



SAFFRON WALDEN
COUNTY HIGH SCHOOL

SWCHS SIXTH FORM SUMMER WORK

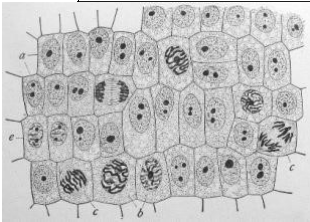
A Level Biology

TASK

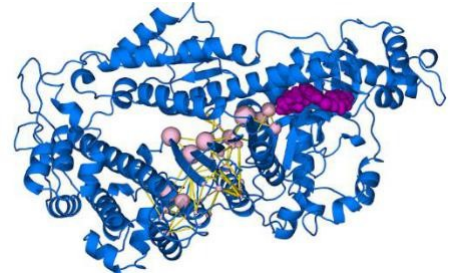
If you have any queries regarding this work, please email lfletcher@swchs.net

Task

Please work through the information provided below.



Getting Ready for A-Level Biology



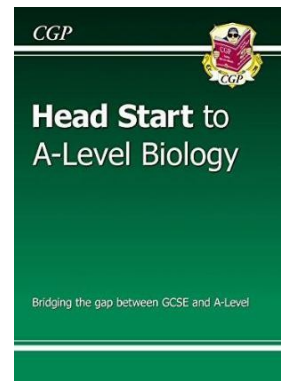
We cover AQA A0Level Biology. The specification is here

<https://filestore.aqa.org.uk/resources/biology/specifications/AQA-7401-7402-SP-2015.PDF>

Head-Start Book - OPTIONAL

This book is really useful. It revises key concepts that were covered at GCSE and are important to fully understand before proceeding to more advanced study.

https://www.amazon.co.uk/Head-Start-level-Biology-Level/dp/1782942793/ref=sr_1_1?crid=2T08BC5D29BM8&keywords=cgp+head+start+to+a+level+biology&qid=1655734230&srefix=CGP+head+start%2Caps%2C70&sr=8-1



Pearson Scientist of the Month:

Look at this website on which Pearson are unveiling their Scientist of the Month – other interesting scientists are also featured.

<https://www.pearson.com/uk/educators/schools/subject-area/science/why-science-matters/scientist-of-the-month.html>

Careers using biology

Explore a huge variety of careers that are open to people with a biologist's background

<https://www.rsb.org.uk/careers-and-cpd/careers>

Note taking

Note making is a good skill to learn. We will cover a lot of material each lesson and you may not be able to write everything down. An important activity will be to go back and expand and supplement what you have written and review the work. This reviewing will make it easier to learn for tests and exams. The Cornell method of note making is one example of effective note making. Divide your page into 3 areas:

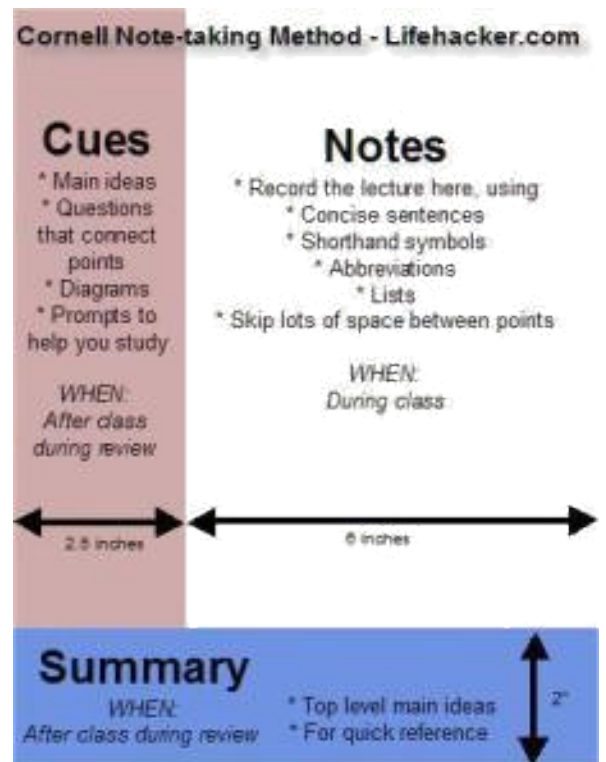
More information here:

http://en.wikibooks.org/wiki/Note_Taking/Specific_Formatting and here

<https://www.youtube.com/watch?v=WtW9lyE04OQ>

Look at the video linked to below – just under 6 mins long on evolution. Try and make notes using the technique already explained. Bring these to class. This will allow you to get an idea of note making styles.

<https://www.youtube.com/watch?v=XyTclNLKq4c>



Transition from GCSE to A Level

What to bring to the first lesson:

- Your Cornell Notes on the Evolution video
- The answers to the protein synthesis video (if you did Combined Science at GCSE)
- Answers to the practical key terms, Biological molecules and microscopes calculations
- Answers to the math skills questions embedded throughout the explanations of key areas.

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 math skills and develop confidence in applying what you already know to unfamiliar situations.

This worksheet aims to give you a head start by helping you understand and practice some of the math skills you'll need and fundamentals for the first two topics: Biological molecules and cell structure.

There is also one topic that is covered in Year 12 that if you did Triple Science, you would have covered and if you did Combined you won't have. While we teach it from scratch in year 12, if you did Combined it would be worth looking at the video and answering the following questions

[GCSE Biology - How are Proteins Made? - Transcription and Translation Explained](#)

1. Where in the cell does transcription take place?
2. What molecule is produced during transcription, and what is its function?
3. What is the name of the enzyme that helps build the mRNA strand during transcription?
4. How does mRNA differ from DNA in terms of structure and bases?
5. What is a codon, and how is it related to amino acids?
6. Where does translation occur in the cell?
7. What is the role of the ribosome in translation?
8. How does tRNA help in the process of translation?
9. What determines the order of amino acids in a protein?

Practical science key terms

Practical science is a key aspect of Biology A-level, and there are some fundamental terms that you need to be familiar with.

Key word	Definition
Which variable is changed or selected by the investigator?	
What is a dependent variable?	
Define a fair test	
What are control variables?	

Match the key terms to their definition

True value

The range within which you would expect the true value to lie

Accurate

A measurement that is close to the true value

Resolution

Repeated measurements that are very similar to the calculated mean value

Precise

The value that would be obtained in an ideal measurement where there were no errors of any kind

Uncertainty

The smallest change that can be measured using the measuring instrument that gives a readable change in the reading

Biological molecules

Find the answers to the following questions, they are fundamentals that will come up in Biology and are from GCSE and will be the foundation for one of the first topics you will cover.

Question	Answer
Define a monomer	
Define a polymer	
Describe the emulsion test for lipids	
Describe Benedict's test for reducing sugars	
What are the monomers that make proteins?	
Describe the Biuret Test for proteins	
How does an enzyme affect a reaction?	
Give three factors which can affect enzyme action	

Cell structure and magnification

While cells, their sub-cellular structure and magnification have been covered since lower down the school, they will be tackled in more detail and the application weaved throughout many units of the course.

Drawing images from microscope observations must be done carefully, including careful measurements for magnification calculations.

Make sure that you are clear on the organelles within different cells and their functions.

You must also be secure in the method used to make observations using a light microscope and the purpose of each method step.

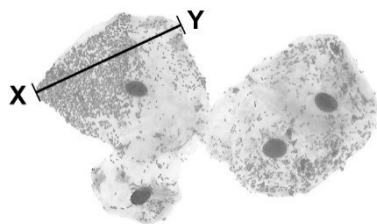
Figure 1 shows an animal cell viewed using a microscope



The cell contains a nucleus.

1. State the function of the nucleus.
2. Name **one** type of cell that does **not** contain a nucleus.
3. On the diagram label three parts of the cell.
4. Name **one** structure found in a plant cell but **not** found in an animal cell.

The figure below shows some different cells.



The real length from point X to point Y is 0.06 mm.

5. Calculate the magnification.

The cells shown above were viewed using a light microscope.

6. Give **two** advantages of using an electron microscope instead of a light microscope.

Maths skills

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 (m²), cubic metre (m³), 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

1.2 Powers and indices

Ten squared = $10 \times 10 = 100$ 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 $100 \times 1000 = 100\,000$ 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.

Questions:

(a) Simplify $a^{20} \times a^5$

Answer

(b) Simplify $\frac{a^{20}}{a^5}$

Answer

(c) Simplify $(a^{20})^5$

Answer

Put these in order starting with the smallest.
You **must** show the value of each number in your working.

$$9^{\frac{1}{2}}$$

$$(-7)^0$$

$$\left(\frac{1}{8}\right)^{-\frac{1}{3}}$$

(a) Simplify

(i) $y^7 \times y^2$

(ii) $y^7 \div y^2$

(iii) $(y^7)^2$

(b) (i) If $y = -1$ which answer in part (a) is positive?

(ii) If $y = 0.5$ which answer in part (a) has the greatest value?

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.



$$488\,889 \div 10^3 = 488.889 \text{ km}$$

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 will 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

<u>Divide by 1000 for each step to convert in this direction</u>				
				
<u>nano</u>	<u>micro</u>	<u>milli</u>	<u>Whole unit</u>	<u>Kilo</u>
<u>e.g. nm</u>	<u>e.g. μm</u>	<u>e.g. mm</u>	<u>e.g. m</u>	<u>e.g. km</u>
				
<u>Multiply by 1000 for each step to convert in this direction</u>				

Questions:

1. Convert 1m to mm
2. Convert 1m to μm
3. Convert 20,000 μm to mm
4. Convert 20m^2 to km^2 :
5. Convert 1m^2 to mm^2 :
6. Convert 5 000 000 mm^3 to m^3 :
Convert 0.000 000 07 m^3 to mm^3 :

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.

2.2 Standard form

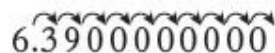
Sometimes biologists need to work with numbers that are very small, such as dimensions of organelles, or very large, such as populations of bacteria. In such cases, the use of scientific notation or standard form is very useful, because it allows the numbers to be written easily.

Standard form is expressing numbers in powers of ten, for example, 1.5×10^7 microorganisms.

Look at this 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} .

2.3 Significant figures

When you use a calculator to work out a numerical answer, you know that this often results in many 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 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.

Questions:

1. The growth rate of a plant is $0.023735 \text{ cm hour}^{-1}$. What is the rate to: a) 3 decimal places?
b) 3 significant figures?
2. A student is calculating the average growth rate of a tray of seedlings by dividing the average change in seedling height by the incubation time. The average change in seedling height is 17.5cm and the incubation time is 60 days. What is the average growth rate (in cm day^{-1})? Give your answer to an appropriate number of significant figures.

2.4 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:

$$\% \text{ Increase} = \frac{\text{New Value} - \text{Initial Value}}{\text{Initial Value}} \times 100$$
$$\% \text{ Decrease} = \frac{\text{Initial Value} - \text{New Value}}{\text{Initial Value}} \times 100$$

Increase \longrightarrow New Value - Initial Value
Decrease \longrightarrow Initial Value - New Value

Remember: When you calculate a percentage change, use the total *before* the increase or decrease, not the final total.

Practice Questions:

A student is investigating the effect of fertilizer on plant growth. She measures the height of a plant before and after applying fertilizer.

- Initial height of the plant: **15 cm**
- Final height of the plant after 2 weeks: **21 cm**

Calculate the **percentage increase** in the height of the plant.

Question 2: Enzyme Activity and Temperature

In an experiment, a student measures the rate of enzyme activity at two different temperatures.

- Enzyme activity at 25°C: **40 units**
- Enzyme activity at 35°C: **60 units**

Calculate the **percentage change** in enzyme activity when the temperature is increased from 25°C to 35°C.