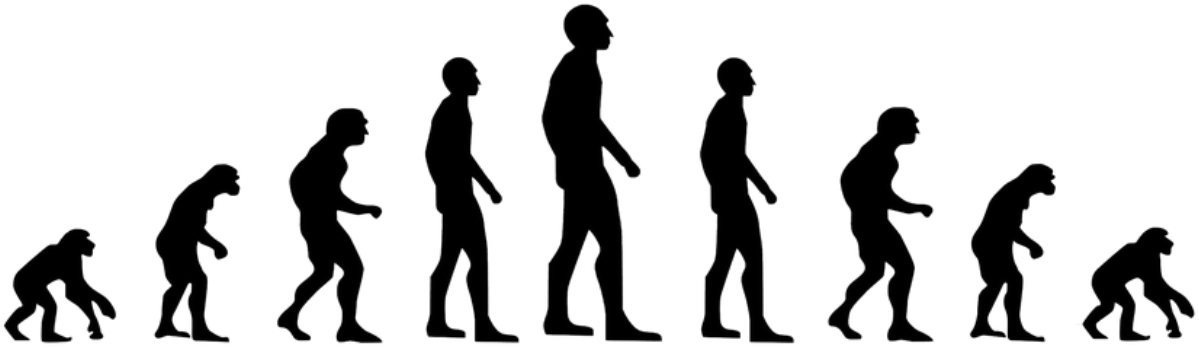
Year 12

A' level Biology

Bridging Work Booklet



Name: _____

ON POINT EDUCATION

Welcome to A' level Biology

This booklet has been produced to help consolidate your knowledge from GCSE and link it to the topics you will be studying at AS/A Level Biology.

Why do bridging work?

The intention of A' levels are to prepare students for undergraduate study. Therefore, preparation work is essential for studying A Level Biology. Completing the booklet will help you highlight the areas you need to work on before you start the course in September.

The tasks included in this booklet are aspects that are crucial in the understanding of the foundations of biology.

We want you to be successful at A-level Biology and what this takes at GCSE is different to what is required at A-level.

Although you have fewer subjects to study, there are different skills required at post-16. As well as, a greater volume of work due to the increased, demand of depth and detail.

Bridging work should help you to gauge your current understanding of the subject and introduce you to the depth of understanding and maths skills that are required for study at post-16.

Studying Biology (or, in fact any subject) at A-level will require you to be highly organised and effective with your own independent work. Not only will you have to balance the workload of this subject and the other subjects you have chosen, you will also be required to commit to the subject and do the very best that you can.

You MUST bring this bridging work with you to your first year 12 Biology lesson in September.

A' level Biology content

Year 12 will cover the following 4 units:

1. Biological molecules
2. Cells
3. Organisms exchange substances with their environment
4. Genetic information, variation and relationships between organisms.

Year 13 will cover these units:

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.

Assessment

At the end of year 12 you will be required to sit a “Paper 1”.

The final assessment for the A-level consists of three exams.

Assessments

Paper 1	Paper 2	Paper 3
What's assessed • Any content from topics 1–4, including relevant practical skills	**What's assessed** • Any content from topics 5–8, including relevant practical skills	**What's assessed** • Any content from topics 1–8, including relevant practical skills
Assessed • written exam: 2 hours • 91 marks • 35% of A-level	**Assessed** • written exam: 2 hours • 91 marks • 35% of A-level	**Assessed** • written exam: 2 hours • 78 marks • 30% of A-level
Questions • 76 marks: a mixture of short and long answer questions • 15 marks: extended response questions	**Questions** • 76 marks: a mixture of short and long answer questions • 15 marks: comprehension question	**Questions** • 38 marks: structured questions, including practical techniques • 15 marks: critical analysis of given experimental data • 25 marks: one essay from a choice of two titles

SI Units

There are seven base units in the SI system:

- the kilogram (kg), for mass
- the second (s), for time
- the kelvin (K), for temperature
- the ampere (A), for electric current
- the mole (mol), for the amount of a substance
- the candela (cd), for luminous intensity
- the metre (m), for distance

Metric unit prefixes

Scientists measure a wide range of quantities, some very large and some very small. Measurements for different orders of magnitude have specific prefixes:

Prefix (Symbol)	Power	Factor
kilo (k)	10^3	1,000
hecto (h)	10^2	100
deka (da)	10^1	10
deci (d)	10^{-1}	0.1
centi (c)	10^{-2}	0.01
milli (m)	10^{-3}	0.001
micro (µ)	10^{-6}	0.000,001
nano (n)	10^{-9}	0.000,000,001

What SI unit and prefix is used to measure the following quantities?

1. The mass of a rabbit? _____
2. The temperature of the human body? _____
3. The width of a leaf? _____
4. The mass of iron in the body?_____
5. The mass of a caterpillar?_____
6. The volume of blood in the human body? _____
7. The distance flown by migrating geese?_____
8. The time between heart beats?_____
9. The width of an onion cell? _____

Sometimes, there are units that are used that are not combinations of SI units and prefixes. These multiples of units are helpful to use. For example, one litre is 0.001 m^3, or one day is 86 400 seconds.

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

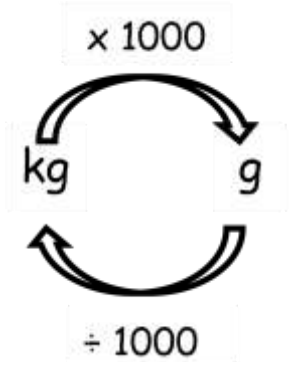
1. The mass of an elephant _____
2. The mass of an earthworm _____
3. The volume of water in a teardrop _____
4. The volume of water in a pond _____
5. The time taken for a sunflower to grow _____
6. The temperature difference between the blood in the heart and in the ear on a cold day _____
7. The width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

Put the following in order of size:

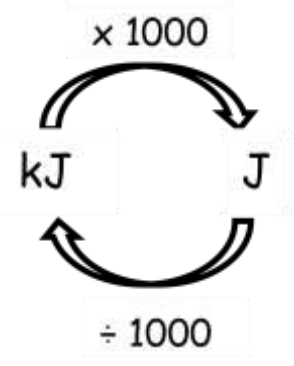
height of an elephant; length of DNA strand; width of a hair; height of a tree; width of a sodium ion; length of a nerve cell; length of a heart; width of a red blood cell; size of a virus; length of a finger; length of a mosquito; length of a human digestive system; width of a field; length of a water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

Converting units

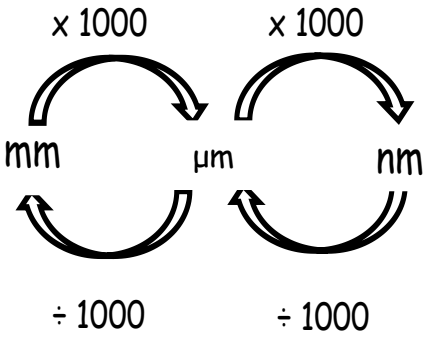
Mass can have units of kg and g.



Energy can have units of J and kJ



Length can have units of mm, µm and nm.



Convert each of the following into metres.

(a) 70 nm _____

(b) 5 µm _____

(c) 1 mm _____

(d) 0.2 mm _____

Convert each of the following into µm.

(a) 4 m _____

(b) 200 nm _____

(c) 17 mm _____

(d) 0.3 nm _____

Areas. How many?

(a) μm^2 in a m^2 _____

(b) μm^2 in a mm^2 _____

Volumes. How many?

(a) mm^3 in a cm^3 _____

(b) μm^3 in a mm^3 _____

Express these rates of change with the correct units:

(a) 2 µg per cm^3 _____

(b) 200 kJ per m^2 per year _____

(c) 10 g per dm^3 _____

(d) 15 cm^3 per minute _____

Application - Converting units

1. What is the length in mm of a bacterium 50µm long?

2. The total surface area of alveoli in a human lung was estimated at $35m^2$
   What is this in cm^2?
   Show your working.

3. The human body contains 4700 cm^3 of blood. What is this volume in m^3?
   Show your working.

4. In an enzyme investigation, 10 g of product was produced in 30 minutes.
   What unit would be most appropriate for the rate of this reaction?
   Calculate the rate of the reaction.

Solve the following:

1. What is the mass in grams of a 15kg soil sample?

2. The volume of solution in an investigation was given as 650mm^3
   What is the volume of this solution in cm^3?

3. A student was carrying out an investigation into the rate of change in volume of air in the lungs during a period of exercise. What would be the most appropriate unit to use in this investigation?

Standard Form

Standard form is a system of writing numbers, which can be particularly useful for working with very large or very small numbers. It is based on using powers of 10 to express how big or small a number is.

1. Convert these numbers into normal form.

a) 5.239×10^3 b) 4.543×10^4 c) 9.382×10^2

d) 6.665×10^6 e) 1.951×10^2 f) 1.905×10^5

g) 6.005×10^3

2. Convert these numbers into standard form.

a) 65345 b) 28748 c) 548454

d) 486856 e) 70241 f) 65865758

Calculations using standard form

1. To add or subtract numbers in standard form, they must have the same exponent. Add (or subtract) the significands and keep the exponent the same. It is easiest to convert the smaller exponents to the biggest exponent. Note that adding or subtracting a much smaller number will have very little effect on a larger number.
2. To multiply numbers in standard form multiply the significands and add the exponents.
3. To divide numbers in standard form divide the significands and subtract the exponents.

Worked Examples

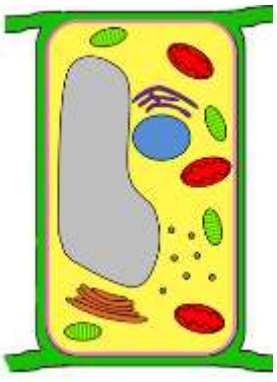
1. $(5.7 \times 10^8) + (8.3 \times 10^7) = (5.7 \times 10^8) + (0.83 \times 10^8) = 6.53 \times 10^8$
2. $(5.7 \times 10^8) - (3.3 \times 10^7) = (5.7 \times 10^8) - (0.33 \times 10^8) = 5.37 \times 10^8$
3. $(5.82 \times 10^4) \times (2.81 \times 10^3) = 16.35 \times 10^7 = 1.64 \times 10^8$
4. $(5.82 \times 10^4) \div (2.81 \times 10^3) = 2.07 \times 10^1 = 20.7$

Solve the following:

1. $(8.07 \times 10^{6}) + (8.58 \times 10^{9}) =$
2. $(7.19 \times 10^{-7}) - (3.27 \times 10^{-7}) =$
3. $(3.99 \times 10^{7}) + (8.69 \times 10^{8}) =$
4. $(4.54 \times 10^{5}) - (1.31 \times 10^{4}) =$
5. $(4.76 \times 10^{10}) + (7.56 \times 10^{9}) =$
6. $(2.4 \times 10^{5}) \times (3.2 \times 10^{3}) =$
7. $(4 \times 10^{7}) \times (1.85 \times 10^{4}) =$
8. $(1.47 \times 10^{3}) \times (2.54 \times 10^{11}) =$
9. $(5.07 \times 10^{6}) \times (1.003 \times 10^{5}) =$
10. $(1.47 \times 10^{-3}) \times (2.54 \times 10^{9}) =$
11. $(3.35 \times 10^{8}) \times (2.04 \times 10^{-15}) =$
12. $(2.4 \times 10^{5}) \div (3.2 \times 10^{3}) =$
13. $(7.4 \times 10^{7}) \div (4 \times 10^{4}) =$
14. $(1.47 \times 10^{3}) \div (4.9 \times 10^{11}) =$
15. $(5.07 \times 10^{6}) \div (2.028 \times 10^{5}) =$
16. $(1.47 \times 10^{-3}) \div (4.9 \times 10^{9}) =$
17. $(3.35 \times 10^{8}) \div (4.1875 \times 10^{-15}) =$

Application Task – standard form

The length, the width and depth of the plant cell are 50µm, 10µm and 8µm respectively. Find the surface area and volume of the plant cell and write your answer in standard form.



Significant figures

The number of significant figures tells us the precision of a measurement. For example, 3.72 m is more precise than 3.7 m – it has been measured to more significant figures. Each digit in a measurement counts as a significant figure, except zero when used as a placeholder (usually leading and trailing zeros).

Therefore:

806	has 3 significant figures.
8.06 × 103	has 3 significant figures. The exponent does not add any precision.
806 001	has 6 significant figures.
806 000	has 3 significant figures. The trailing zeros are assumed to be just placeholders, and the number could be written as 8.06×10^3. It is however possible that that this value was measured precisely and the last three digits just happen to be all zeros, so it has 6 significant figures, like the previous example.
806.0	has 4 significant figures. You would not write that trailing zero unless it was measured.
0.00806	has 3 significant figures. The leading zeros are just placeholders and the number could have been written as 8.06×10^{-3}.
80.600	has 5 significant figures. You would not write the trailing zeroes unless they were measured.

It is important to realise that 2 and 2.0 are the not the same.

- 2 has one significant figure and means the value is between 1.5 and 2.5.
- 2.0 has two significant figures and means the value is between 1.95 and 2.05.

Complete the following

1.Round the following numbers to 1 significant figure

a) 231 b) 58 c) 4050 d) 681

e) 5672 f) 1.348 g) 640.32 h) 99

2. Round the following numbers to 1 significant figure

a) 0.2346 b) 0.003512 c) 0.066 d)0.008134

e) 0.000065 f) 0.00192 g) 0.00000631 h) 0.0999

3. Round these to the number of significant figures written in brackets after each number

a) 5832 (2sf) b) 83555 (3sf) c) 0.03134 (2sf) d) 0.012954 (3sf)

e) 6.594 (2sf) f) 5.46726 (3sf) g) 10.32 (2sf) h) 100.659 (3sf)

Percentages

Percentages are useful for comparing information where the sample sizes or totals are different. By converting different data to percentages, you can readily compare them. Percentage means parts out of 100 and is the same as a fraction with a denominator (bottom) of 100.

a) Ventricular systole lasts for 0.3 s. The cardiac cycle lasts for 0.8 s. What percentage of the cardiac cycle is ventricular systole?

b) A soil sample weighed 2.4 g. After heating at 100 ^{0}C in an oven to evaporate the water, it weighed 1.8 g. What percentage of the soil sample was water

c) Stearic acid has the formula $C_{17}H_{35}COOH$. What percentage of the atoms in stearic acid are:
   (i) carbon?
   (ii) hydrogen?
   (iii) oxygen?

d) In an onion root tip squash, 200 cells were observed and each cell was assigned to a stage of the cell cycle. Here are the results:

Stage	Number of cells	Percentage of cells at this stage?
Interphase	150	
Prophase	20	
Metaphase	12	
Anaphase	4	
Telophase	8	
Cytokinesis	6	

What percentage of cells were at each stage of the cell cycle?

Analysing data

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

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.

Mean, median and graphs

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).

- What conclusions does your graph suggest?
- How confident are you in these conclusions?

Analysing data

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

Analysing data

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

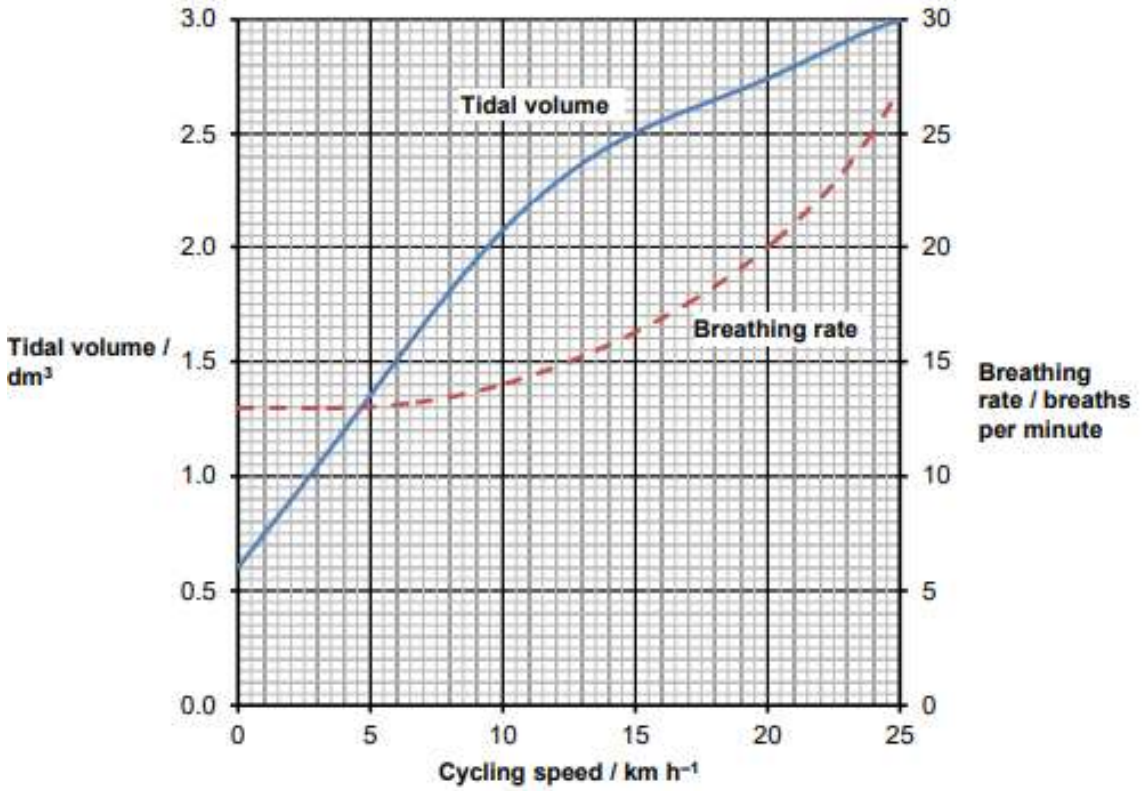
2. What percentage of deaths from chronic bronchitis in women happened to women aged 65-74?

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?

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 pedalling at different speeds. The graph shows the results.

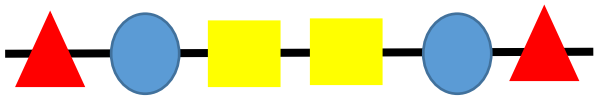


1. What was the tidal volume when the cycling speed was 17 km h^{-1} ?
2. What was the breathing rate when the cycling speed was 8 km h^{-1} ?
3. What was the change in breathing rate when the cyclist changed from 10 to 20 km h^{-1} ? Express this as a percentage.
4. At what speed did the breathing rate 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

Biological molecules

Protein Structure

Proteins are described as the building blocks of life. In humans, proteins are found in every cell in the body.



Primary structure of protein

This image above shows the primary structure of a protein.

1. Name the monomers that join together to make proteins.

2. Describe the primary structure of a protein.

3. What type of bond holds together the secondary structure of a protein?

Carbohydrates

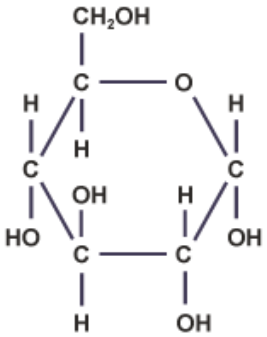
Carbohydrates are important in organisms as an energy source.

The image above is of glucose.

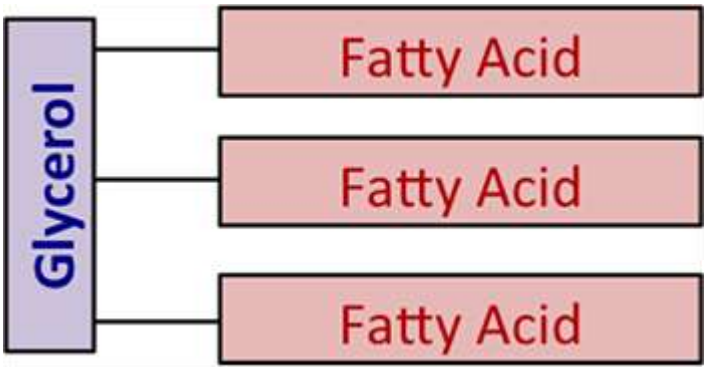
1. What is the chemical formulae for glucose?

2. Why is this molecule described as being organic?

3. Name the polymers of glucose that are used as storage in plants and animals.



Lipids



Lipids are fats and oils. A triglyceride consists of a molecule of glycerol with three fatty acids.

1. Which elements make up fatty acids?

2. What are the differences between saturated and unsaturated fatty acids?

3. What are the differences between triglycerides and phospholipids?

Cells

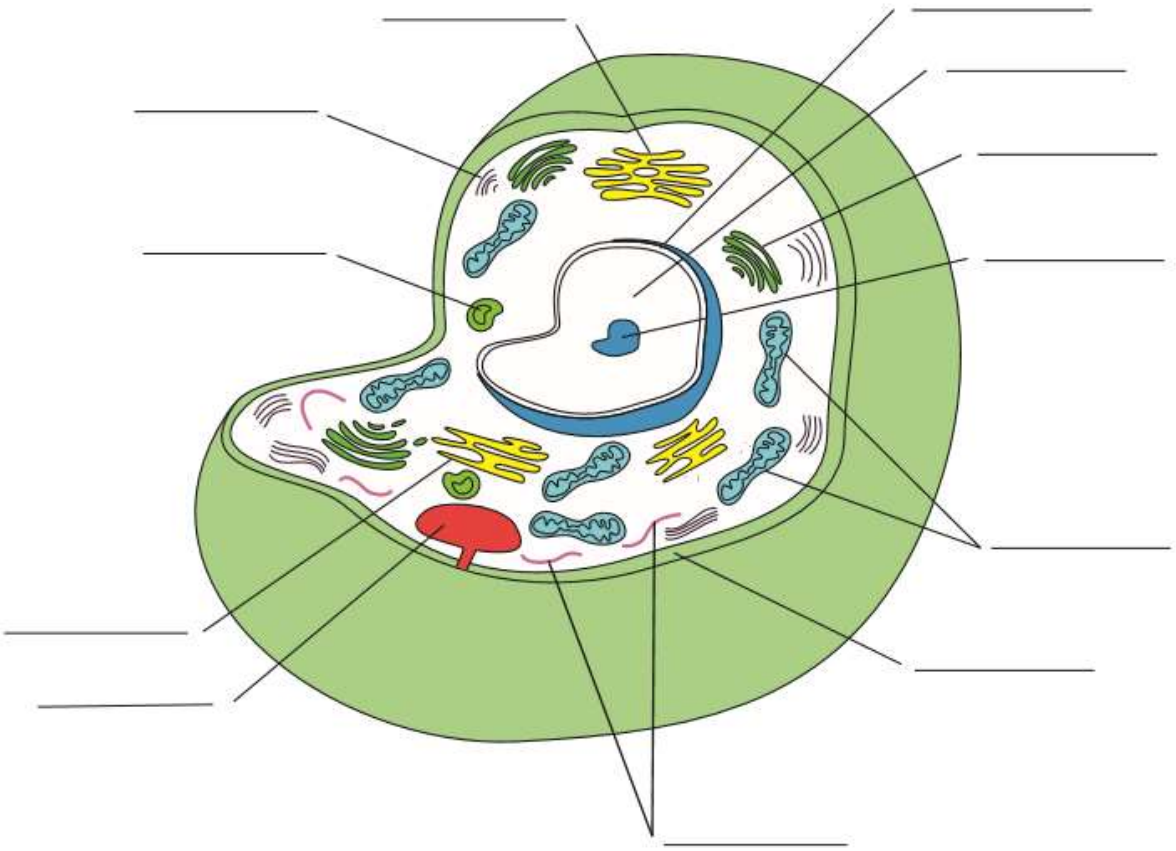
All life on Earth exists as cells. These have basic features in common.

Complete the table:

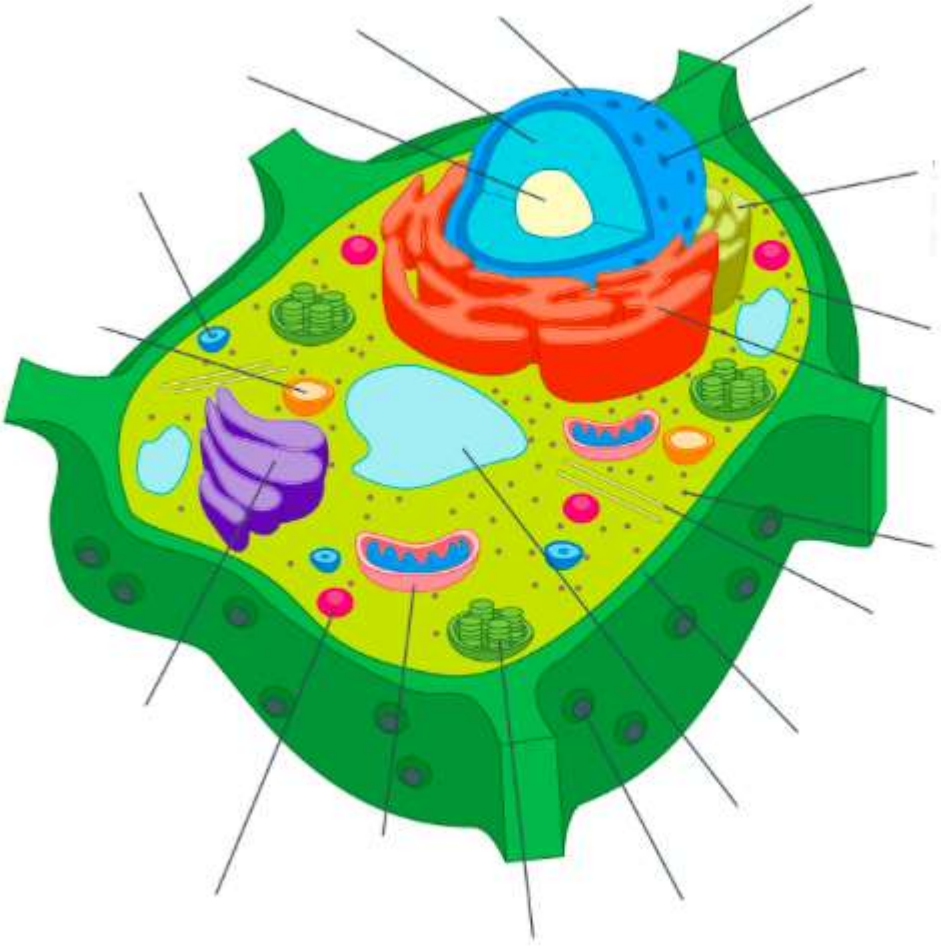
Structure	Function
Cell surface membrane	
Chloroplast	
Cell vacuole	
Mitochondria	
Nucleus	
Cell wall	
Chromosomes	
Ribosomes	

Label the cell diagrams below:

Animal Cell



Plant Cell



Practical work in Biology

Complete the table by writing in the correct definitions

Accuracy	
Anomalies	
Calibration	
Measurement Error	
Random Error	
Systematic Error	
Zero Error	
Precision	
Range	
Repeatable	
Reproducible	
Resolution	
Uncertainty	
Validity	
Continuous Variable	
Control Variable	
Dependent Variable	
Independent Variable	

If you have 30 minutes to spare, here are some presentations. They provide some interesting answers and some thought provoking questions. Use the link or scan the QR code to view.

Henrietta Lacks: The Immortal Woman
Available at:
https://ed.ted.com/lessons/the-immortal-cells-of-henrietta-lacks-robin-bulleri
https://www.youtube.com/watch?v=WU5uCiV0MyQ
An immortal cell line was generated in 1951. However, the generation of immortal cells in the instance raises questions about ethics, race, and genetics.

Ben Goldacre: Battling Bad Science
Available at:
https://www.youtube.com/watch?v=h4MhbkWJzKk
There are news reports of new health advice, but how can you know if they are right? Doctor and epidemiologist Ben Goldacre shows us the ways evidence can be distorted.

How bacteria "talk" - Bonnie Bassler
Available at:
https://ed.ted.com/lessons/how-bacteria-talk-bonnie-bassler
Bonnie Bassler discovered that bacteria "talk" to each other, using a chemical language that lets them coordinate defence and mount attacks. The find has stunning implications for medicine, industry -- and our understanding of ourselves.

How do viruses jump from animals to humans
Available at:
https://www.ted.com/talks/ben_longdon_how_do_viruses_jump_from_animals_to_humans#t-13212
Every animal species hosts unique viruses that have specifically adapted to infect it. Over time, some of these have jumped to humans – these are known as 'zoonotic' viruses.

Places to go for help:

The AQA website is a great place to start.

1.The Biology webpages are aimed at teachers, but you may find them useful too. Information includes:

- The specification – this explains exactly what you need to learn for your exams.
- Practice exam papers
- Lists of command words and subject specific vocabulary – so you understand the words to use in exams
- Practical handbooks explain the practical work you need to know
- Past papers and mark schemes from the old specifications
- Maths skills support

2.Royal Society of Biology

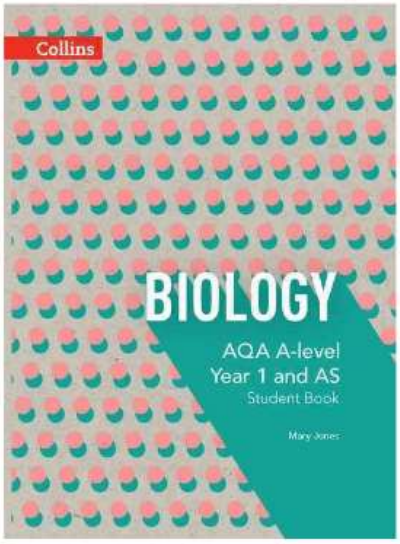
"A single unified voice for biology". They work with everyone from government policy makers to students, as well as universities and researchers studying biology. Their website includes a dedicated student section. Have a look at rsb.org.uk

3.The Student Room

Join the A-level Biology forums and share thoughts and ideas with other students if you are stuck with your independent learning. Visit thestudentroom.co.uk

4.Textbooks

During the course, we will refer to the approved textbook published by HarperCollins. Others are available by Oxford University Press.



5.Revision guides

These are great if you want a quick overview of the course when you are revising for your exams. Remember to use other tools as well, as these **are not** detailed enough on their own.

6.YouTube

YouTube has thousands of Biology videos. Just be careful to look at who produced the video and why. This is because some videos distort the facts. Check the author, date and comments – these help indicate whether the clip is reliable.

7. Magazines

Focus, New Scientist or Philip Allan updates can help you put the biology you are learning in context. The science department subscribe to Biological Sciences Review (Hodder Education), which covers subjects in the depth you would need to achieve the best grades through topical, A-level focused content that deepens subject knowledge and builds independent learning and exam skills.

8. The Learning Toolbox website

This website has lots of tips and strategies to help you study better. http://coe.jmu.edu/learningtoolbox/studentstart.htm)

9.Open Education Database

This website has further ideas to help you to learn faster and smarter http://oedb.org/library/college-basics/hacking-knowledge