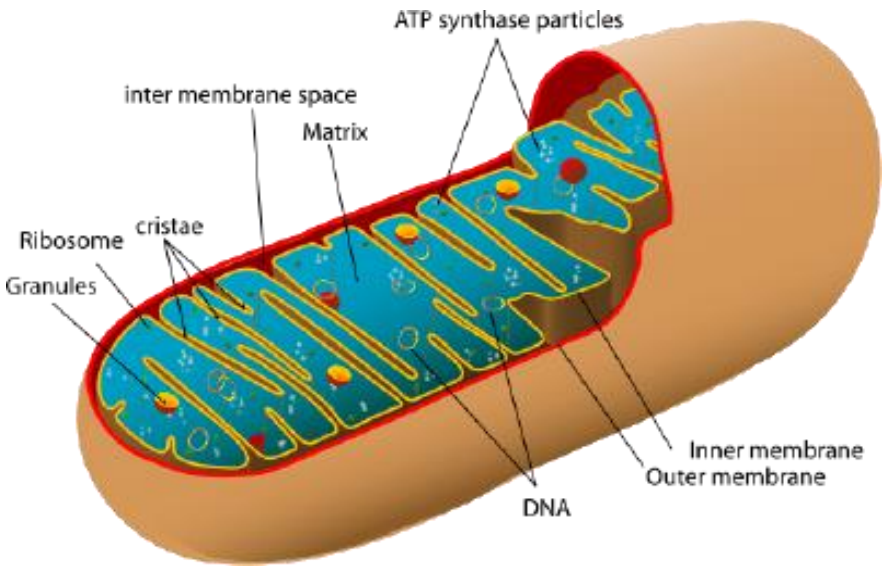
How to use this booklet

This booklet includes an introduction to the subject and any initial questions you may have about the course, such the content studied, the previous content needed, the university courses or careers the A-Level would lead to etc.

It also includes information about films, books and documentaries you could watch that would enhance and deepen your knowledge around the subject in the wider world.

Most importantly, each week there are three tasks set. Each week there will be at least one task that reviews some content or skills that is essential from GCSE which you should complete

A level Biology transition pack



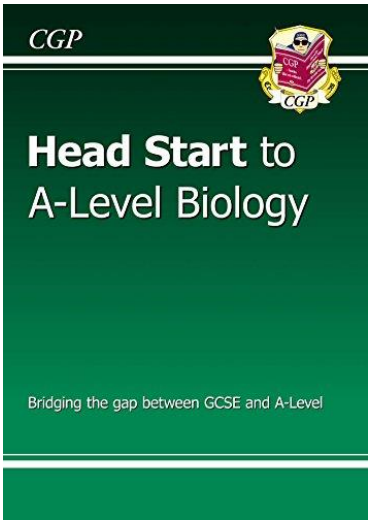
Name:

Oxford A Level Sciences
OCR A Biology

OCR
Oxford Cambridge and RSA

Book Recommendations

Kick back this summer with a good read. The books below are all popular science books and great for extending your understanding of Biology



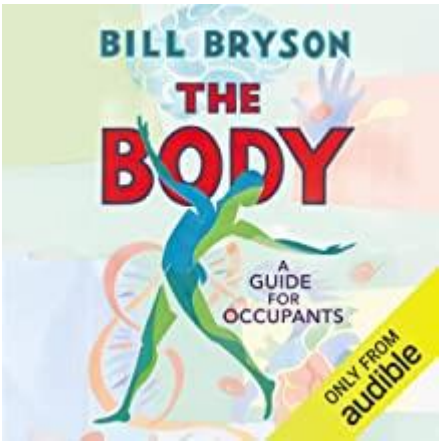
Almost essential

AVAILABLE FREE ON AMAZON KINDLE! Just download the app on your phone

Paperback £4.95
This would be very useful prereading and support for the booklet, bridging the gap between some of the GCSE and A-Level topics.

A must have!

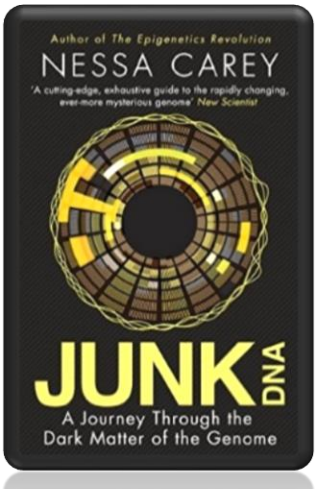
You should try and read and answer the questions on these pages as you go along!



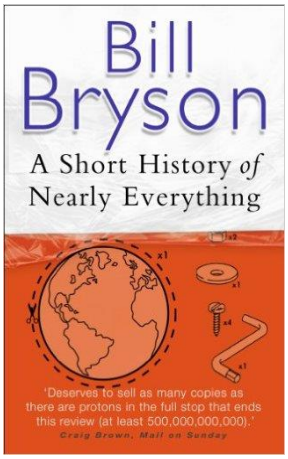
The Body: A Guide for Occupants

Whether this is a read or a listen (I have it on audio), this is something ever Biology student should be familiar with.

'We spend our whole lives in one body and yet most of us have practically no idea how it works and what goes on inside it. The idea of the book is simply to try to understand the extraordinary contraption that is us.'



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. Available at amazon.co.uk

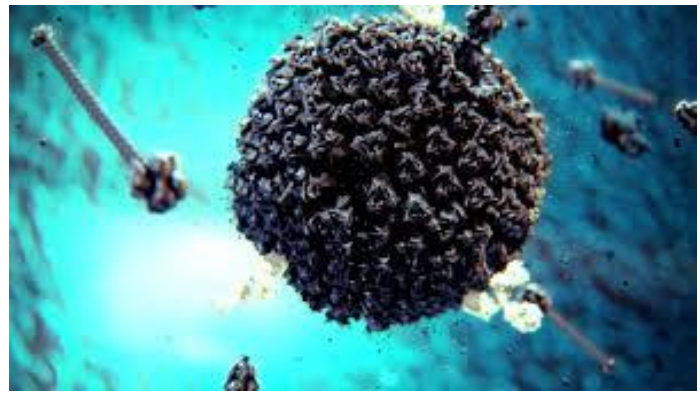


A Short History of Nearly Everything
A whistle-stop tour through many aspects of history from the Big Bang to now. This is a really accessible read that will re-familiarise you with common concepts and introduce you to some of the more colourful characters from the history of science! Available at amazon.co.uk

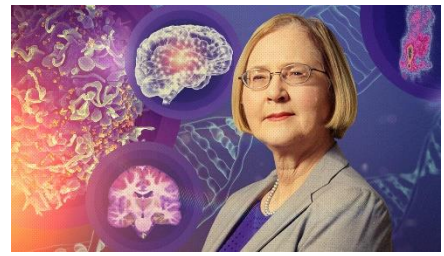
Movie Recommendations

If you have 30 minutes to spare, here are some great presentations (and free!) from world leading scientists and researchers on a variety of topics. They provide some interesting answers and ask some thought-provoking questions. Use the link.

The hidden life of the cell
https://www.bbc.co.uk/iplayer/episode/b01nln7d/secret-universe-the-hidden-life-of-the-cell
There is a battle playing out inside your body right now. It started billions of years ago and it is still being fought in every one of us every minute of every day. It is the story of a viral infection, the battle for the cell.



A New Superweapon in the Fight Against Cancer
Available at :
http://www.ted.com/talks/paula_hammond_a_new_superweapon_in_the_fight_against_cancer?language=en
Cancer is a very clever, adaptable disease. To defeat it, says medical researcher and educator Paula Hammond, we need a new and powerful mode of attack.



The science of cells that never get old
Available at :
https://www.ted.com/talks/elizabeth_blackburn_the_science_of_cells_that_never_get_old?language=en
What makes our bodies age ... our skin wrinkle, our hair turn white, our immune systems weaken? Biologist Elizabeth Blackburn shares a Nobel Prize for her work finding out the answer,

Why Doctors Don't Know About the Drugs They Prescribe
Available at :
http://www.ted.com/talks/ben_goldacre_what_doctors_don_t_know_about_the_drugs_they_prescribe?language=en
When a new drug gets tested, the results of the trials should be published for the rest of the medical world — except much of the time, negative or inconclusive findings go unreported, leaving doctors and researchers in the dark.

Growing New Organs
Available at :
http://www.ted.com/talks/anthony_atala_growing_organs_engineering_tissue?language=en
Anthony Atalla's state-of-the-art lab grows human organs — from muscles to blood vessels to bladders, and more.

How CRISPR lets us edit our DNA
https://www.ted.com/talks/jennifer_doudna_how_crispr_lets_us_edit_our_dna
Geneticist Jennifer Doudna co-invented a groundbreaking new technology for editing genes, called CRISPR-Cas9. The tool allows scientists to make precise edits to DNA strands, which could lead to treatments for genetic diseases ... but could also be used to create so-called "designer babies." Doudna reviews how CRISPR-Cas9 works -- and asks the scientific community to pause and discuss the ethics of this new tool.

Pre-Knowledge Topics

A level Biology will use your knowledge from GCSE and build on this to help you understand new and more demanding ideas. Complete the following tasks to make sure your knowledge is up to date and you are ready to start studying.

If you have any queries or questions about the course or the work set, please do not hesitate to contact me

Any other activities you have completed please feel free to scan in or take a photo and send them to me via email.

Course outline

2a. Overview of A Level in Biology A (H420)

Learners must complete all components (01, 02, 03 and 04) to be awarded the OCR A Level in Biology A.

Content Overview	Assessment Overview	
Content is split into six teaching modules: • Module 1 – Development of practical skills in biology • Module 2 – Foundations in biology • Module 3 – Exchange and transport • Module 4 – Biodiversity, evolution and disease • Module 5 – Communication, homeostasis and energy • Module 6 – Genetics, evolution and ecosystems Component 01 assesses content from modules 1, 2, 3 and 5. Component 02 assesses content from modules 1, 2, 4 and 6. Component 03 assesses content from all modules (1 to 6).	Biological processes (01) 100 marks 2 hour 15 minutes written paper	**37%** of total A level
	Biological diversity (02) 100 marks 2 hour 15 minutes written paper	**37%** of total A level
	Unified biology (03) 70 marks 1 hour 30 minutes written paper	**26%** of total A level
	Practical Endorsement in biology (04) (non exam assessment)	**Reported separately** (see section 5f)

Week 1

Behind the headlines

"Eat a big breakfast to lose weight fast – you'll 'burn twice as many calories'," reports The Sun.

The advice to eat more at breakfast than at dinner has long been proposed to help people trying to lose weight. The idea is that calories consumed at the start of the day are more likely to be burned off than those consumed in the evening.

German researchers say they found that people do burn off more calories after breakfast than dinner. They also feel less hungry in the afternoon and evening if they have a bigger breakfast.
However, their study included just 16 people, who were all healthy young men. None of the participants were trying to lose weight and the study did not measure weight loss.

We do not know whether eating a big breakfast every day would lead to weight loss in real-world conditions, or whether the results are relevant to women or people who have health complications due to being overweight or obese. The study was also just a 3-day laboratory experiment in which men ate only set meals provided and did no physical exercise.

However, other studies have suggested that eating a healthy breakfast may help people to eat less during the rest of the day. This could help people stick to a weight loss diet, rather than skipping breakfast and eating more later because they are hungry.

Task 1:

1. Click both images and read the Sun article and then the journal article.
2. What kind of research was this?
3. What did the research involve?
4. What were the basic results?
5. How did the researchers interpret the results
6. What were their conclusions?
7. How did the sun article overstate the results?

Task 2 Maths Skills 1

Oxford A Level Sciences

OCR A Biology

GCSE → A Level transition
Student sheet

Basic components of living systems

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 (m^2), cubic metre (m^3), 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

Practice questions

1 A burger contains 4 500 000 J of energy. Write this in:

a kilojoules

b megajoules.

2 HIV is a virus with a diameter of between 9.0×10^{-8} m and 1.20×10^{-7} m. Write this range in nanometres.

1.2 Powers and indices

Ten squared = 10 × 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.

Practice questions

3 Calculate the following values. Give your answers using indices.

a $10^8 \times 10^3$ **b** $10^7 \times 10^2 \times 10^3$

c $10^3 + 10^3$ **d** $10^2 - 10^{-2}$

4 Calculate the following values. Give your answers with and without using indices.

a $10^5 \div 10^4$ **b** $10^3 \div 10^6$

c $10^2 \div 10^{-4}$ **d** $100^2 \div 10^2$

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.

$488\,889 \div 10^3 = 488.889$ 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 would 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

Practice question

5 Calculate the following conversions:

a 0.004 m into mm

b 130 000 ms into s

c 31.3 ml into µl

d 104 ng into mg

6 Give the following values in a different unit so they make more sense to the reader.

Choose the final units yourself. (Hint: make the final number as close in magnitude to zero as you can. For example, you would convert 1000 m into 1 km.)

a 0.000 057 m

b 8 600 000 µl

c 68 000 ms

d 0.009 cm

Task 3: Bad science

Health Secretary, Matt Hancock, gets muddled between microbes and antibodies:

- https://twitter.com/i/status/1245985613100257280

Can you explain what the Health Secretary has got muddled in his statement? Could you write to him below and explain the difference between antibodies and microbes?

Week 2

Behind the headlines

Mail Online health

'Obesity is a brain disease': Western diet of sweet fatty junk food 'makes you forget to stop eating - even when you're full'

- After eating enough, our pleasant memories of food are meant to fade
- But a new study has found diets high in sugar and fat stop that process
- Participants in the study who eat healthier diets showed more restraint

By MIA DE GRAAF FOR DAILYMAIL.COM
PUBLISHED: 20:06, 12 July 2016 | **UPDATED:** 21:17, 12 July 2016

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Research articles

Hippocampal-dependent appetitive control is impaired by experimental exposure to a Western-style diet

Richard J. Stevenson, Heather M. Francis, Tuki Attuquayefio, Dolly Gupta, Martin R. Yeomans, Megan J. Oaten and Terry Davidson

Published: 19 February 2020 | https://doi.org/10.1098/rsos.191338

"Researchers find a western-style diet can impair brain function," reports The Guardian.
An experiment on 110 students at an Australian university found that those asked to eat Belgian waffles and fast food performed worse on learning and memory tests after a week than those who ate their regular diet.

The students eating fast food were also more likely to want to eat sugary breakfast cereal immediately after eating a full breakfast, than they were before they began the week-long experiment.

The researchers say both outcomes may be a result of changes to the hippocampus (a region of the brain associated with memory). They say the hippocampus usually suppresses memories of how good food tastes when we become full, so we do not eat more than we need.

However, the researchers consider that eating a western-style diet may impair the ability of the hippocampus to do this job. That would mean people continue to crave tasty food even when they're not hungry. This might explain why it's difficult for people who often eat fast food to resist the temptation to eat fatty or sugary foods. But it's still only a hypothesis.

Task 1:

1. Click both images and read the Mail Online and then the journal article.
2. What kind of research was this?
3. What did the research involve?
4. What was the 'western-style' diet?
5. What did the control group eat for breakfast
6. What were the basic results?
7. How did the researchers interpret the results
8. What were their conclusions?
9. How did the Mail overstate the certainty of the results

Task 2: Maths Skills 2

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.

Practice questions

1 New antibiotics are being tested. A student calculates the area of clear zones in Petri dishes in which the antibiotics have been used. List these in order from smallest to largest.

$0.0214\ cm^2$ $0.03\ cm^2$ $0.0218\ cm^2$ $0.034\ cm^2$

2 A student measures the heights of a number of different plants. List these in order from smallest to largest.

22.003 cm 22.25 cm 12.901 cm 12.03 cm 22 cm

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 worked 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:

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}.

Practice questions

3 Change the following values to standard form.

a 3060 kJ **b** 140 000 kg **c** 0.000 18 m **d** 0.000 004 m

4 Give the following numbers in standard form.

a 100 **b** 10 000 **c** 0.01 **d** 21 000 000

5 Give the following as decimals.

a 10^6 **b** 4.7×10^9 **c** 1.2×10^{12} **d** 7.96×10^{-4}

2.3 Significant figures

When you use a calculator to work out a numerical answer, you know that this often results in a large number of 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 (3 s.f.):

7.88 25.4 741

Bigger and smaller numbers with 3 significant figures:

0.000 147 0.0147 0.245 39 400 96 200 000 (notice that the zeros before the figures and after the figures are *not* significant – they just show you how large the number is by the position of the decimal point).

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.

Practice question

6 Write the following numbers to **i** 2 s.f. and **ii** 3 s.f.

a 7644 g

b 27.54 m

c 4.3333 g

d 5.995×10^2 cm^3

7 The average mass of oxygen produced by an oak tree is 11800 g per year.
Give this mass in standard form and quote your answer to 2 significant figures.

Task 3:Bad science: President Trump claims that the coronavirus is ‘too brilliant’ for antibiotics to work against

Can you explain to President Trump why antibiotics won’t work on the coronavirus

Week 3

Behind the headlines


Mirror

Click here to find out how you can help us bring the nation together during the COVID crisis

CORONAVIRUS NEWS POLITICS SPORT FOOTBALL CELEBS TV FILM ROYALS WEIRD NEWS TECH MONEY TRAVEL

Ditch the Diet Coke! People who drink two glasses a day at 'higher risk of early death'

A study of over 450,000 people found regular consumers of fizzy drinks were up to 26 percent more likely to die over the next two decades

SHARE COMMENTS

By Mark Waghorn & Shivali Best
16:00, 3 SEP 2019 | UPDATED 18:57, 3 SEP 2019


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Original Investigation

September 3, 2019

Association Between Soft Drink Consumption and Mortality in 10 European Countries

Amy Mullee, PhD[1,2,3]; Dora Romaguera, PhD[4,5]; Jonathan Pearson-Stuttard, BMBCh[6,7]; et al

Author Affiliations

JAMA Intern Med. 2019;179(11):1479-1490. doi:10.1001/jamainternmed.2019.2478

"Ditch the Diet Coke! People who drink two glasses a day at 'higher risk of early death'," warns the Daily Mirror. The headline is based on a new study that looked at whether soft drink consumption was linked to poorer long-term health outcomes.

Researchers asked more than 450,000 adults (average age 51) from 10 European countries about their consumption of soft drinks. Soft drinks included sugary and artificially sweetened fizzy drinks such as cola as well as diluted cordial.

The researchers followed up the participants for an average of 16 years and found that people who drank 2 or more glasses of any type of soft drink a day were 17% more likely to have died during the study, compared to people who drank less than 1 soft drink a month.

Sugary drinks were linked to deaths from digestive diseases (such as liver disease), while artificially sweetened drinks were linked to deaths from cardiovascular diseases such as heart disease.
While the link between sugar consumption and health problems is well established, it is unclear why artificially sweetened drinks could have an adverse effect on health.

Due to the nature of the study the researchers were unable to prove that soft drinks are directly to blame for the small increased risk of death. However, the researchers say their findings add support to public health campaigns urging people to drink water instead of soft drinks. After all, tap water in the UK is safe to drink and free of calories.

Task 1:

1. Click both images and read the Mirror and then the journal article.
2. What kind of research was this?
3. What did the research involve?
4. What were the basic results?
5. How did the researchers interpret the results
6. What were their conclusions?
7. How did the Mirror overstate the strength of the evidence?

Task 2: Maths skills 3

Oxford A Level Sciences

OCR A Biology

GCSE → A Level transition
Student sheet

3 Working with formulae

It is often necessary to use a mathematical formula to calculate quantities. You may be tested on your ability to substitute numbers into formulae or to rearrange formulae to find specific values.

3.1 Substituting into formulae

Think about the data you are given in the question. Write down the equation and then think about how to get the data to substitute into the equation. Look at this worked example.

A cheek cell has a 0.06 mm diameter. Under a microscope it has a diameter 12 mm. What is the magnification?

$$\text{magnification} = \text{image size (mm)} \div \text{object size (mm)} \quad \text{or} \quad M = \frac{I}{O}$$

Substitute the values and calculate the answer:

$$M = 12 \text{ mm}/0.06 \text{ mm} = 12/0.06 = 200$$

Answer: magnification = ×200 (magnification has no units)

Sometimes an equation is more complicated, and the steps need to be carried out in a certain order to succeed. A general principle applies here, usually known by the mnemonic BIDMAS. This stands for **B**rackets, **I**ndices (functions such as squaring or powers), **D**ivision, **M**ultiplication, **A**ddition, **S**ubtraction.

Practice questions

1 Calculate the magnification of a hair that has a width of 6.6 mm on a photograph. The hair is 165 μm wide.

2 Estimate the area of a leaf by treating it as a triangle with base 2 cm and height 9 cm.

3 Estimate the area of a cell by treating it as a circle with a diameter of 0.7 μm. Give your answer in μm^2.

4 An *Amoeba* population starts with 24 cells. Calculate how many *Amoeba* cells would be present in the culture after 7 days if each cell divides once every 20 hours. Use the equation $N_t = N_0 \times 2^n$ where N_t = number after time t, N_0 = initial population, n = number of divisions in the given time t.

5 In a quadrat sample, an area was found to contain 96 aphids, 4 ladybirds, 22 grasshoppers, and 3 ground beetles. Calculate the diversity of the site using the equation $D = 1 - \Sigma\left(\frac{n}{N}\right)^2$

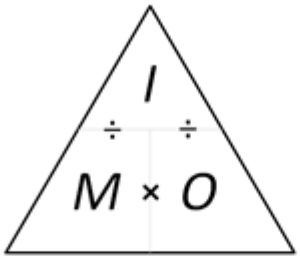
where n = number of each species, N = grand total of all species, and D = diversity.

Remember: In this equation there is a part that needs to be done several times then summed, shown by the symbol Σ.

3.2 Rearranging formulae

Sometimes you will need to rearrange an equation to calculate the answer to a question. For example, the relationship between magnification, image size, and actual size of specimens in micrographs usually uses the equation $M = \frac{I}{O}$, where M is magnification, I is size of the image, and O = actual size of the object.

You can use the algebra you have learnt in Maths to rearrange equations, or you can use a triangle like the one shown.



Cover the quantity you want to find. This leaves you with either a fraction or a multiplication:

$M = I \div O$ $O = I \div M$ $I = M \times O$

Practice questions

6 A fat cell is 0.1 mm in diameter. Calculate the size of the diameter seen through a microscope with a magnification of ×50.

7 A Petri dish shows a circular colony of bacteria with a cross-sectional area of 5.3 cm^2. Calculate the radius of this area.

8 In a photograph, a red blood cell is 14.5 mm in diameter. The magnification stated on the image is ×2000. Calculate the real diameter of the red blood cell.

9 Rearrange the equation $34 = 2a/135 \times 100$ and find the value of a.

10 The cardiac output of a patient was found to be 2.5 $dm^3\,min^{-1}$ and their heart rate was 77 bpm. Calculate the stroke volume of the patient.
Use the equation: cardiac output = stroke volume × heart rate.

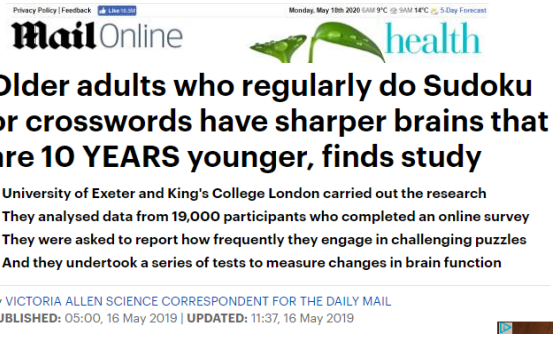
11 In a food chain, efficiency = $\frac{\text{biomass transferred}}{\text{biomass taken in}} \times 100$
A farmer fed 25 kg of grain to his chicken. The chicken gained weight with an efficiency of 0.84. Calculate the weight gained by the chicken.

Task 3:Bad science: President Trump claims that injecting people with disinfectant could treat coronavirus

Can you explain the difference between an antibiotic and a disinfectant, why using a injecting a disinfectant is dangerous and why antibiotics won't work on the coronavirus .

Week 4

Behind the headlines



Privacy Policy | Feedback Like 18.3M Monday, May 18th 2020 6AM 9°C 9AM 14°C 5-Day Forecast

Mail Online health

Older adults who regularly do Sudoku or crosswords have sharper brains that are 10 YEARS younger, finds study

- University of Exeter and King's College London carried out the research
- They analysed data from 19,000 participants who completed an online survey
- They were asked to report how frequently they engage in challenging puzzles
- And they undertook a series of tests to measure changes in brain function

By VICTORIA ALLEN SCIENCE CORRESPONDENT FOR THE DAILY MAIL
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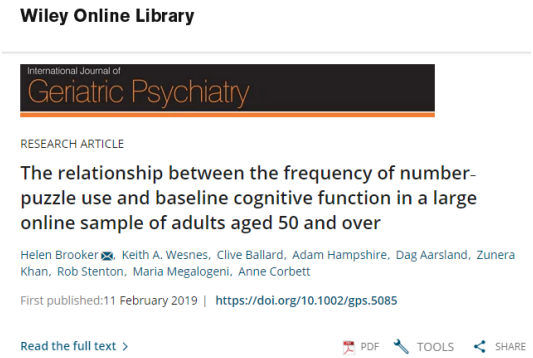

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International Journal of Geriatric Psychiatry

RESEARCH ARTICLE

The relationship between the frequency of number-puzzle use and baseline cognitive function in a large online sample of adults aged 50 and over

Helen Brooker, Keith A. Wesnes, Clive Ballard, Adam Hampshire, Dag Aarsland, Zunera Khan, Rob Stenton, Maria Megalogeni, Anne Corbett

First published:11 February 2019 | https://doi.org/10.1002/gps.5085

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"Older adults who regularly do Sudoku or crosswords have sharper brains that are 10 YEARS younger," reports the Mail Online.
In 2 linked studies, researchers asked people aged 50 to 93 to fill in online surveys, which included questions about whether they regularly did number puzzles (like Sudoku) or word puzzles (such as crosswords).
People also did online tests designed to test their thinking and memory (known as cognitive abilities).
The researchers found that people who said they did puzzles regularly did better on the tests of cognitive ability. The researchers are quoted in the Daily Telegraph saying this suggests that regularly doing word and number puzzles helps keep our brains working better for longer.

Task 1:

1. Click both images and read the Mail Online and then the journal article.
2. What kind of research was this?
3. What did the research involve?
4. What were the basic results?
5. How did the researchers interpret the results
6. What were their conclusions?

Task 2: Tertiary Protein Structure and 3-Dimensional Shape

Read the article carefully and then answer the questions which follow.

Proteins are the most complex and varied of the molecules that living organisms are made of and this allows them to have a huge variety of functions. They are **polymers** – long molecules made of repeated small molecules, but the reason they are so varied in structure, shape and function is that they are polymers made up from not just 1 repeated small molecule but any one of 20 **amino acids**, arranged in any order. In contrast, starch is polymer made of repeated glucose molecules and it has just 1 function, to act as an insoluble store of carbohydrate in plant cells.

Each of the 20 amino acids is slightly different, so whilst they are similar enough to join to any neighbouring amino acid in the protein, they have slightly different chemical properties and can make slightly different chemical bonds within the protein. So a long chain of amino acids (a protein) will have hundreds of these chemical bonds holding it in a precise 3 dimensional shape called its **tertiary structure**.

The order of amino acids in the protein is coded by the DNA sequence of a **gene** (the order of A, C, G and T) in the nucleus of the cell. So if a mutation occurs in a gene, a different amino acid will be coded for, a slightly different pattern of chemical bonds occurs in the protein, and the 3 dimensional shape of the protein is slightly different too.

In enzymes, this idea of tertiary structure and 3 dimensional shape is familiar to you. Each type of enzyme has an **active site** that is just the right shape to bind to its **substrate** and catalyse a reaction – the active site is a **complementary** shape to the substrate. This is why the enzyme maltase can digest the sugar called maltose but it can't digest the sugar called lactose.

People with the condition **haemophilia** have problems with their blood clotting process. It is caused by a mutated gene for an enzyme called factor VIII. Factor VIII is involved in converting prothrombin to thrombin to cause blood clotting. The faulty factor VIII enzyme is not able to catalyse this reaction.

You should remember that in the immune response, **antibodies** can attach to just 1 type of **antigen** so antibodies that help give immunity against measles do not work against 'flu. Antibodies are proteins with a particular order of amino acids and so a precise tertiary structure and 3-dimensional shape. Part of each antibody is called the **antigen binding site** and this has a 3 dimensional shape that is complementary to the shape of the antigen. Each type of antibody has a slightly different order of amino acids and so a slightly different shaped antigen binding site that is complementary in shape to a different antigen.

Haemoglobin is a large protein found in red blood cells that allows them to carry oxygen from the alveoli or gills to the other tissues of the body. These tissues use the oxygen for aerobic respiration. Some mammals need haemoglobin that binds very tightly to oxygen – if they live in places where there is not much oxygen in the environment; other mammals need haemoglobin that releases its oxygen more easily – if they have a very high rate of respiration. So the haemoglobin protein of each mammal is slightly different, having a slightly different order of amino acids and so a slightly different tertiary structure. This is what gives the different types of haemoglobin their different properties.

1. Give the names of 4 different proteins mentioned in the article and briefly explain their function.

i.

ii.

iii.

iv.

2. Explain why proteins are described as polymers.

3. Why is it significant that there are 20 different amino acids?

4. What is meant by the 'tertiary structure' of a protein?

5. Why does an enzyme bind to only one substrate and catalyse only one reaction?

6. Using this idea, why does a mutation to the gene for factor VIII cause non-functional factor VIII to be produced?

7. Explain in terms of protein structure, why antibodies against one type of 'flu' virus can't give immunity to other strains of 'flu' virus.

8. Suggest 2 animals that might need haemoglobin that is especially good at binding to oxygen.

9. And 2 animals that might need haemoglobin that is better at releasing oxygen.

10. Why would the tertiary structure of a haemoglobin molecule be altered by a mutation to the haemoglobin gene?

Task 3: A Level Biology Transition Baseline Assessment

The following 40 minute test is designed to test your recall, analysis and evaluative skills and knowledge. Remember to use your exam technique: look at the command words and the number of marks each question is worth.

Answer the questions on lined paper and use the mark scheme to check your answers. You will need to take a photo of your answers and corrections and send them ´

1. a) What are the four base pairs found in DNA?

……

(2)

b) What does DNA code for?

……

(1)

c) Which organelle in a cell carries out this function?

……

(1)

2. a) What theory did Charles Darwin propose?

……

(1)

b) Why did many people not believe Darwin at the time?

……

(1)

c) Describe how fossils are formed.

……

……

……

(3)

d) The fossil record shows us that there have been some species that have formed and some that have become extinct.

i) What is meant by the term 'species'?

……

(2)

ii) Describe how a new species may arise:

……

……

……(3)

3. Ecologists regularly study habitats to measure the species present and the effect of any changes. One team of ecologists investigated the habitat shown in the picture below:

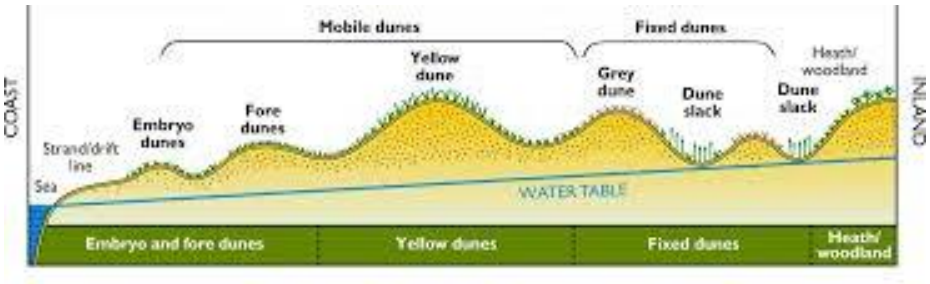

Image taken from http://www.macaulay.ac.uk/soilquality/Dune%20Succession.pdf

a) Define the following keywords:

i) Population

……

ii) Community

……

(2)

b) Give an example of one biotic factor and one abiotic factor that would be present in this habitat

Biotic: ……

Abiotic: ……

(2)

c) Describe how the ecologists would go about measuring the species present between the coast and the inland.

……

……

……

……

……

……

(6)

4. Every living organism is made of cells.

Image taken from http://prestigebux.com/worksheet/label-an-animal-cell-worksheet

a) Label the following parts of the animal cell:

2 .....

5 .....

8 .....

(3)

b) Describe how is the structure of the cell membrane related to its function?

.....

.....

.....

(3)

5. A medical research team investigated how quickly the body deals with glucose after a meal. They studied the blood glucose concentration of people who exercised versus those who did not.
Here are their results:

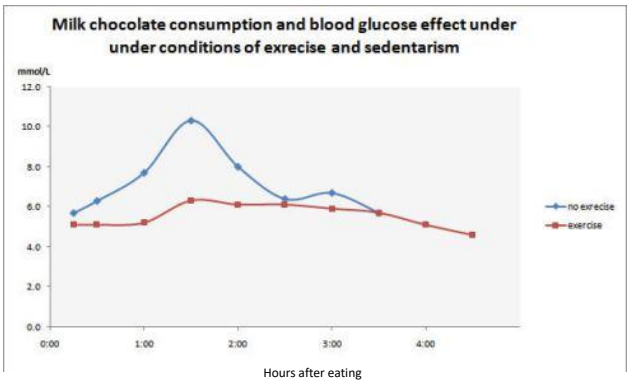

Image taken from https://memoirsofanamnesic.wordpress.com/category/blood-glucose/

a) What organ in the body regulates blood glucose concentration?

.....

(1)

b) Explain how the stages that would bring about a return to normal blood glucose concentrations.

……

……

……

……

……

(4)

c) Name one variable the researchers will have controlled.

……

……

(1)

d) The researchers made the following conclusion:

"Blood glucose returns to normal values for all people after 4 hours"

To what extent do you agree with this conclusion.

……

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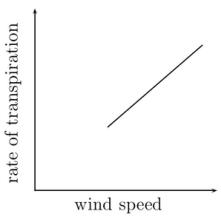
……

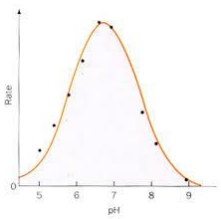
……

……

(3)

6. Scientists need to be able to interpret data in graphs to decide if there are trends in the results. For each graph bellow, describe the trend.





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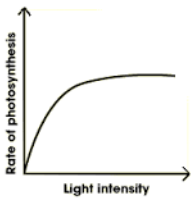

……

……(4)

Please mark your work accurately and email me your score and any questions at:
crich@hamptoncollege.org.uk

Suggested Mark Scheme:

Question			Answer	Marks
1	a		Adenine-Thymine Cytosine-Guanine	1 1
	b		Protein/enzymes	1
	c		Ribosomes	1
2	a		Evolution (by natural selection)	1
	b		Not enough evidence	1
	c		(Plant/animal dies) and is quickly buried in sediment Not all conditions for decay are present Hard parts of the body are replaced by minerals	1 1 1
	d	i	Organisms that can reproduce to produce viable offspring/offspring that can also reproduce (fertile)	1
		ii	3 from Geographical isolation/named example Mutation of genes Natural Selection/selective advantage Species can no longer interbreed (not produce fertile offspring)	 1 1 1 1
3	a	i	A group of organisms, all of the same species, and all of whom live together in a particular habitat.	1
		ii	The total of all populations living together in a particular habitat.	1
	b		Biotic – one from: Predators, prey, plant, microbes Abiotic – one from: Availability of water, temperature, mineral concentration, reference to climate/weather	 1 1
	c		Measure out a transect Using a tape measure Use a quadrat At regular (named) intervals Identify species present Using a key/guide	1 1 1 1 1 1
4	A		2 Nucleolus 5 Smooth Endoplasmic Reticulum 8 Golgi body	1 1 1

Question			Answer	Marks
4	b		Any 3 from the following structure **and** function must be given. Lipid bilayer - has a hydrophobic inside and hydrophilic outside, allowing for selective permeability Proteins - allow for specific substances to come or some molecules to pass through, Cholesterol - allows for fluidity of the membrane, Glycoproteins - for cell identification they serve as markers	 1 1 1 1
5	a		Pancreas	1
	b		3 from Pancreas detects change Insulin secreted By alpha cells Respiration increased Uptake of glucose increased Liver increases storage of glucose as glycogen	 1 1 1 1 1 1
	c		Any one from: Amount of chocolate, time taken to eat, other food/drink consumed, age, gender, weight, fitness level/metabolic rate, health/pre existing conditions, use of medicines/drugs	1
	d		Any three from Data suggests that blood glucose returns to normal Doesn't show how much exercise has been done Doesn't say age/gender/other named variable May only be true for chocolate/only one type of food investigated	 1 1 1 1
6			Top left: transpiration increases when wind speed increases/there is a positive correlation Top right: rate increases with pH until the optimum is reached, after the optimum, rate decreases Bottom left: Increasing light initially increases the rate of photosynthesis, but after a while remains constant Bottom right: Population increases slowly at first and then increases at a greater rate/increases exponentially	1 1 1 1