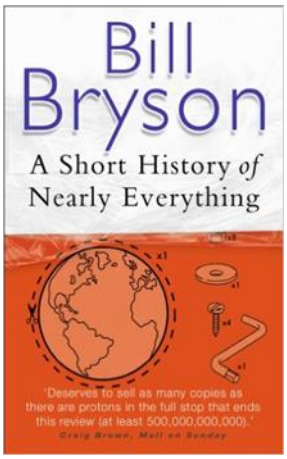
Kick back this summer with a good read. The books below are all popular science books and great for extending your understanding of Biology



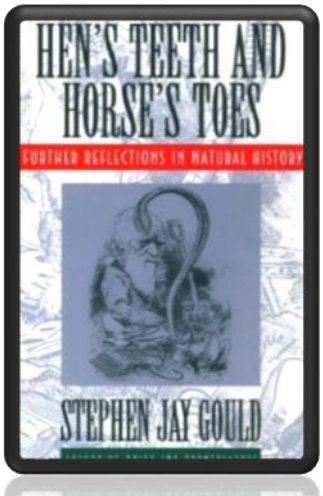
Junk DNA
Our DNA is so much more complex than you probably realize, this book will really deepen your understanding of all the work you will do on Genetics. Available at amazon.co.uk

The Red Queen
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

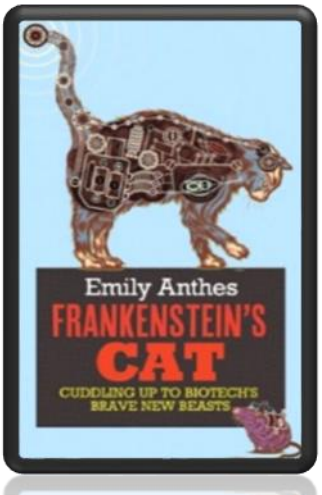




A Short History of Nearly Everything
A whistle-stop tour through many aspects of history from the Big Bang to now. This is a really accessible read that will re-familiarise you with common concepts and introduce you to some of the more colourful characters from the history of science! Available at amazon.co.uk



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



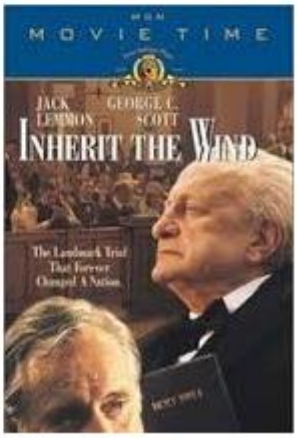
An easy read.
Frankenstein's cat
Discover how glow in the dark fish are made and more great Biotechnology breakthroughs. Available at amazon.co.uk

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.

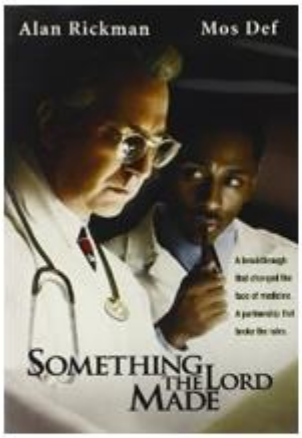
Gorillas in the Mist (1988)
An absolute classic that retells the true story of the life and work of Dian Fossey and her work studying and protecting mountain gorillas from poachers and habitat loss. A tear jerker.

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 or scan the QR code to view:

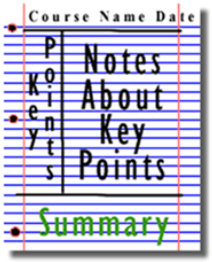
A New Superweapon in the Fight Against Cancer
Available at :
http://www.ted.com/talks/paula_hammond_a_new_superweapon_in_the_fight_against_cancer?language=en
Cancer is a very clever, adaptable disease. To defeat it, says medical researcher and educator Paula Hammond, we need a new and powerful mode of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

Transition Pack Tasks - to complete over summer



Research activity: Task 1

Instructions

Make **one** page of notes on **one** of the topics from the resources section of "The Big Picture" https://www.stem.org.uk/big-picture/resource-collection to be handed in during your first lesson in September.

This should be done in the style of the Cornell notes system, which is a way to condense lots of information in a readily accessible summary format. http://coe.jmu.edu/learningtoolbox/cornellnotes.html

The Big Picture is an excellent publication from the Wellcome Trust. Along with the magazine, the company produces posters, videos and other resources aimed at students studying for GCSEs and A-level. Some examples of topics available are given below, but there are many more on the website. Choose a topic that interests you from their resources selection.

Topic 1: The Cell

Available at: http://bigpictureeducation.com/cell

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: The Immune System

Available at: http://bigpictureeducation.com/immune

The immune system is what keeps us healthy in spite of the many organisms and substances that can do us harm. In this issue, explore how our bodies are designed to prevent potentially harmful objects from getting inside, and what happens when bacteria, viruses, fungi or other foreign organisms or substances breach these barriers.

Topic 3: Populations

Available at: http://bigpictureeducation.com/populations

What's the first thing that pops into your mind when you read the word population? Most likely it's the ever-increasing human population on earth. You're a member of that population, which is the term for all the members of a single species living together in the same location. The term population isn't just used to describe humans; it includes other animals, plants and microbes too. In this issue, we learn more about how populations grow, change and move, and why understanding them is so important.

Scientific and investigative glossary of key terms: Task 2

Scientific and Investigative Skills

As part of your A-level you will complete a practical assessment. This will require you to carry out a series of practical activities as well as planning how to do them, analysing the results and evaluating the methods. This will require you to: use appropriate apparatus to record a range of quantitative measurements (to include mass, time, volume, temperature, length and pH); use appropriate instrumentation to record quantitative measurements, such as a colorimeter or photometer; use laboratory glassware apparatus for a variety of experimental techniques, including serial dilutions; use of light microscopes at high power and low power, including use of a graticule; produce scientific drawing from observation with annotations; use qualitative reagents to identify biological molecules; separate biological compounds using thin layer/paper chromatography or electrophoresis; safely and ethically use organisms; use microbiological aseptic techniques, including the use of agar plates and broth; safely use instruments for dissection of an animal organ, or plant organ; and use sampling techniques in fieldwork.

Task:

Produce a glossary for the following key words:

accuracy, precision, anomaly, calibration, control group, control variable, dependent variable, independent variable, fair test, correlation, hypothesis, null hypothesis, probability, raw data, reliability, repeatability, reproducibility, random error, systematic error, true value, validity, zero error.

Maths skills: task 3

Maths tasks should be completed and self-marked (mark scheme at the end), then brought to your first biology lesson. Show workings in calculations to show how you got to your answer.

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.

1.3 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

2.2 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

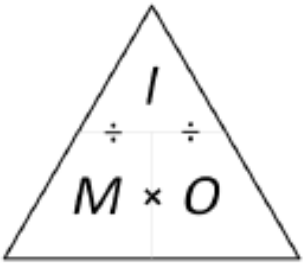
5 Give the following as decimals.

a 10^5 b 4.7×10^9 c 1.2×10^{12} d 7.96×10^{-4}

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.

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		

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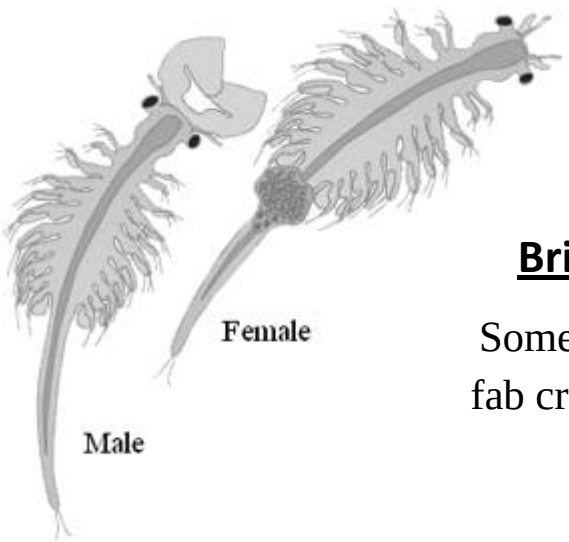
Project: task 4



Brine Shrimp *Artemia*

Some of you may know these fab creatures as sea monkeys!!

Brine Shrimp are fascinating creatures that have changed little since the Triassic period. On induction day, you will get to investigate these organisms by:

- Looking at samples in class.
- Making biological drawings of one from under the microscope. Is it male or female?
- Making observations about their movements.

You will be given more information on induction day about your summer research project which makes up task 4 of your summer work. This part should not be started until after induction day, and incorporates different aspects of the A-level biology specification.

Your Summer Project!!

Brine shrimp *Artemia* are related to many areas of the the Yr 12 AS Biology Specification as shown below.

Produce a project that explains each of the curriculum links below.

***Hand it in* to your Biology Teacher in your first lesson in September.**

1. Brine Shrimp live in water. Explain why water is such a biologically significant molecule? What are the chemical properties of water
that are important in biology?

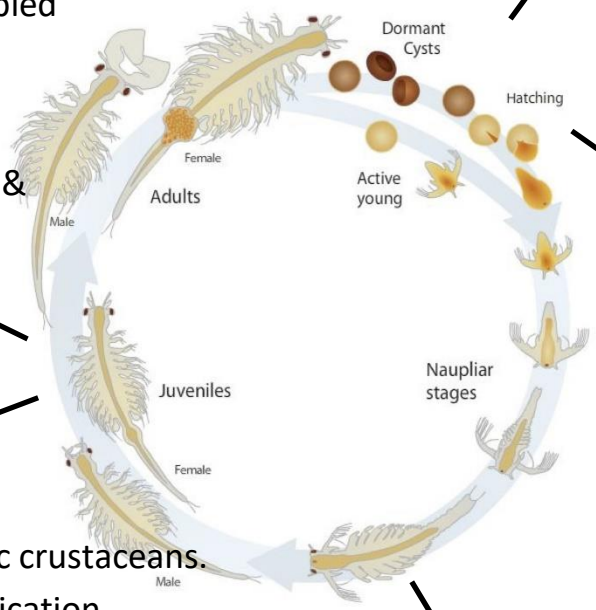
(AQA 3.1.7 Water)

2. All life on Earth exists as cells. Name and explain the functions of all structures in a Eukaryotic cell.

(AQA 3.2.1.1 Structure of Eukaryotic Cells)

3. Describe the adaptations of Brine Shrimps that have enabled them to survive successfully since the Triassic period.

(AQA 3.4.4 Genetic diversity & adaptation)



4. Brine shrimp live in salty water (hence the name brine!!) How do they control their osmotic regulation?

(AQA 3.2.3 Transport across cell membranes.

5. *Artemia* is a genus of aquatic crustaceans. How is the phylogenetic classification system organised?

(AQA 3.4.5 Species & Taxonomy)

Why not try setting up your own Brine shrimp ecosystem over the summer? They are available commercially as Sea Monkeys and small sets can be bought in most toy shops!!

Keep a photo diary to show us!

What else? Having a good biological general knowledge is vital for success on the A-level course. This involves reading around the subject. Can you add any additional information which you found interesting about brine shrimps?

Answers to maths skills practice questions

1 Numbers and units

1 a 1 kJ = 1000 J, so 4 500 000 J = 4 500 000/1000 kJ = 4500 kJ b 1 MJ = 1000 kJ, so 4500 kJ = 4.5 MJ

2 1 m = 10^9 nm (there are a billion nanometre in a metre)

9.0×10^{-8} m = $9.0 \times 10^{-8} \times 10^9$ nm = $9.0 \times 10^{-8+9}$ nm = 9.0 × 10 nm = 90 nm

1.20×10^{-7} m = $1.20 \times 10^{-7} \times 10^9$ nm = $1.20 \times 10^{-7+9}$ nm = 1.20 × 100 nm = 120 nm

Range = 90 nm to 120 nm

5 a 4 mm b 130 s

c 31 300 µl d 0.000 104 mg

6 a 57 µm b 8.6 L or 8.6 dm^3

c 68 s d 0.09 mm

2 Decimals, standard form, and significant figures

3 a 3.06×10^3 kJ b 1.4×10^5 kg

c 1.8×10^{-4} m d 4×10^{-6} m

4 a 1×10^2 b 1×10^4

c 1×10^{-2} d 2.1×10^7

5 Give the following as decimals.

a 1 000 000 b 4 700 000 000

c 1 200 000 000 000 d 0.000 796

3 Working with formulae

6 O = 0.1 mm l = ? M = 50 $l = M \times O$ = 50 × 0.1 mm = 5 mm

7 Area = 5.3 cm^2 radius? $A = \pi r^2$

$5.3 = \pi r^2$ $r^2 = \frac{5.3}{\pi} = 1.687$ $r = \sqrt{1.687} = 1.3$ cm

Or $A = \pi r^2$ $r^2 = \frac{A}{\pi}$ $r = \sqrt{\frac{A}{\pi}}$ $r = \sqrt{\frac{5.3}{\pi}} = 1.3$ cm

8 7.25×10^{-6} m (7.25 µm)

9 $a = \frac{\left(\frac{34}{100}\right) \times 135}{2} = 22.95$

10 cardiac output = stroke volume x heart rate

stroke volume = $\frac{2.7}{77} = 0.035\ dm^3$

11 Substitute in the known values: $0.84 = \frac{\text{biomass transfer}}{25} \times 100$

Rearrange the equation to give: $\text{biomass transfer} = \frac{0.84}{100} \times 25 = 0.21$ kg

5 Percentages and uncertainty

1 a $\frac{2240}{3600000} \times 100 = 0.06\%$ b $\frac{480}{3600000} \times 100 = 0.013\%$

2 5.88%

3

Sucrose conc. / mol dm^{-3}	Initial mass / g	Final mass / g	Mass change / g	Percentage change in mass
0.9	1.79	1.06	−0.73	−40.8%
0.7	1.86	1.30	−0.56	−30.1%
0.5	1.95	1.70	−0.25	−12.8%
0.3	1.63	1.76	+0.13	+8.0%
0.1	1.82	2.55	+0.73	+40.1%

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'

the PiXL club
partners in excellence

Bumblebee Conservation Trust

AgeGuess

OPAL
EXPLORE NATURE

big butterfly count

eoceans
www.eoceans.org

THE SHORE THING
GET INVOLVED!

WildlifeLog
SPOT IT - SHARE IT - SAVE IT

The Big Moss Map

MOOC

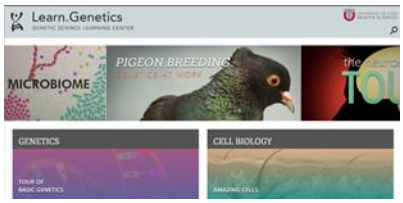
edX
coursera
canvas
OPEN 2 STUDY
UDACITY
FUTURELEARN
KHAN
ed2go

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 dead easy to take part in!

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/

ZSL
LIVING CONSERVATION

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

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 bookmark!
http://www.dnaftb.org/

Ok, so not a website, but a video you definitely want to watch. One of the first topics you will learn about is the amazing structure of the cell. This BBC film shows the fascinating workings of a cell… a touch more detailed than the "fried egg" model you might have seen.
http://www.dailymotion.com/video/xzh0kb_the-hidden-life-of-the-cell_shortfilms
If this link expires – google "BBC hidden life of the cell"