A Level Biology

A transition guide for Year 11 students

Transition guide: Biology

We have created this support resource to help students make the transition from GCSE to AS or A-level Biology.

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You're studying AS or A-level Biology, congratulations!

Biology is the study of living things, but not just animals and plants. You'll also learn about the molecules that make living things work, the cells that they're made from, the systems within plants and animals, and the interconnections between organisms.

Biology is different from physics and chemistry, in 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 learn about the statistical analysis behind making claims.

At first, you may find the jump in demand from GCSE a little daunting, but if you follow the tips and advice in this guide, you'll soon adapt.

We recommend you keep this somewhere safe, as you may like to refer to the information in it throughout your studies.

Why study A-level Biology?

Biology A-level will give you the skills to make connections and associations with all living things around you. Biology literally means the study of life – and if that's not important, what is? Being such a broad topic, you're bound to find a specific area of interest, plus it opens the door to a fantastic range of interesting careers.

Many people use an AS or A-level in Biology in their future studies or work. Even if you don't decide to work in biology, studying it still develops useful and transferable skills for other careers. You'll develop research, problem solving and analytical skills, alongside teamwork and communication. Universities and business regard all of these very highly.

Possible degree options

According to bestcourse4me.com, the top seven degree courses taken by students who have A-level Biology are:

- Biology
- Psychology
- Sport and exercise science
- Medicine
- Anatomy
- Physiology and pathology pharmacology
- Toxicology and pharmacy chemistry.

This list is by no means exhaustive. Biology can prove useful for a wide variety of degree courses.

For more details, go to the bestcourse4me.com, or UCAS.

Which career appeals to you?

Studying Biology at A-level or degree opens up all sorts of career opportunities, such as:

- doctor
- clinical molecular geneticist
- nature conservation officer
- pharmacologist
- research scientist
- vet
- secondary school teacher
- marine biologist
- dentist.

Specification at a glance

AS and first year of A-level

1 Biological molecules.

2 Cells.

3 Organisms exchange substances with their environment.

4 Genetic information, variation and relationships between organisms.

A-level only

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.

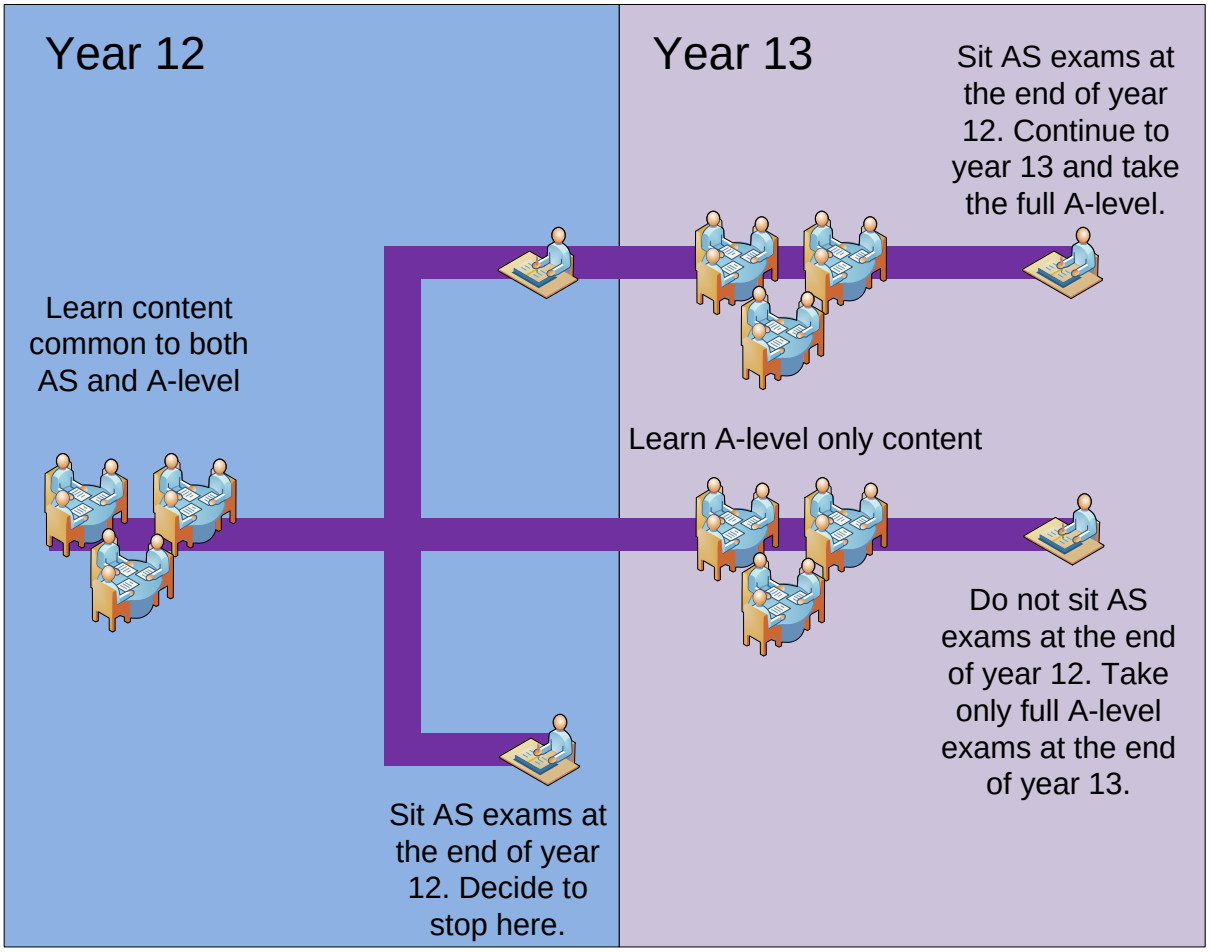
Should you study AS or A-level?

AS and A-level are separate qualifications.

An AS lasts one year. Your exam results don't count towards an A-level, but they're still valuable and AS points are accepted by higher education institutions.

Despite being separate from an A-level, AS course content is the same as the first year of A-level. If you want to switch from an AS to an A-level, you can. Your teacher will help you decide whether it's the right move for you.

All exams for the AS take place at the end of the one-year course. Exams for the A-level take place at the end of the two-year course.



The assessment for the AS consists of two exams

Paper 1	+	Paper 2
What's assessed • Any content from topics 1–4, including relevant practical skills		What's assessed • Any content from topics 1–4, including relevant practical skills
Assessed • written exam: 1 hour 30 minutes • 75 marks • 50% of AS		Assessed • written exam: 1 hour 30 minutes • 75 marks • 50% of AS
Questions • 65 marks: short answer questions • 10 marks: comprehension question		Questions • 65 marks: short answer questions • 10 marks: extended response questions

The assessment for the A-level consists of three exams

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

Places to go for help

1. Our website is a great place to start

Our 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. Some questions won't be relevant to the new AS and A-level, so please check with your teacher.
- 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're stuck with your homework. Just be very careful not to share any details about your assessments, there are serious consequences if you're caught cheating. Visit thestudentroom.co.uk

4. Textbooks

Our approved textbooks are published by Collins, Hodder and Oxford University Press. Textbooks from other publishers will also be suitable, but you'll need to double check that the content and formula symbols they use match our specification.

5. Revision guides

These are great if you want a quick overview of the course when you're revising for your exams. Remember to use other tools as well, as these aren't 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 because some videos distort the facts. Check the author, date and comments – these help indicate whether the clip is reliable. If in doubt, ask your teacher.

7. Magazines

Focus, New Scientist or Philip Allan updates can help you put the biology you're learning in context.

Useful information and activities

There are a number of activities throughout this resource. The answers to some of the activities are available on our secure website, e-AQA. Your teacher will be able to provide you with these answers.

SI units

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

The seven SI base units are:

Physical quantity	Usual quantity symbol	Unit	Abbreviation
mass	m	kilogram	kg
length	l or x	metre	m
time	t	second	s
electric current	I	ampere	A
temperature	T	kelvin	K
amount of substance	N	mole	mol
luminous intensity	(not used at A-level)	candela	cd

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:

Prefix	Symbol	Multiplication factor		
Tera	T	10^{12}	1 000 000 000 000	
Giga	G	10^{9}	1 000 000 000	
Mega	M	10^{6}	1 000 000	
kilo	k	10^{3}	1000	
deci	d	10^{-1}	0.1	1/10
centi	c	10^{-2}	0.01	1/100
milli	m	10^{-3}	0.001	1/1000
micro	μ	10^{-6}	0.000 001	1/1 000 000
nano	n	10^{-9}	0.000 000 001	1/1 000 000 000
pico	p	10^{-12}	0.000 000 000 001	1/1 000 000 000 000
femto	f	10^{-15}	0.000 000 000 000 001	1/1 000 000 000 000 000

Activity 1

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

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.

Activity 2

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

Activity 3

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.

Important vocabulary for practical work

You will have come across most of the words used in practical work in your GCSE studies. It is important that you use the right definition for each word.

Activity 4

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.

Cells

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

Activity 5

Complete the table.

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

Draw the structure of a plant cell and an animal cell.

On each cell, add labels showing each of the structures in the table, if they exist.

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.

Activity 6

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.

Principles of moving across boundaries

In biology, many processes involve moving substances across boundaries.

Activity 7

Match the examples to the principle(s) involved. For each, give a brief description of why it is relevant.

Osmosis

Diffusion

Active transport

Changing surface area or length

Examples

Drinking a sports drink after exercise

Gas exchange in the lungs

Absorbing nutrients from food into the body

Moving ions into cells

The effect of salt on slugs

Penguins huddling together to keep warm

Potato pieces get heavier when put in pure water

Potato pieces get lighter when put in very salty water

Cacti do not have thin, large leaves

Genetic inheritance

Activity 8

Huntington's disease is an example of a disease where the mutation causing the disease is dominant.

h: normal (recessive)

H: mutation (dominant)

		Paternal alleles	
		H	h
Maternal alleles	h		
	h		

Cystic fibrosis is an example of a disease where the mutation causing the disease is recessive.

F: normal (recessive)

f: mutation (dominant)

		Paternal alleles	
		F	f
Maternal alleles	F		
	f		

For each of the Punnett squares:

1. Complete the diagrams to show the alleles for each child.
2. State which parent and child is:
    - healthy
    - has the disease
    - a carrier.

Activity 8 (continued)

Each of the following statements is false. Re-write each one so that it becomes true.

1. The first Punnett square shows that one in every four children from this couple will have Huntington's disease.

2. The second Punnett square shows that there is a one in three chance that a child born to this couple will have cystic fibrosis.

3. All children of the second couple will either be carriers or suffer from cystic fibrosis.

4. The percentage of children who are sufferers on the diagram is the same as the percentage of children each couple will have who are sufferers.

5. Having one child who is born with cystic fibrosis means that the next three children will not have the disease.

6. A 50:50 chance is the same as a 0.25 probability.

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.

Activity 9: Mean, media, mode and scatter graphs

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

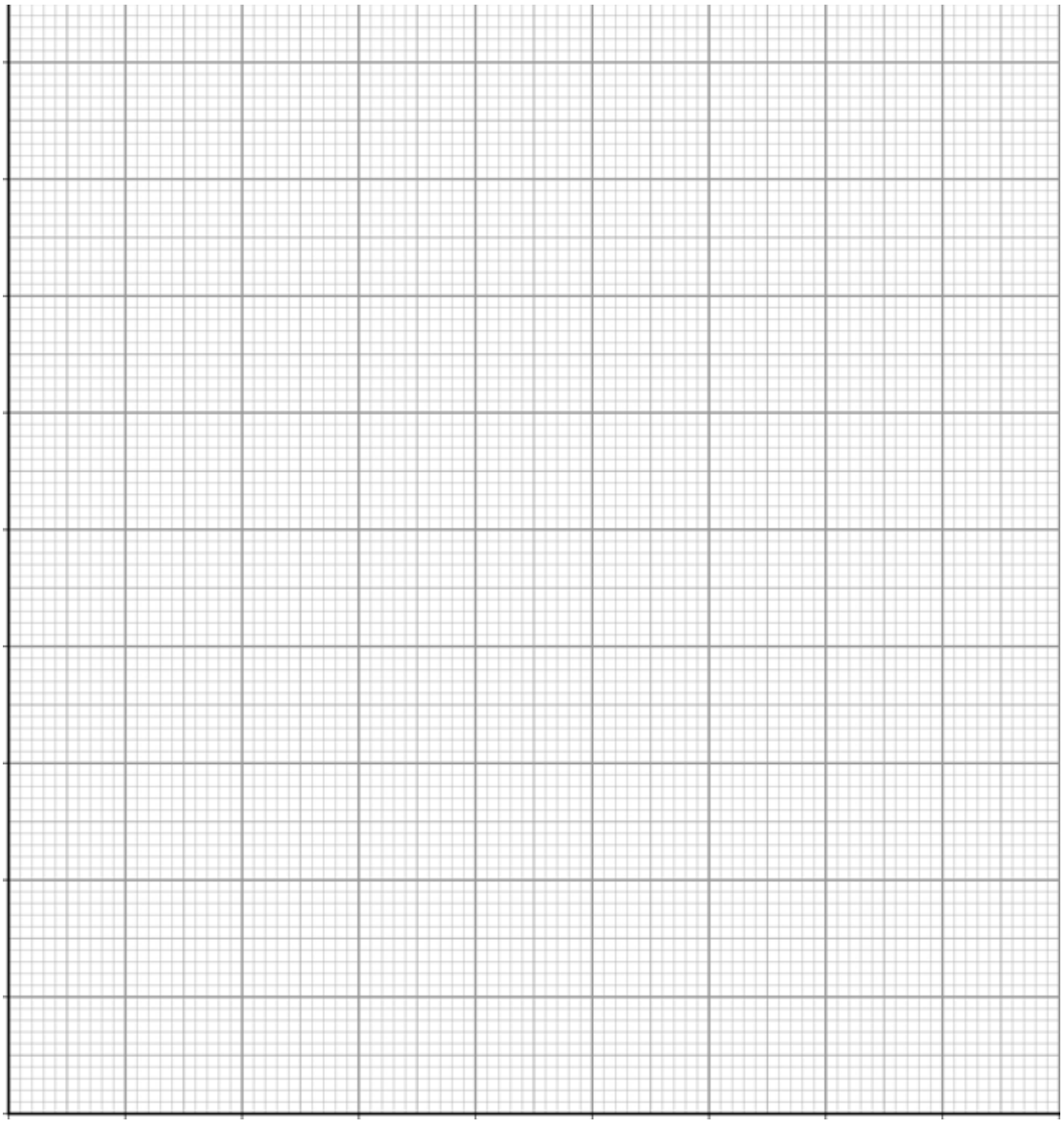
– indicates zero cover.

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.

Activity 9: Mean, media, mode and scatter graphs (continued)

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).



Activity 9: Mean, media, mode and scatter graphs (continued)

4. What conclusions does your graph suggest?

5. How confident are you in these conclusions?

Activity 10: Analysing tables

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

Activity 10: Analysing tables (continued)

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

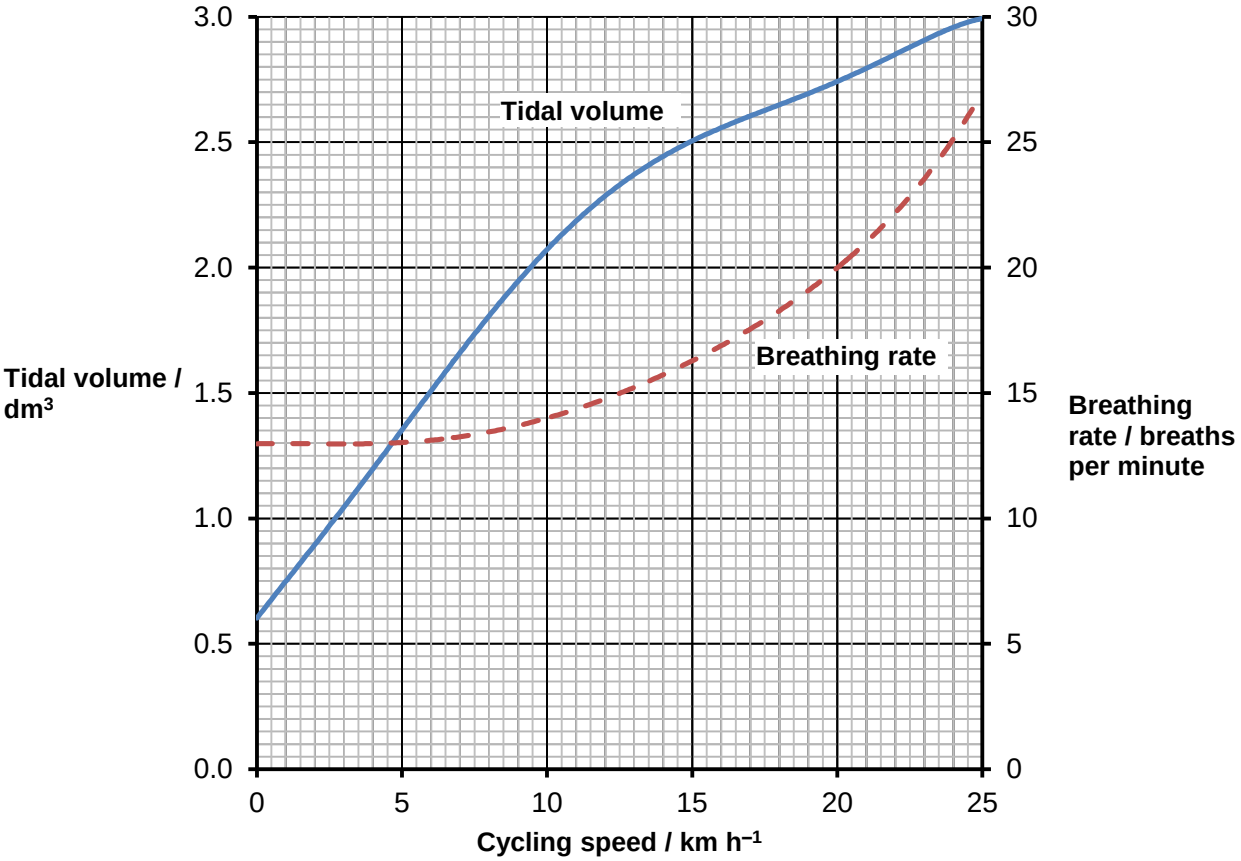
2. What percentage of deaths from chronic bronchitis in women happened to women aged 65-74?

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?

Activity 11: 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 pedaling 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 $y=mx + c$