A Level Biology

Introduction

Welcome to A level Biology! Biology is the study of life and this broad subject covers many fascinating topics, ranging from microbiology to zoology. Biology A level will give you the skills to make connections and associations with all living things around you and can open the door to a wide range of interesting careers. Many students who take A level Biology go on to use it in their future studies or work, however it also develops useful and transferable skills for other careers.

The transition from GCSE to A Level is a big step; A level biology is much more demanding than GCSE and requires a greater degree of commitment and independent learning. To make this smoother and to give you the best possible start, we have prepared this transition pack for you. To really succeed on this challenging A level course you need to be organised and efficient with your study, and you need to read around the subject to extend your understanding beyond what is covered in class.

We have therefore included a suggested reading section and links to useful web resources. The activities towards the end of this pack are designed to give you some practice in the core knowledge and skills you need to bring to the course in September.
You are expected to read through the resources and complete all activities throughout the summer.

If you have any questions, don't hesitate to get in touch. The Science Department look forward to seeing you in September!

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Course Overview

Biology is the study of living things, but not just plants and animals. You'll also learn about the molecules that make up living things, the cells that they're made from, the systems within plants and animals, and the interconnections between organisms. The difference between
Biology and the other sciences is that living things don't always do what you expect them to do! You can't test one organism and assume all the rest will be the same, so you'll also learn about the importance of statistical analysis.
There is a much greater maths demand in Biology at A level than at GCSE, so you should also use this time to ensure any weaknesses in your GCSE Maths are strengthened.

At Millom School, the awarding body we use is AQA. During the first year of A level Biology, you will study the following topics:
1 Biological molecules.
2 Cells.
3 Organisms exchange substances with their environment.
4 Genetic information, variation and relationships between organisms.

In the second year of A level Biology, you will study a further four topics, these are:
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.

This is a two year course with all external examinations taken at the end of Year 13. The exams comprise three exam papers, and each paper is two hours long. You are also required to complete a set of practical activities throughout the course and the skills, knowledge and understanding of these will be assessed within the written papers.
There is some GCSE knowledge you will need at A level, please refer to the 'GCSE to A level progression' document to see what you are expected to know, and how the A level course expands on this knowledge. This is especially important for those students who studied Combined Science at GCSE.

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Resources

The following section outlines some resources that you will find helpful during your summer work.
This list is by no means exhaustive and it is important that you begin familiarising yourself with some of this material over the summer term – the difficulty of the content covered at A-level is much greater than at GCSE.

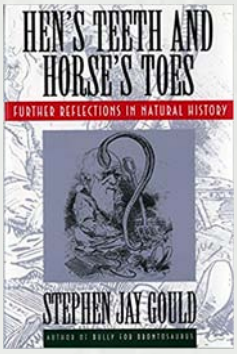
Head Start to AS Biology CGP (ISBN:9781782942795)

Textbook AQA Biology A Level Student Book (ISBN: 9780198351771)

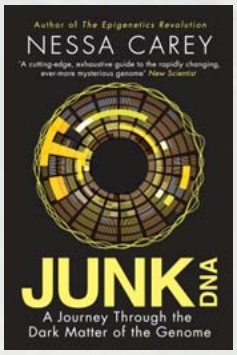
AQA specification https://www.aqa.org.uk/subjects/science/as-and-a-level/biology-7401-7402

Book Recommendations

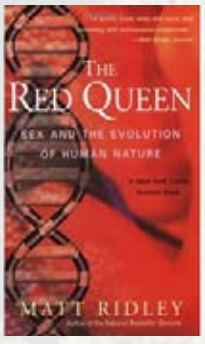
The following books are popular science books and great for extending your understanding of Biology and all are available at Amazon.



Hen's teeth and horses toes by Stephen Jay Gould - This book discusses lots of fascinating stories about Geology and evolution and makes excellent reading if you're going to study Geography as well.



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.



The Red Queen - This book will really help your understanding of evolution, particularly the fascinating role of sexual selection in evolution.

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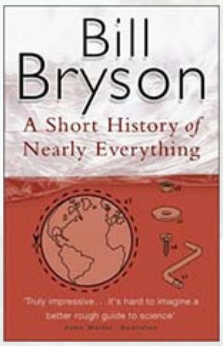
Resources

Book Recommendations



A Short History of Nearly Everything - A whistle-stop tour through many aspects of history from the Big Bang to now. This is an accessible read that will familiarise you with common concepts and introduce some of the colourful characters from the history of science.

Frankenstein's cat - Discover how glow in the dark fish are made and other Biotechnology breakthroughs.

Focus, New Scientist and Philip Allan updates are scientific magazines which are also a good place to begin your research and broaden your knowledge.

The Big Picture is another excellent publication from the Welcome Trust. Along with the magazine, the company produces posters, videos and other resources aimed at students studying for GCSEs and A level.
Some of the resources they have produced which link in to A-level Biology have been listed below:
The Cell: http://bigpictureeducation.com/cell
The Immune System: http://bigpictureeducation.com/immune
Populations: http://bigpictureeducation.com/populations
Populations: http://bigpictureeducation.com/healthand-climate-change

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Resources

Web Recommendations

The AQA website is a good place to start. Information you may find useful here: 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.
https://www.aqa.org.uk/subjects/science/as-and-a-level/biology-7401-7402

Royal Society of Biology works with everyone from government policy makers to students, as well as universities and researchers studying biology. Their website includes a dedicated student section.
https://www.rsb.org.uk/

Utah University has many resources linked to Genetics that are pitched at an appropriate level. There are also 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/

Along the same theme, at GCSE you learnt how genetic diseases are inherited. In this virtual fly lab you get to breed fruit flies to investigate how different features are passed on.
http://sciencecourseware.org/vcise/dro sophila/

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

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Resources

Revision Websites

The following websites provide useful information and revision materials aimed at A level students:
http://www.s-cool.co.uk/a-level/biology
http://biologymad.com
https://www.khanacademy.org/science/biology
https://www.senecalearning.com

You Tube

You may also find the following channels on You Tube useful for revision:
https://www.youtube.com/user/khanacademy
https://www.youtube.com/user/MrPollockBiology
https://www.youtube.com/user/AmoebaSisters
https://www.youtube.com/channel/UCqbOeHaAUXw9Il7sBVG3_bw
https://www.youtube.com/user/crashcourse

Biology practical work:
https://www.youtube.com/channel/UCmsS5FoVy56jpKMyTVM4J8g

Science communication is essential in the modern world and all the big scientific companies, researchers and institutions have their own social media accounts.

Some good science accounts to follow are:
New Scientist
Live Science
National Geographic
BBC Nature
BBC Earth
BBC Science news

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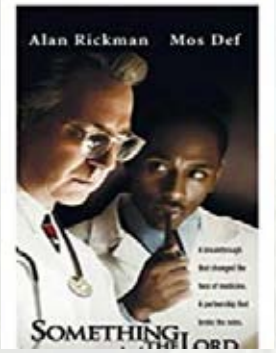
Resources

Film 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. 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.

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) 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

Not a film, but a documentary exploring the inner world of the human cellular structure via the narrative of a viral infection from within the world of a single cell. Very topical at the moment!
https://www.bbc.co.uk/iplayer/episode/b01nln7d/secret-universe-the-hidden-life-of-the-cell

There's an incredible variety of science and nature focused documentaries on BBC iPlayer and Netflix. Some series and box sets you might want to check out are: The Blue Planet, Planet Earth, The Ascent of Man, Primates, Dynasties, Frozen Planet, Life Story and The Hunt.

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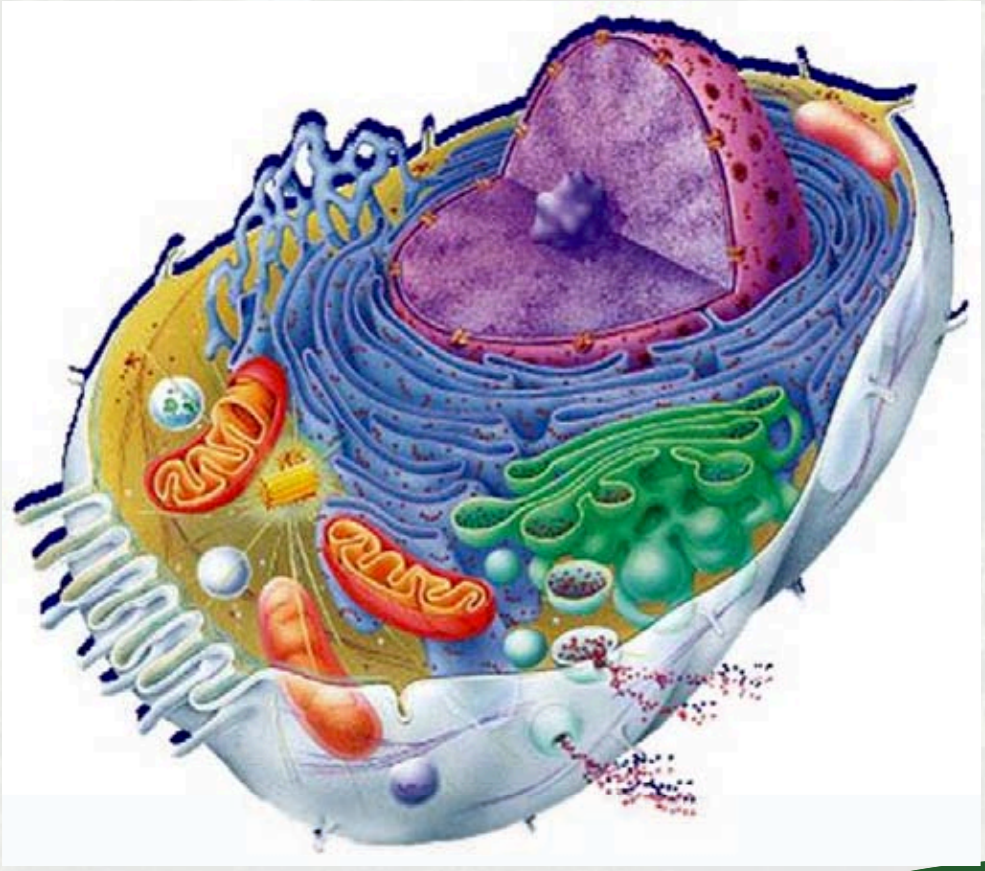
Summer Tasks

The activities on the following pages are designed to give you some practice in the core knowledge and skills you need to bring to the course in September. You are expected to complete all of these activities, and upload your completed work onto One Note.
Completion of the following tasks will ensure that you begin Year 12 in the best way possible and give yourself the best chance of success in this subject.

Task 1: Eukaryotic cells
1.At AS level you will look in much closer detail at the inner workings of cells, and how they are seen using different types of microscope. Using a biology text book (if you have one) or one of the suggested websites to label as many parts of the (a) animal (b) plant cells as you can. You should be able to add at least 10 labels.

a) Animal Cell



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Summer Tasks

b) Plant cell

c) Draw out a table for 10 cell organelles and summarise their main functions

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Summer Tasks

Task 2: Prokaryotic cells

1.Draw and fully label a diagram of a typical prokaryotic cell. (At least 5 labels)

2.Compare and contrast prokaryotic and eukaryotic cells and produce a table to show their similarities and differences.

3.Watch the following video clip: http://www.youtube.com/watch?v=gEwzDydciWc

4.Research and then describe the process of binary fission. Include a diagram.

Task 3: Microscopy
Find out the maximum magnification and resolution of the following types of microscope:
a. Light microscope
b. Scanning electron microscope
c. Transmission electron microscope

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Summer Tasks

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Type of microscope	Magnification	Resolution
Light		
Scanning electron		
Transmission electron		

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Summer Tasks

Read the Introduction to microscopy from the following website:
http://micro.magnet.fsu.edu/primer/anatomy/introduction.html

Write down 5 things you have learnt from this website:

Task 4: Movement in cells

There are a number of ways that substances may move into and out of living cells. Some of these are passive (require no energy) and others are active (require energy). Describe each of these types of cell transport, include diagrams to help your explanations, and give an example of each one:

a. Diffusion
b. Facilitated diffusion
c. Osmosis
d. Active transport

Task 5: SI units

Every measurement must have a size (e.g. 2.7) and a unit (e.g. metres or °C). Sometimes, there are different units available for the same type of measurement. E.g. ounces, pounds, kilograms and tonnes are all 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. The seven SI base units are:

Physical quantity measured	Base unit	SI abbreviation
Amount of substance	mole	mol
Length	meter	m
Mass	kilogram	kg
Time	second	s
Thermodynamic temperature	kelvin	K
Electric current	ampere	A
Luminous intensity	candela	cd

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Summer Tasks

All other units can be derived from the SI base units.
For example, area is measured in square metres (written as m^2) and speed is measured in metres per second (written as 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:

Standard form and prefixes			
Name	**Symbol**	**Scaling factor**	**Common example**
Tera	T	1012	Large computer hardrives can be terabytes in size
Giga	G	109	Computer memories are measured in gigabytes
Mega	M	106	A power station may have an output of 600MW (megawatts)
Kilo	k	103	Mass is often measured in kilograms
Deci	d	Oct 1, 2025	Fluids are sometimes measured in decilitres (i.e. 0.1 litre)
Centi	c	Oct 2, 2025	Distances are measured in centimetres
Milli	m	Oct 3, 2025	Time is sometimes measured in milliseconds
Micro	μ	Oct 6, 2025	Micrometres are often used to measure wavelengths of electromagnetic waves
Nano	n	Oct 9, 2025	Nanometres are used to measure atomic spacing
Pico	p	Oct 12, 2025	Picometres are used measure atomic radii.

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

a) The time between heart beats
b) The length of a leaf
c) The distance that a migratory bird travelled each year
d) The width of a cheek cell
e) The mass of a rabbit
f)The mass of iron in the body
g) 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.

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

a) The mass of an elephant
b) The mass of an earthworm
c) The volume of water in a teardrop
d) The volume of water in a pond
e) The time taken for a sunflower to grow
f) The temperature difference between the blood in the heart and in the ear on a cold day
g) The width of a hair
h) The length that your fingernails grow each day
i)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.

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Task 6: 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.

	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		
Energy store at the end of the process		
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.

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Summer Tasks

Task 7: Important vocabulary for practical work

Find definitions for the key terms and complete the table:

Key word	Definition
Accurate	
Data	
Precise	
Prediction	
Range	
Repeatable	
Reproducible	
Resolution	
Uncertainty	
Variable	
Control variable	
Dependent variable	

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Summer Tasks

Task 8:

Command words are the words and phrases used in exams and other assessment tasks that give information about how you should answer the question.
Using the link below, find out what the command words are for the definitions.

https://www.aqa.org.uk/resources/science/as-and-a-level/biology-7401-7402/teach/command-words

Add notion or labelling to graph or drawing:
Give an account of:
Work out the value of something:
Give reasons:
Support a case with evidence:
Specify meaning:
Set out main characteristics:
Present an informed opinion:
Present different perspectives on an issue:
Give a technical term or its equivalent:
Review and respond to given info:
Name or otherwise characterise:
Present a possible case:
Give a plausible outcome:
Provide structured evidence to reach a conclusion:
Judge from available evidence:
Separate info into components and identify characteristics:
Present a reasoned case:
Present key points:
Draw conclusions from info provided:
Express in clear terms:
Finish a task by adding to given info:

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Summer Tasks

Task 9: Analysing data

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.

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

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Task 9: Analysing data

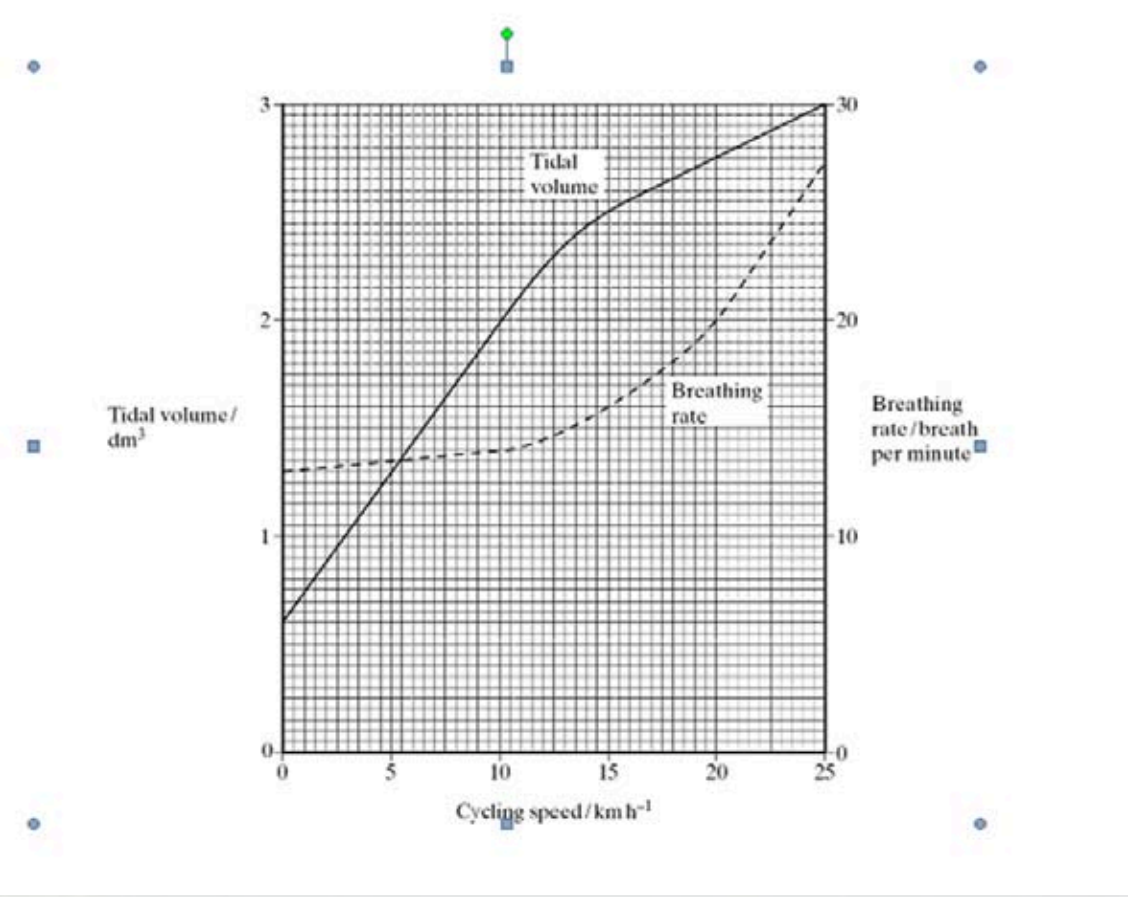
a)Of the men who died aged 35-64 from one of these three causes, what percentage of them died of lung cancer?

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

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

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

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.



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Task 9: Analysing data

a)What was the tidal volume when the cycling speed was 17 km h^{-1}?

b)What was the breathing rate when the cycling speed was 8 km h^{-1}?

c)What was the change in breathing rate when the cyclist changed from 10 to 20 km h^{-1}? Express this as a percentage.

d)At what speed did the breathing rate start to increase?

e)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}.

f)For this initial linear section, what is the equation of the tidal volume line? Hint: use y=mx + c