

A LEVEL BIOLOGY TRANSITION UNIT

Name:

Introduction

Some students find the transition from GCSE to A-level Biology very challenging. To help make this transition smoother and to give you the best possible start, we have prepared this transition work.

Module	Description
 Content knowledge and skills 	Essential GCSE knowledge in terms of content, exam technique and how science works. Found in this document. At some points you are pushed a little beyond the GCSE specification to start researching simple facts/concepts from a level.
2- Mathematical skills	GCSE mathematical skills applied to biology. Over 10% of the exams and can be the easiest marks if you keep these skills practiced.

It is important that you read through this booklet and then complete all the questions. If you require more space then you can use lined paper. The majority of the topics are GCSE topics which you should have already covered. You will need secure knowledge of these topics before you start the course in September. In addition to this there are several questions that require you to research a topic so that you become familiar with new vocabulary and concepts.

The second section involves your GCSE mathematical skills which are regularly applied to biological examples in the exams.

We will study the OCR Biology H420 course.

To help you complete this booklet the following resources may be useful:

- <u>http://www.s-cool.co.uk/a-level/biology</u>
- <u>https://www.khanacademy.org/science/biology</u>
- <u>http://www.ocr.org.uk/qualifications/as-a-level-gce/as-a-level-gce-biology-a-h020-h420-from-2015/</u>

What to bring in September to the first lesson

Sort this out now!

- 1. Essential stationary: Pencil, 30cm ruler, blue/black pens, calculator.
- 2. Optional: highlighters, colouring pens etc.
- 3. Folder
- 4. File dividers
- 5. Enthusiasm

Task 1: Skills: Exam technique- describing and explaining data

In order to be successful in A-level Biology exam technique is essential. A key area of exam technique is understanding the command words in the question.

Resources: https://www.my-gcsescience.com/biology-command-words-context/

- 1. Describe how to respond to each of these command words
- a) Describe

b) Explain

c)Compare

d) Evaluate

2. The Galapagos Islands are in the Pacific Ocean, 1400 km from South America.

A type of bird called a ground finch lives on the islands. The picture shows a ground finch.



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The size of the seeds the ground finch can eat depends upon the size of the beak. To eat large seeds, a large beak is needed.

The bar charts show the sizes of the beaks of ground finches on **one** island, in 1976 and in 1978.



2 (a) The population of the ground finches and their beak sizes changed between 1976 and 1978.

Describe these changes.

2 b) In 1977 there was very little rain on the island. The lack of rain affected the seeds that the finches ate.

The table shows how the seeds were affected.

Year	Mean number of seeds per m ²	Mean mass of each seed in mg
1976	8.5	3.5
1978	2.8	4.2

Suggest an **explan**ation for the changes in beak sizes between 1976 and 1978

Task 2 Subject knowledge: Enzymes

Resources: GCSE enzymes: <u>https://www.bbc.co.uk/bitesize/guides/z88hcj6/revision/1</u> GCSE food tests: <u>https://www.bbc.co.uk/bitesize/guides/z8wsgk7/revision/6</u> A level carbohydrates: <u>https://www.youtube.com/watch?v=_zm_DyD6FJ0</u>

- 1. What is the function of enzymes?
 - 2. Draw a labelled diagram showing the lock and key model of enzyme action

3. Complete the following table:

Where is this	What molecule	What are the
enzyme produced?	does the enzyme	products of the
	break down?	breakdown?
	Where is this enzyme produced?	Where is this What molecule enzyme produced? does the enzyme break down?

4. Describe how you would test for:

Fat	Starch	Protein

5. Find out what the following mean (break down the each word into 2 parts) and give one example for each one:

a)Monosaccharide

- b) Disaccharide
 - c) Polysaccharide

Task 3: Subject knowledge: Factors affecting enzymes

GCSE enzymes: <u>https://www.bbc.co.uk/bitesize/guides/z88hcj6/revision/1</u>

- 1. What factors affect the activity of enzyme?
- 2. Enzymes in the human body have an optimum temperature of 37°C. What does this mean?
- 3. What is the minimum amount of energy required for a reaction to take place called?
- 4. How do enzymes speed up chemical reactions?
- 5. If an enzyme-controlled reaction normally takes place at 10°C, in general terms how will the reaction be affected by:

(a)a fall in temperature to 2°C

- (b) a rise in temperature to 20°C.
- (c) a rise in temperature to 65°C?
 - 6. If an enzyme is denatured, why does it no longer work?

- 7. The graph shows the rate of an enzyme reaction at different levels of acidity or alkalinity (pH). From the graph, what is the optimum pH for this enzyme?
- (a) pH 2 (c) pH 10
- (b) pH 7 (d) none of these.



- 8. A protein-digesting enzyme when mixed with starch solution would:
- (a) have no action (c) produce glucose
- (b) produce amino acids (d) digest the starch?

9. Research: What is an enzyme inhibitor and how does it work?

Task 4: Subject knowledge and practical skills: Microscopes& Organelles

Resources: GCSE cells and microscopy: <u>https://www.bbc.co.uk/bitesize/guides/zg9mk2p/revision/1</u> A level cell structure: <u>https://www.youtube.com/watch?v=mUJryLNKScg</u>

1. Label the microscope below:



2. Find out the difference between light microscopes and electron microscopes.

Light microscopes	Electron microscopes

- 3. You will be using lots of scientific vocabulary on the biology course find out the meanings of the following keywords:
 - a) Resolution
 - b) Magnification
 - c) Nucleolus
 - d) Golgi apparatus
 - e) Lysosome
 - f) Ribosome
 - g) Rough endoplasmic reticulum
- 4. You must know the following units of measurement when working with microscopes. They are all in comparison to a metre. Complete the table below..

Unit	Symbol	Equivalent in metres in standard form (m)
kilometre	km	1×10^{3}
metre		
	mm	1×10^{-3}
micrometre		1 × 10 ⁻⁶
nanometre	nm	

5. Figure 4 shows a photomicrograph of onion cells.



Figure 4

(i) The width of the labelled cell in Figure 4 is 6 mm. The cell has been magnified 750 times.

Calculate the actual width of this cell in mm. Give your answer in standard form. Reminder: always show full working with units!

..... mm

6. Place a tick in the box to indicate where the organelle is found. Some organelles can be found in both plant and animal cells.

Organelle	Plant Cell	Animal Cell
Cell Wall		
Chloroplast		
Cytoplasm		
Endoplasmic		
reticulum		
Golgi apparatus		
Lysosome		
Nucleolus		
Nucleus		
Plasma membrane		
Ribosome		
Vacuole		
Mitochondria		

7. Cells are categorised as either prokaryotes or eukaryotes. Find out what this means and give 1 example for each of these categories.

Prokaryote	Eukaryote

- 8. The diagram shows an animal cell
 - a) Name each labelled part and give its function



A Name _____

Function_____

B Name_____

Function_____

C Name_____

Task 5: Subject knowledge: Movement across membranes

Resources: GCSE https://www.bbc.co.uk/bitesize/guides/z22vw6f/revision/1

Function _____

1. Place the following features in the correct part of the Venn Diagram using the letters given.





4. Some students set up the experiment below to investigate osmosis

a) What is osmosis?

b) What will happen to the water level in the capillary tube during the investigation? Explain why this happens

c) Describe two examples where osmosis is used in living things

Task 6: Subject knowledge: Gas exchange

Resources: GCSE https://www.bbc.co.uk/bitesize/guides/zyjbqhv/revision/1

- 1. Where does gas exchange take place?
- 2. Where does aerobic respiration take place?
- 3. Describe how the lungs are adapted for gas exchange
- 4. Label the parts of the lung in the diagram below:



5. Describe the process of breathing in (inspiration)

6. Pulmonary ventilation is the total volume of air that is moved into the lungs in one minute. Find out the equation for pulmonary ventilation.

9. The diagram below shows a vertical section of a leaf. Name structures A-F.



- 9. Where does gas exchange take place in a leaf?
- 10. What is the role of the stomata in gas exchange

Task 7: Subject knowledge: The heart

Resources: GCSE https://www.bbc.co.uk/bitesize/guides/zhnk7ty/revision/4

Extension: if you are interested this is what the a level moves on to: <u>https://www.youtube.com/watch?v=IS9TD9fHFv0&t=94s</u>

1. Label the diagram and complete the gap fil exercise below.



2. Complete the passage below:

The heart is made out of ______ muscle. It is a double _____

that squeezes the blood around the _____and to the _____. The

______ side pumps blood to the lungs to pick up ______. The

_____ side pumps blood around the rest of the body.

- 3. Find out another term that is used for a heart attack
- 4. Which side of the heart is thicker and why?
- 5. Name the artery that only supplies the heart?
- 6. Name 3 blood vessels

7. Which blood vessel contains valves?

8. What is the function of valves?

Task 8: Subject knowledge: Causes of disease & immunity

Resources: https://www.bbc.co.uk/bitesize/guides/z83qfcw/revision/1

- 1. What are the three main types of microorganisms?
- 2. What is a pathogen?
- 3. Define the term antigen
- 4. List 3 things that white blood ce ls do
- 5. What is the difference between an antibiotic and an antibody?
- 6. What is found in a vaccination?
- 7. Match the description on the left with the term on the right by writing the correct letter in each space.

 a disease that destroys the immune system 	a. active
2. disease-causing bacteria	b. antigens
traps pathogens in respiratory system	c. passive
proteins and chemicals that are foreign to the body	d. mucus
5. contains weakened antigens	e. lymphocytes
immunity occurring when your body makes its own antibodies	f. antibody
substance made in response to an antigen	g. enzymes
immunity occurring when antibodies are introduced from an outside	h. pathogens
source	i. vaccine
9. cells attacked by AIDS virus	j. AIDS
10. destroy pathogens in stomach, pancreas, and liver	

10. Disease causing microorganisms gain entry into the body via one of its interfaces with the environment such as the skin. Name 2 other examples of interfaces through which microoganisms may gain entry into the body.

Task 9: Practical skills: Variables and methodology

Resources GCSE https://www.bbc.co.uk/bitesize/guides/zk3fy4j/revision/1

Controls and control variables: <u>https://www.thoughtco.com/difference-between-control-variable-and-group-609102</u>

A level validity (note that OCR no longer uses the term reliability but uses repeatability and reproducibility instead. Extension: what is the difference between these terms?): <u>https://www.youtube.com/watch?v=R13eVJxju5w</u>

- 1. What is the difference between an independent variable and a dependent variable?
- 2. Which axis has the independent variable on a graph?
- 3. What term is used for the variable we keep the same throughout an investigation?
- 4. What is validity in designing an experiment?
- 5. What does correlation mean?
- 6. What does the term directly proportional mean?
- 7. How can the validity of an experiment be increased?
- 8. How can the pH of a solution be control led?
- 9. What is the difference between a control (group) and a control variable?

Task 10: Subject knowledge: Cell division

Research and compare the process of cell division in eukaryotes to produce somatic cells and the process to produce gametes. Consider their:

- Process steps involved
- Function for the organism

(approx. 1 side, include links to your sources)

Task 11: Mathematical skills

Use the tutorials found here: <u>https://www.ocr.org.uk/subjects/science/maths-for-biology/</u> If you need to revise.

These skills are essential at A-level biology and you have already been developing them in your science and maths lessons over the course of your primary and secondary education. You will continue to fine tune and add to these skills over the next 2 years.

The following skills are required for OCR A-Level Biology H420:

Maths skills – Level 2 maths make up 10% of the marks. (there is also an unspecified number of simpler maths questions, see the spec for more detail)

M0 Arithmetic and numerical computation

- M0.1 Recognise and make use of appropriate units in calculations
- M0.2 Recognise and use expressions in decimal and standard form
- M0.3 Use ratios, fractions and percentage
- M0.4 Estimate results
- M0.5 Use calculators to find and use power, exponential and logarithm functions
- M1 Handling data
- M1.1 Use an appropriate number of significant figures
- M1.2 Find arithmetic means
- M1.3 Construct and interpret frequency tables and diagrams, bar charts and histograms
- M1.4 Understand simple probability
- M1.5 Understand the principles of sampling as applied to scientific data
- M1.6 Understand the terms mean, median and mode
- M1.7 Use a scatter diagram to identify a correlation between two variables
- M1.8 Make order of magnitude calculations
- M1.9 Select and use a statistical test
- M1.10 Understand measures of dispersion, including standard deviation and range

M1.11 – Identify uncertainties in measurements and use simple techniques to determine uncertainty when data are combined

M2 Algebra

- M2.1 Understand and use the symbols =, <, <<, >>, >, α , ~
- M2.2 Change the subject of an equation

M2.3 – Substitute numerical values into algebraic equations using appropriate units for physical quantities

- M2.4 Solve algebraic equations
- M2.5 Use logarithms in relation to quantities that range over several orders of magnitude

M3 Graphs

- M3.1 Translate information between graphical, numerical and algebraic forms
- M3.2 Plot two variables from experimental or other data
- M3.3 Understand that y = mx + c represents a linear relationship
- M3.4 Determine the intercept of a graph
- M3.5 Calculate rate of change from a graph showing a linear relationship
- M3.6 Draw and use the slope of a tangent to a curve as a measure of rate of change

M4 Geometry and trigonometry M4.1 Calculate the circumference, surface areas and volumes of regular shapes

• Questions: M0 Arithmetic and numerical computation

- 1. Convert each of the following into mm.
 - (a) 100 nm
 - (b) 2 µm
 - (c) 20 km
- 2. Volumes and areas.

Areas.

(a) How many nm² in a μm^2 ?

Volumes

- (a) How many nm^3 in a μm^3 ?
- (b) How many nm³ in a mm^3 ?
- 3. Use correct notation to express the following:
 - (a) 20 m per second
 - (b) 14 breaths per minute
 - (c) $360 \text{ dm}^3 \text{ per hour}$
- 4. Convert these into standard form, to one decimal place.
 - (a) 0.3
 - (b) 0.0056
 - (c) 0.0000000000056

5. Linoleic acid has the formula $C_{18}H_{32}O_2$. What percentage of atoms in linoleic acid are:

- (a) Carbon?
- (b) Hydrogen?





- (a) Carbon?
- (c) Oxygen?

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6. In an experiment using catalase to catalyse the release of oxygen gas from a solution of hydrogen peroxide, the theoretical yield is 15.4 cm³. The actual yield was 9.8 cm³. What was the percentage yield for this enzymatic reaction?

7. Convert the following to sensible units:

- (a) 85000 g
- (b) 0.0000008 /
- (c) 9000 µm
- (d) 500000000 mg

8. In one year a population of 80 rabbits had decreased by 10%, what is the total number of rabbits at the end of the year?

Fill in the correct values for volume to 1 decimal place and calculate f	the mean
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Measurement	Volume (m/) X	Volume (m/) √
1	4.85	
2	7.0	
3	7.14	
4	5.99	
	Mean:	

10. 30 kittens were classified according to their coat colour:

Coat colour	Number of kittens
Black	17
White	4
Ginger	9

What was the ratio of black to white to ginger kittens?

11. Estimate answers showing your working, then check your estimates with a calculator:

Estimate

Calculator

answer

a) 11.2 x 14.9 =

12. Challenge: (hint marks for working even if you aren't sure how to get all the way to the answer) At the start of an experiment there are 100 bacterial cells in a culture. This bacterium divides (doubles) about every 20 minutes under standard conditions. How many cells will there be after 3 hours?

Questions: M1 Handling data

Questions M1.1

- 1) 0.30202 to 2 sig fig
- 2) 0.675 to 2 sig fig
- 3) 7.006 to 3 sig fig



Questions M1.3

For the below data:

a) Determine the most appropriate graph to plot with reasons:

Number of flower heads with different masses of flowers

Mean mass of flowers per flower head (g)	Frequency
5.0-5.4	42
5.5-5.9	22
6.0-6.4	53
6.5-6.9	31
7.0-7.4	20
7.5-7.9	10

For the below data:

Number of flowers of different colours

Flower colour	Frequency			
White	46			
Pink	92			
Red	42			

a. Determine the most appropriate graph to plot with reasons:

b. Plot the graph



Question M1.6

Ecologists wanted to compare the number of buttercups in a field. Using quadrats they counted the numbers of plants in 10 randomly selected 1 m^2 areas. Calculate and compare the mean, median and mode for the data set. Which of these is the most appropriate statistical measure to report for the data set and why?

Number of buttercups
9
15
58
12
10
13
15
11
14
15

10	

Questions M1.8

This image shows the capillaries in a 1 mm² area of rat retina. What is the diameter of the capillaries?



Wellcome Images

Show your full working:

Questions M1.11

 A 10 μl pipette is guaranteed by its manufacturer as accurate to ±0.03 μl, this was tested in the lab by drawing up 10 μl of water repeatedly and verifying the volumes independently. The volumes were verified as follows:

9.9978; 10.0062; 10.0020; 10.0047; 9.9998; 9.9982; 10.0023; 10.0034; 10.0012; 9.9994

Is this pipette accurate to within the manufacturer's specifications?

• Questions: M2 Algebra

- Consolidate your learning on recognising and using symbols by filling the blanks in the following statements with the most <u>appropriate symbol</u>. =, <, <<, >>, >, α, ~
 - a) In a study on penguins it was found that survival rate of chicks increased as populations of fish increased, so that survival rate _____ fish population.
 - b) There were 10,000 chicks in 2006 but only 2,000 in 2007, so the number

in 2007 was ______ the number of chicks in 2006.

c) Fish stocks were 300,000 fish in 2006 and 290,000 in 2007 so for the

fish, the population in 2006 was ______ the population in 2007.

- 2. By recalling and, where necessary, rearranging equations work out the formula for each of these situations: **Show your full working.**
 - a. If you are told the volume of a cube, how would you work out the length of the edges?

b. Given the surface area of a circular pond how would you work out the diameter?

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Questions: M3 Graphs

Question 1

Data for the concentration of maltose (mmol dm⁻³) over a period of time (min) was collected for an enzyme-controlled reaction:

Concentration of Maltose (mmol dm⁻³) Time (min)

- i) Draw a curve of best fit.
- ii) Describe the relationship between the two variables.
- iii) Use tangents to work out the rates of reaction for the graph at 3 minutes, 7 minutes and 9 minutes.
- iv) Describe the pattern of rate of reaction over time.

Question 2

Students studied the possible impact of the size of the rabbit population on the size of the dandelion population by recording how many dandelions are present in sample areas with differing sizes of rabbit populations during the summer and winter months. They collected the following data:



- i) Extrapolate the data to work out how many dandelions there would be with no rabbits present if the trend continued for both summer and winter.
- ii) Linear graphs have the general equation y = mx + c where "m" represents the gradient of the line and "c" represents the y-intercept. Work out the equations of the lines for the graphical data for both summer and winter data sets.

• Questions: M4.1 Calculate the circumference, surface areas and volumes of regular shapes

These formulae will not be given in the exam so you must learn them off by heart:

- 1. write the 4 formulae below
 - 1) Circumference
 - 2) Area of circle
 - 3) Surface area of cuboid
 - 4) Volume of Cuboid

These formulae will be given in the exam if you need them:

- 1) Surface area of cylinder = $2\pi r(r+l)$
- 2) Volume of cylinder = $\pi r^2 l$
- 3) Surface area of sphere = $4\pi r^2$
- 4) Volume of sphere $=\frac{4}{3}\pi r^3$

Write your answers correct to 3 significant figures.



Radius =

	a) 2.	.00 cm			
2.	Area of cir Radius =	cle			
	a) 2.	.00 cm			
3.	Surface ar	ea of cuboid			
	a)	b = 6.00 µm	l = 2.00 µm	h = 5.00 µm	
4.	Volume of	cuboid			
	a)	b = 6.00 µm	l = 2.00 µm	h = 5.00 µm	
5.	Surface ar	ea of cylinder			
	a)	r = 2.00 cm	l = 4.00 cm		
6.	Volume of	cylinder			
	a)	r = 2.00 cm	l = 4.00 cm		
7.	Surface ar	ea of sphere		L	

a)	r	=	2.	00	cm	
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8. Volume of sphere

a) r = 2.00 cm

9. Calculate the surface area to volume ratio of a spherical cell that has a radius of 0.50 $\,\mu\text{m}.$