BBC BITESIZE

Hello. I'm Dr Alex Lathbridge and this is Bitesize Biology.

This series is a little bit different, it's all about exam techniques; tips, tricks and advice to help you pass your exam.

Today, we're talking mathematics: what sort of maths questions might appear in your exams, how to answer them, and, crucially, how to not panic.

At least 10% of the questions in your exam, that's one in ten, are going to test maths skills, which might seem weird because this is biology, not maths.

But, when scientists run an experiment, we need to look at the data and find out what it might be telling us, and to do that, we need maths.

First things first, make sure that you bring the right equipment into the exam, don't be like me, be prepared. Make sure you've got your calculator, your ruler and a pencil.

Take it slowly. Read the question once, then read it again. Then read it a third time.

Always show your working out when it comes to maths. Because even if it's an easy calculation you can do in your head, you could get a mark for doing the right working out method, even if you somehow come up with the wrong answer, so it's a no brainer. Just show your working out.

And just like you should read the question twice, double check your answer once you've written it down, do you get the same answer when you calculate it again? And if so, does your answer match the question. Are you using the correct units?

Units are important. Scientists use units to demonstrate how things are measured. We use the metric system, things like metres, grams and seconds.

Let's talk about converting units, for example:

We've got length, which is measured in metres

Mass is measured in kilograms

Time is measured in seconds

Temperature is measured in degrees Celcius

And energy is measured in joules

To convert between different units, it's really simple.

You just need to multiply or divide by the right factor of ten (so 10, 100 or 1000 etc).

So, if we look at mass measurements to begin with, to convert grams into kilograms, you divide by 1000, and to convert grams into milligrams you multiply by 1000.

For measurements of distance, to convert metres into kilometres you divide by 1000, to convert metres in centimetres you multiply by 100.

And to convert centimetres into millimetres you multiply by 10.

There are 10 millimetres in a centimetre, 100 centrimetres in a metre, and 1000 metres in a kilometre.

If you are given a question with two different units in it, make sure that you do a conversion so that both measurements have the same unit before doing your calculation.

So, if you've got something in grams, and something in kilograms, make sure they're both in grams, or both in kilograms.

It's also very possible you might come across questions asking you to convert microscope units.

The units used in microscope work are really tiny and they are known as micrometres and nanometres.

There are 1000 micrometres in a millimetre, so to convert micrometres into millimetres you divide them by 1000.

So, 2000 micrometres , divided by 1000, equals 2 millimeters.

Micrometres have that funny looking unit symbol that looks like a letter "u" with a little tail on the side.

Nanometres are even smaller. There are 1000 nanometres in a micrometre. So to convert nanometres to micrometres, you divide nanometres by 1000.

Speaking of microscopes, you're going to need to know how to calculate magnification.

Magnification is how much bigger the image under the microscope is than the real object that you are looking at.

There is a formula you'll need to remember for your exam:

Magnification = image size divided by the real size

You might be asked to instead find the image size or the real size, so you'll need to rearrange the

equation in order to get your answer.

Here's a really good tip: always look at the units given in the answer area on your exam paper. This is telling you what units you need your answer to be in, or what you need to convert everything to.

There are some other equations for biology, that you're going to need to remember and be able to manipulate.

Let's start with BMI, Body Mass Index.

This is: mass in kilograms, divided by the height in metres, but you square the height.

Let's say we want the BMI of someone who is 80kg and is 1.8 metres tall.

You would say 80kg divided by 1.8 metres squared, which is 3.24m. So, 80 divided by 3.24m, gets you a BMI of 24.7.

Just remember to square the height.

Cardiac output is the amount of blood pumped from the heart every minute.

It is calculated by multiplying the heart rate by the stroke volume.

Stroke volume is the volume of blood pumped out by each heartbeat. You're literally measuring the impact of each heartbeat.

Cardiac output = heart rate x stroke volume.

And remember things like area and volume because they're important

Area = height x width

Volume = height x width x depth

The volume of a cylinder is a little bit tricky. It's the radius squared multiplied by "pi", multiplied by the height of the cylinder.

Take a look on the BBC Bitesize website because you'll get to see some formula triangles, and they're good because they help you remember how to rearrange equations in your exam.

Percentages are just one way of expressing numbers that are part of a whole. These numbers can also be written as fractions or decimals.

50% can also be written as a fraction, 50/100 or 1/2, or a decimal, 0.5. They are all the same amount.

We might get asked to calculate the percentage amount of something as a percentage total of something else. That sounds complicated, but it's really simple.

We do this by dividing the first value by the second value and multiplying that answer by 100.

For example, a question might be:

23 students out of 30 passed their exam. What percentage of the class is this?

23 divided by 30, multiplied by 100 = 77%

You might be asked to calculate a percentage change.

An example of this might be where a plant has grown during a study and the scientists want to find out by what percentage the plant has grown from its original amount.

The way to do this is by first taking away the original (or starting) amount from the final amount.

And then dividing that figure by the original value and multiplying by 100.

Let's say a plant started being 6cm tall and then by the end of the study, it grew to 9cm.

To work out the percentage change you just do: 9cm (the final value) minus 6cm (the starting value) and that's 3cm

3cm (the change) divided by (the starting value) 6cm is 0.5cm

0.5 multiplied by 100 = 50, so we can say that it's grown by 50%.

Let's calculate some averages: mean, mode, median and range.

To calculate the mean number of a dataset, you add up all the values, and then divide that total by the number of values that you have.

12 + 10 + 8 = 30, I've got three values there, so 30 / 3 = 10

To find the mode, here's where you're looking for the most common value, so find the number that appears most often in the dataset.

The median is the middle value in an ordered dataset. In order to find the median, put the values in a dataset in numerical order, and the one that is in the middle of your list is the median.

The range is how spread out the data is. To calculate the range, you need to find your dataset's largest number and smallest number and subtract the smallest number from the largest. That is your range.

I know maths can be a little bit intimidating, especially if you encounter it out of the blue, in an exam where you've been talking about plants and animals and cells. But it is fundamental to doing great science.

The best thing you can do is pack your calculator, make sure that it works, remember your ruler and your pencil. Maybe three pencils.

Read the question twice and double check your answers. Listen to this episode a few times and check out the Bitesize pages for more info.

Maths is a lot easier when you see it written down.

I'm Dr Alex Lathbridge and this is Bitesize Biology. All episodes available now on BBC Sounds