Newstead Wood A level Biology - Bridging Work.

I am delighted that you have chosen to study A level Biology and that we will be able to spend the next two years exploring in detail this fascinating subject together.

In this Bridging Work document, I have set out the work that I would like you to complete before September in preparation for your A level Biology studies to commence. (Please note that you must complete part A,B & C).

If you have any questions about this work or the course, do not hesitate to email me.

Mrs Lebreuilly

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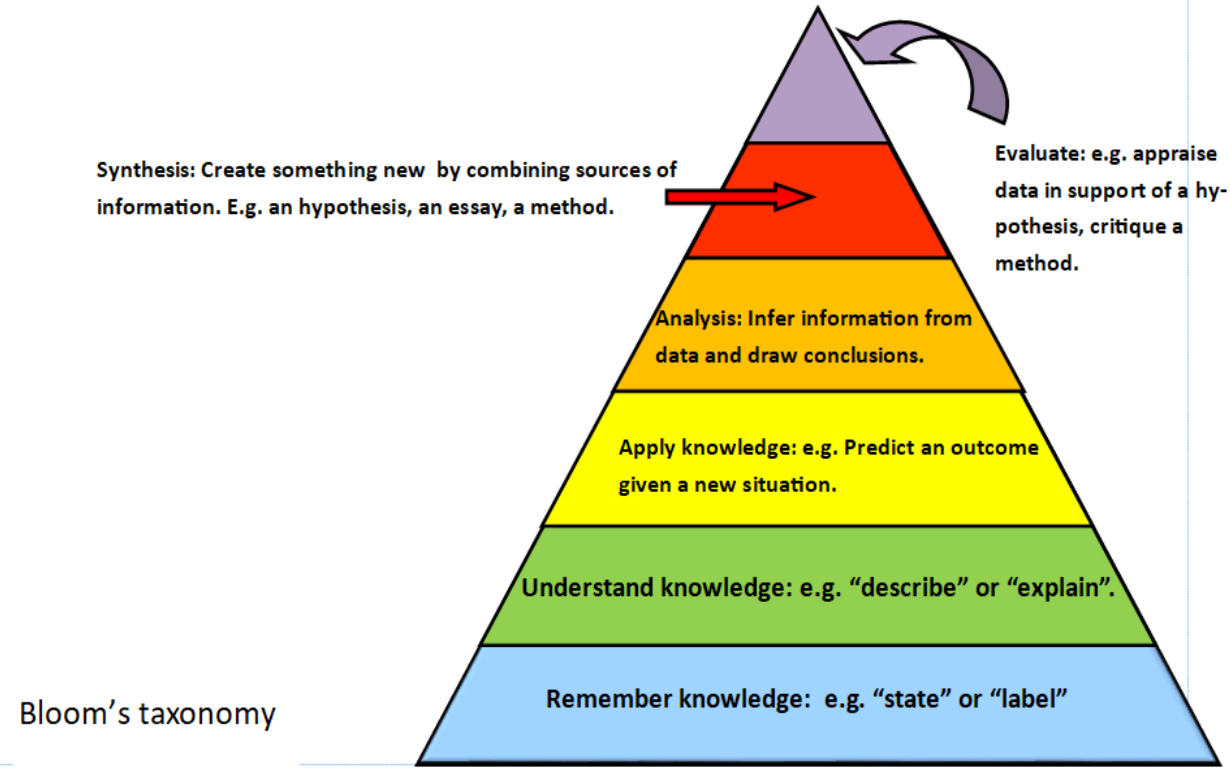
Your success in A level Biology is going to be measured not only in terms of what you can remember but also what you are able to do with that knowledge. It is therefore essential that you are practising the skills outlined below throughout the A level Biology course.

Whilst you are given many opportunities to develop these skills in lessons, it is also important that you are mindful of your own progression, so that you can take steps to further your development. (An essential part of independent learning). Refer to these 6 levels regularly to determine the level you are working at in each topic.



Bloom's taxonomy

Bridging Unit tasks - Part A

Complete all of Part A below, before September 2024.

Task 1: SI Units

Every measurement must have a size (eg 2.7) and a unit (eg metres or ºC).

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.

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

Task 2: Sizes.

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.

Task 3: Vocabulary for practical work

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.

Task 4: Photosynthesis and respiration

Two of the most important reactions that take place in living things are photosynthesis and respiration. 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.

Task 5: 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.

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.

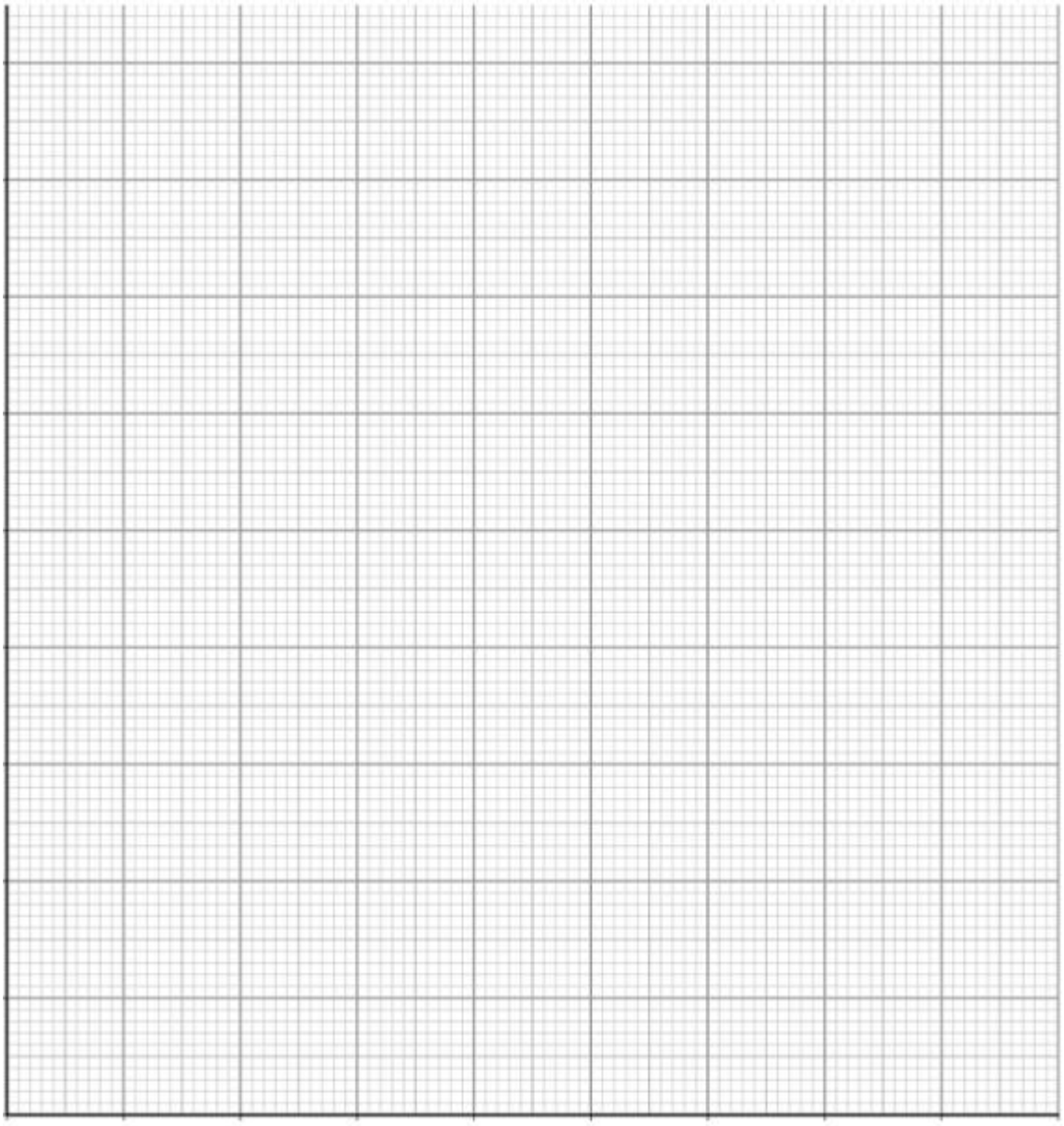
	Area covered in each quadrat A to E in cm^2				
	A	B	C	D	E
Bog moss	55	40	10	–	–
Bell heather	–	–	–	15	10
Sundew	10	5	–	–	–
Ling	–	–	–	15	20
Bilberry	–	–	–	15	25
Heath grass	–	–	30	10	5
Soft rush	–	30	20	5	5
Sheep's fescue	–	–	25	35	30
Bare ground	20	15	10	5	5
Surface water	15	10	5	–	–
Soil depth / cm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

1. 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).
2. What conclusions does your graph suggest?
3. How confident are you in these conclusions?



Task 6: 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

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

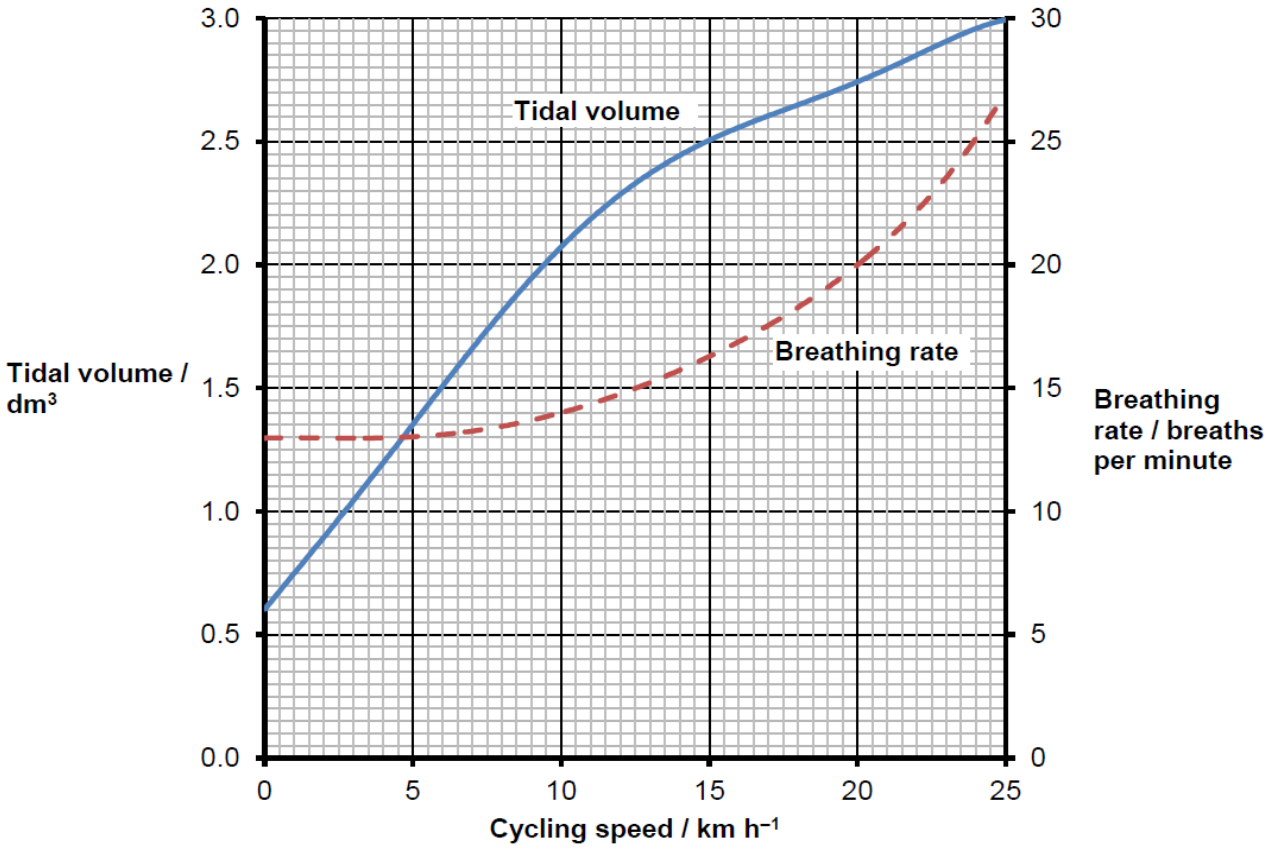
2.What percentage of deaths from chronic bronchitis in women happened to women aged 65-74?

3.Deaths from lung cancer drop as people get older. Is there a bigger percentage diffence 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?

Task 7: 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

Task 8: Designing practical investigations - Investigating microbes and cellulose.

Cellulose is a fibrous substance that makes up about 50% of the cell wall in mature plant cells. The molecules are very long and contain carbon, hydrogen and oxygen. Cellulose is a stable substance at ambient temperatures and it is often found in a complex with lignin (another plant polymer). The lignocellulose complex is found in wood, agricultural waste and waste paper. Microbes secrete cellulase enzymes which partly digest the cellulose, so that it is broken down into soluble sugar molecules which the microbes can then absorb and use. Higher organisms such as herbivores do not make cellulases, so depend on cellulolytic bacteria in their intestinal tracts. On land major decomposers of cellulose are fungi, aided by a few aerobic and anaerobic bacteria. Cellulolytic bacteria species include *Cellulomonas sp., Pseudomonas sp.* and *Ruminococcus sp.* Cellulolytic fungi include *Chaetominium sp, Fusarium sp., Myrothecium sp.,* and *Trichoderma sp.* (Fry *et al*, 2007).

To do: Using this information and other facts you may research, plan an investigation into some aspect of the production of cellulase enzymes by microbes, or the effects of the enzymes. Your investigation plan should be written in the table on the next two pages. You are encouraged to think very carefully about why you would do each step, rather than just following a pre-existing method unquestioningly. (Use extra sheets of paper if you require more space).

Some examples of ideas that could be explored: a) the effect of temperature on the activity of cellulolytic microbes or enzymes (cellulases); b) The cellulolytic activity of microbes from different soils; c) the effect on cellulolytic activity of adding different minerals to the soil samples; d) whether fungi or bacteria are more important in terms of cellulolytic activity, in particular types of soil.

More details about this practical investigation can be found here: https://pbiol.rsb.org.uk

References

Fry, P., Grainger, J. and Hurst, J. (2007). Investigating microbes and cellulose, in: *Practical Microbiology for Secondary Schools.* Reading: Society for General Microbiology. pp. 16 – 17 and 42.

Plan heading	Details
Aim of investigation. i.e. what question will you investigate?	
Hypothesis. What do you think your findings will be based on your preparatory reading and why?	
Equipment and materials needed.	
Outline of method. (use numbered bullet points).	

Variables (Identify clearly which is the independent & dependent variables for your investigation. What are the control variables? How will they be controlled and why do they need to be? Are there any confounding variables? What can be done to limit the influence of these?)	Independent: Dependent: Control variables: 1. 2. 3. 4. 5. Confounding variables?		
Risk assessment for the outlined method. (Identify hazards, risks and control measures).	**Hazard**	**Risk**	**Control measures**
Plan for the results. An outline of how you would present the results, if you were to carry out the investigation and what you would look for when analysing the data, to help you reach a conclusion.	Plan for presentation of results: Plan of what you would look for when analysing data collected:		

Plan justification.	1. Why would this investigation produce reliable data? 2. How would you know if you have obtained precise data? 3. Will the data be accurate? What is accuracy? 4. What steps in your plan ensure that the investigation will be valid?

Task 9: Evaluating an investigation.

Key features of an A grade student's work, the level of detail and criticism that they can apply when evaluating their own practical procedures or those of others.

Consider the following scenario: Some students investigated the effect of the Bt toxin on insect pests that feed on maize plants. They divided the field into 3 plots and planted the following:

Plot 1 – untreated maize seedlings

Plot 2 – seedlings genetically modified to produce the Bt toxin that kills insect pests.

Plot 3 – seedlings sprayed with Bt toxin every week.

Each week a different student counted the number of seedlings that had died in each plot. The teacher was concerned about the investigation and suggested that a) the method may not be very valid, b) not all of the variables have been controlled, c) the results may not be accurate.

To do: Explain why the teacher's concerns are justified and suggest improvements to the investigation.

a). Why is the method not valid? What are your suggestions for improvement?

b). Which variables have not been controlled? How could you suggest overcoming this?

c). Why may the results not be valid? What are your suggested improvements?

Task 10: Applied maths for Biology

1. What are the rules relating to zeroes and non -zero digits when determining significant figures?
2.

	Number of stomata present					
Surface	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Mean
Upper	1	2	2	3	2	2
Lower	36	42	35	41	37	

   Calculate the mean result for the lower surface of the leaf. Give your answer to **two** significant figures.

3. Nerve pathway A is 90 cm long. A nerve impulse travels along this pathway at 76m/s. Calculate how long it takes for the nerve impulse to travel the length of the pathway. Give your answer to **two** significant figures.
4. Round the following numbers to the number of significant figures indicated:

0.009909 to 3 s.f

53879 to 2 s.f

0.005089 to 1 s.f

98347 to 2 s.f

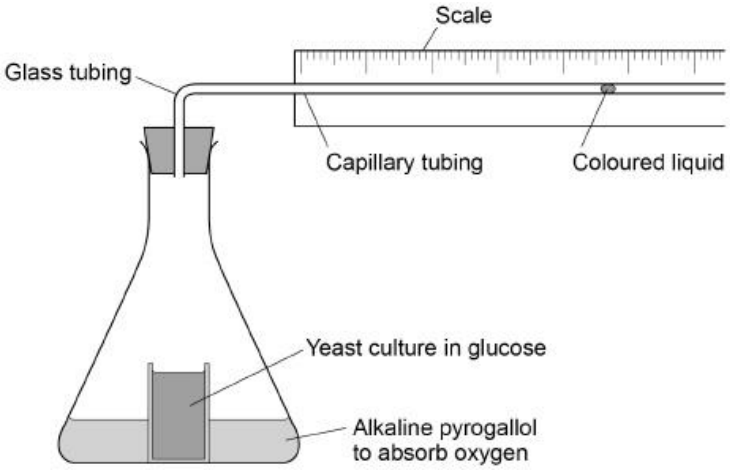
3.5175 to 3 s.f

5. Work out the surface area (cm^2), volume (cm^3), and surface area- to – volume ratio for cubes of the following dimensions:

2cm x 2cm x 2cm

5cm x 5cmx5cm

12cm x 12cm x 12cm

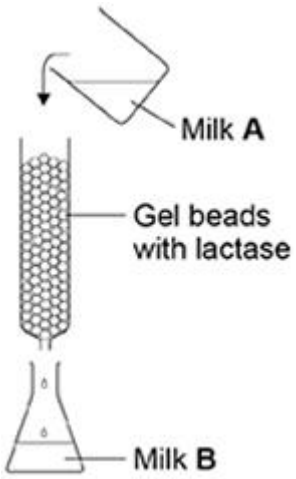
6. 

A student used the apparatus shown on the previous page to measure the rate of respiration in yeast. The student found that the coloured liquid moved 1.5 cm in 24 hours. The diameter of the lumen (hole) of the capillary tubing was 1 mm.

The volume of a capillary tubing is given by $\pi r^2 l$, where π is 3.14 and l = length.

Calculate the volume of gas produced in cm^3 $hour^{-1}$. Show your working.

7. Many humans are unable to digest lactose. A scientist investigated the production of lactose-free milk. He produced gel beads containing the enzyme lactase and placed the beads in a column. He poured milk (Milk **A**) into the column and collected the milk (Milk **B**) after it had moved through the column over the beads. This is shown in the diagram below.

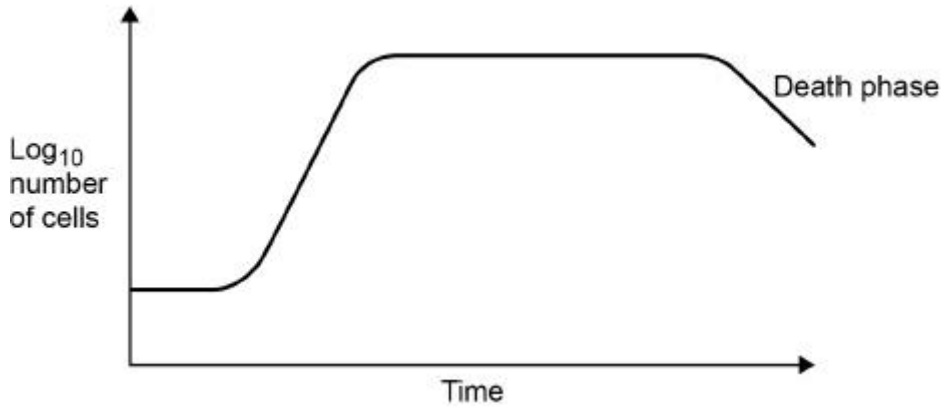


The gel beads were all similar sizes. Use the formula below t$\frac{4}{3}$ calculate the volume of one of the beads with a 3.0 mm diameter. Volume of sphere = πr^3

8. Convert the following cell and organelle sizes to complete the table:

Cell / or object	Size in mm	Size in µm	Size in nm
Ant	3		
Human hair		100	
Palisade leaf cell		70	
Plant cell ribosome			20
HIV virus			100
Egg cell mitochondrion	0.002		

9.



The graph shows a typical population growth curve for yeast under laboratory conditions.

a) Explain why a log scale is used to record the number of cells.

b) The following equation can be used to make predictions of the growth in the

population of yeast cells under ideal laboratory conditions.

$$X_t = X_0 e^{rt}$$

X_t = the population after a certain time
X_0 = the population at the start
e = 2.72 (base of natural logarithm)
r = growth rate
t = time period in hours over which r applies

A population of 2000 yeast cells was left for 10 hours.
The value for the growth rate was 0.5

Assuming no yeast cells died, calculate the predicted size of the population after 10 hours. Show your working.

Bridging Unit tasks - Part B

<u>One report task</u> to be completed for the start of the Autumn term September 2024.

Visit the following website, which is part of the University of Cambridge's resources for A level students: https://myheplus.com/subject/biology. On this website you will see details of different and diverse biological topics such as epigenetics and neuroscience amongst others.

To do: Please research and produce a written report, of **no more than 500 words maximum**, on a topic of your choosing from this list on the HE+ website. <u>The report should be referenced</u> using the Harvard referencing system, (see guidance document) and the references do not count to the word limit. The report should a) introduce the key ideas related to the topic, plus explain the meaning of any keywords used, and b) outline some of the practical applications for the future that could develop from furthering our biological understanding in this area. You may include a diagram or visual image with your report, if it will help you to explain your chosen topic.

Bridging Unit tasks - Part C

Please choose at least one extra source to read before the start of the Autumn term in September 2024. You will be asked to explain what you found interesting about your wider reading in class.

(Please note it is not necessary for you to choose one of the books listed here, it could be another of your own choosing. If you are buying a book, check to see whether a reduced price second- hand copy or Kindle version is available first).

Books

Richard Dawkins: The Selfish Gene; The Blind Watchmaker; Unweaving the Rainbow; Climbing Mount Improbable; The Ancestor's Tale.

Steve Jones: Y: The Descent of Men; In the Blood: God, Genes and Destiny; Almost Like a Whale: The 'Origin of Species' Updated; The Language of the genes.

Matt Ridley: Genome: The Autobiography of a Species in 23 Chapters; The Red Queen: Sex and the Evolution of Human Nature; Francis Crick: Discoverer of the Genetic Code; Nature Via Nurture: Genes, Experience and What Makes Us Human.

Nessa Carey: Junk DNA and Epigenetics Revolution.

Barry Gibb: The Rough Guide to the Brain (Rough Guides Reference Titles)

Oliver Sachs: The Man Who Mistook His Wife For A Hat

Daniel Chamovitz: What A Plant Knows

Websites

1. http://www.ibiblio.org/virtualcell/index.htm - An interactive cell biology site.
2. http://www.accessexcellence.org/RC/VL/GG - A web site showing illustrations of many processes of biotechnology.
3. http://www.dnai.org/a/index.html - Explore the genetic code.
4. http://nobelprize.org - Details of the history of the best scientific discoveries.
5. http://nature.com - The site of the scientific journal.
6. http://royalsociety.org - Podcasts, news and interviews with scientists about recent scientific developments.
7. http://www.nhm.ac.uk - The London Natural History Museum's website with lots of interesting educational material.
8. http://www.bmj.com - The website of the British Medical Journal.
9. http://www.bbc.co.uk/news/science_and_environment - The BBC news page for Science and the Environment.