A-level Biology at Fortismere

Exam board: AQA

Biology has changed almost beyond recognition since the revolutions in genetics, cellular and molecular biology. It advances at an astonishing rate, as reflected in the very high proportion of stories about Biology in the media which cover both the latest discoveries and the controversial areas of biotechnology, genetic modification and medicine. This, coupled with the enthusiasm of our pupils for this subject, makes it a uniquely relevant and exciting area of study.

"Don't become a mere recorder of facts, but try to penetrate the mystery of their origin." Ivan Pavlov (winner of The Nobel Prize in Physiology or Medicine in 1904).

Biology is a rapidly developing science which is having and will continue to have far reaching ramifications for the world and society. Our department comprises six members of teaching staff and is well resourced with a plethora of practical equipment and stimulus material including a hippopotamus skull, a preserved human brain, a stuffed platypus and an eight foot model of the DNA double helix.

Is there such a thing as 'good bacteria'? Why does bread taste sweet after chewing?

A-level Biology at Fortismere nurtures and intrigues your growing curiosity. Your ability to work independently is fostered by a strong emphasis on practical work and activities ranging from testing the efficacy of biological washing powder to establishing the area of the lab that harbours most microorganisms.

How do tumours develop? Can spinal cord damage be repaired?

This course provides you with the opportunity to learn about and engage in discussion on exciting contemporary developments, such as screening for genetic disorders and the ethics of stem cell therapy. Discovery through practical work is at the heart of teaching and learning.
Can a chimpanzee be taught to speak with sign language? Are humans still evolving?

Biology is a popular subject at Fortismere School, with around 60 students enrolling on the course every year. Practical activities include analysing DNA from a 'crime scene', genetically engineering glow-in-the-dark bacteria and going on a field trip to Flatform Mill and Indonesia in Year 12. A large number of students go on to biology related degrees, such as medicine, biochemistry and natural sciences. In both years you will have two teachers covering different aspects of the syllabus, with a carefully balanced combination of personalised support and independent research.

Have you ever wondered what the inside of a snake looks like? Can genes be switched on and off?

Subject content

Core content

1 Biological molecule

2 Cells

3 Organisms exchange substances with their environment

4 Genetic information, variation and relationships between organisms

AS required practical activities

The following practicals will be carried out by all students taking this course. Written papers will assess knowledge and understanding of these, and the skills exemplified within each practical.

Required activity	
1. Investigation into the effect of a named variable on the rate of an enzyme-controlled reaction	a, b, c, f, l
2. Preparation of stained squashes of cells from plant root tips; set-up and use of an optical microscope to identify the stages of mitosis in these stained squashes and calculation of a mitotic index	d, e, f
3. Production of a dilution series of a solute to produce a calibration curve with which to identify the water potential of plant tissue	c, h, j, l
4. Investigation into the effect of a named variable on the permeability of cell-surface membranes	a, b, c, j, l
5. Dissection of animal or plant gas exchange system or mass transport system or of organ within such a system	e, h, j
6. Use of aseptic techniques to investigate the effect of antimicrobial substances on microbial growth	c, i

AS

Assessments

Paper 1

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

Questions
65 marks: short answer questions
10 marks: comprehension question

Paper 2

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

Questions
65 marks: short answer questions
10 marks: extended response questions

Practical skills to be assessed in written papers

Overall, at least 15% of the marks for an AS Biology qualification will require the assessment of practical skills.

In order to be able to answer these questions, students need to have been taught, and to have acquired competence in, the appropriate areas of practical skills as indicated in the table of coverage below.

Independent thinking

	Practical skill
PS 1.1	Solve problems set in practical contexts
PS 1.2	Apply scientific knowledge to practical contexts

Use and application of scientific methods and practices

	Practical skill
PS 2.1	Comment on experimental design and evaluate scientific methods
PS 2.2	Present data in appropriate ways
PS 2.3	Evaluate results and draw conclusions with reference to measurement uncertainties and errors
PS 2.4	Identify variables including those that must be controlled

Numeracy and the application of mathematical concepts in a practical context

	Practical skill
PS 3.1	Plot and interpret graphs
PS 3.2	Process and analyse data using appropriate mathematical skills as exemplified in the mathematical appendix for each science
PS 3.3	Consider margins of error, accuracy and precision of data

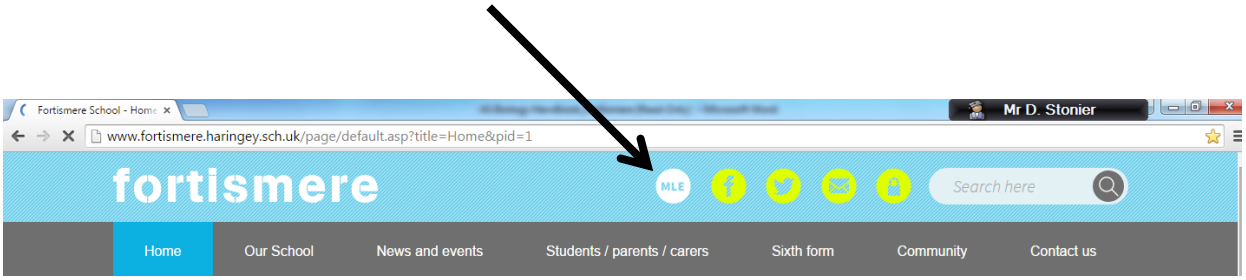
Instruments and equipment

	Practical skill

	Practical skill
PS 4.1	Know and understand how to use a wide range of experimental and practical instruments, equipment and techniques appropriate to the knowledge and understanding included in the specification

How to answer A-level biology questions

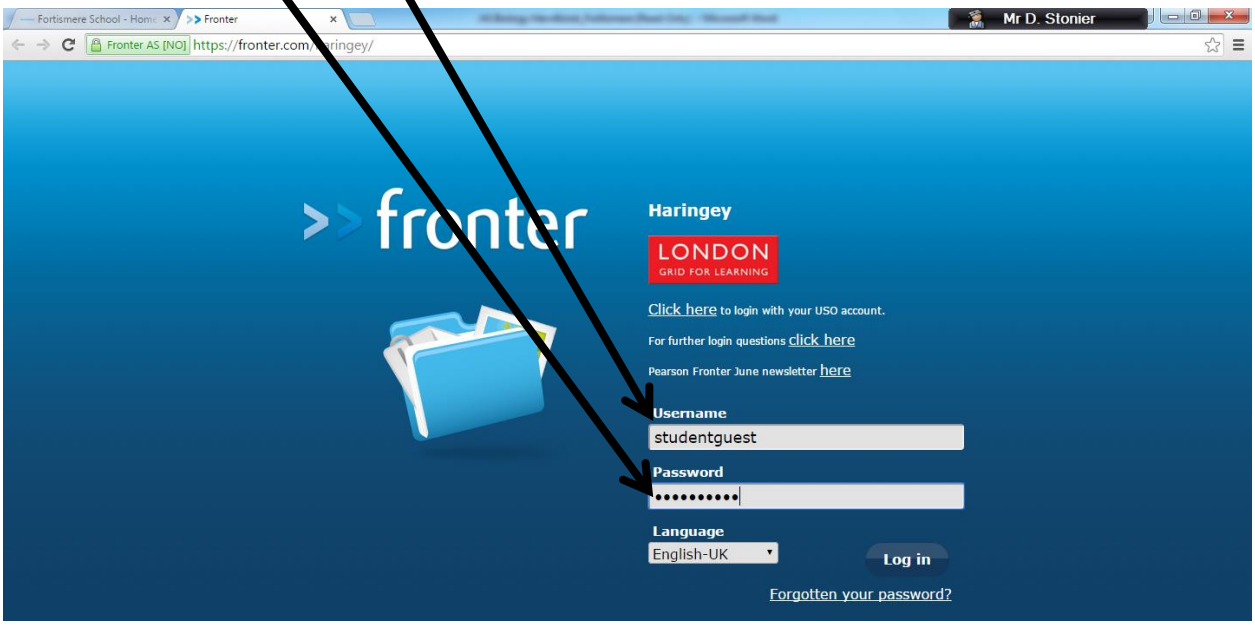
There is a wealth of past exam questions on Fortismere's MLE – this can be accessed by clicking on the MLE tab at the top of the school website's homepage.



The MLE is called Fronter and you can use your Fortismere username and password to gain access.

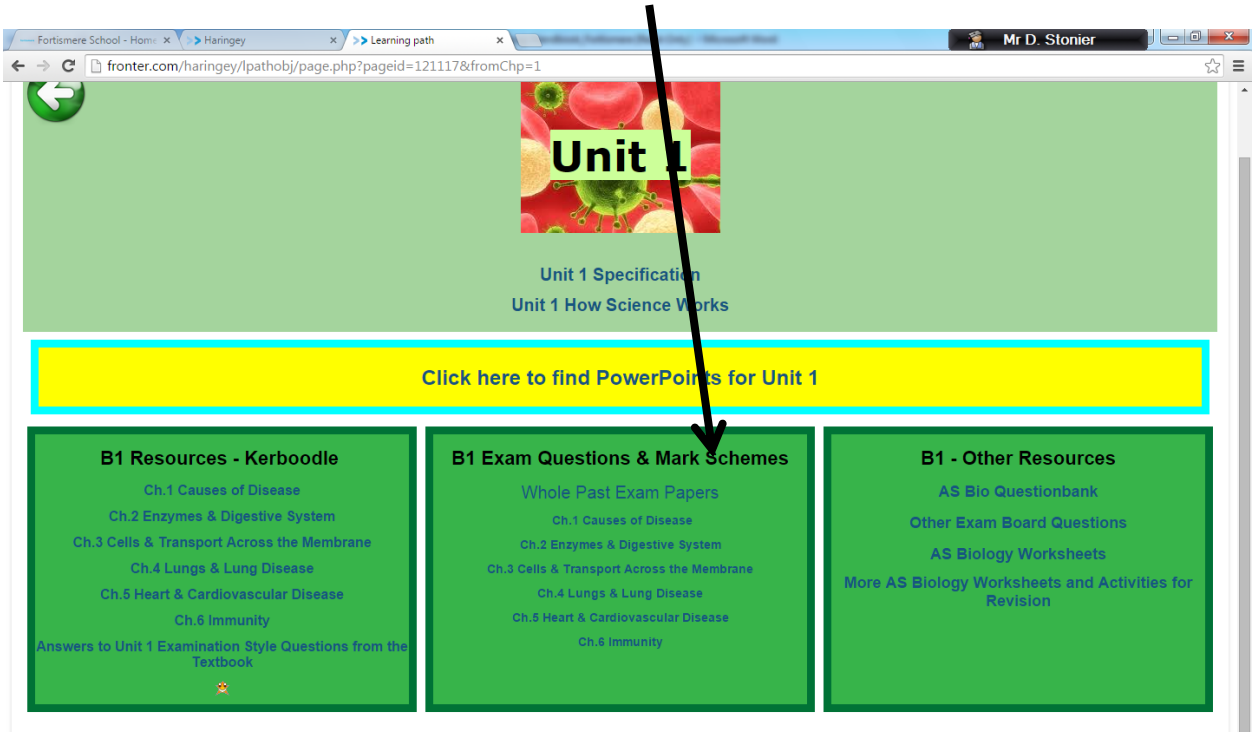
Username: **studentguest**

Password: **fortismere**



Navigate your way to the **'science corridor'** and then to the **'biology pages'** where you will be able to click on the 'AS or A2 biology pages'.

Below is an image of the page where Unit 1 Biology past exam questions can be found – they are indexed by chapter and you can also find whole past papers .



Assessment objectives

Assessment objectives (AOs) are set by Ofqual and are the same across all AS and A-level Biology specifications and all exam boards.

The exams will measure how students have achieved the following assessment objectives.

- AO1: Demonstrate knowledge and understanding of scientific ideas, processes, techniques and procedures
- AO2: Apply knowledge and understanding of scientific ideas, processes, techniques and procedures:
  - in a theoretical context
  - in a practical context
  - when handling qualitative data
  - when handling quantitative data
- AO3: Analyse, interpret and evaluate scientific information, ideas and evidence, including in relation to issues, to:
  - make judgements and reach conclusions
  - develop and refine practical design and procedures.

Weighting of assessment objectives for AS Biology

Assessment objectives (AOs)	Component weightings (approx %)		Overall weighting (approx %)
	Paper 1	Paper 2	
AO1	47–51	33–37	35–40
AO2	35–39	41–45	40–45
AO3	13–17	21–25	20–25
Overall weighting of components	50	50	100

- At least 15% of the overall assessment of AS & A2 Biology will assess knowledge and skills relating to practical work.

A-level Biology questions will involve one of the command words below – it is important to understand the command word before attempting a question.

When students progress from GCSE to A-level Biology, they often struggle with meaning of command words – for example: do you know the difference between describe and explain? Misunderstanding this is the most common reason for a score of zero on a question even when the student understands the science concept in the question.

Each command word fits with an 'AO' (assessment objective). Use the 'AO' definitions on the previous page to assess whether you agree or disagree with these. (some command words might fit with more than one 'AO')

Annotate (AO1)
Add notation or labelling to a graph, diagram or other drawing

Compare (AO1)
Identify similarities and/ or differences

Complete (AO1)
Finish a task by adding to given information

Contrast (AO1)
Identify differences

Define (AO1)
Specify meaning

Describe (AO1)
Give an account of

Discuss (AO1)
Present key points

Distinguish (AO1)
List the differences between different items

Draw (AO1)
Produce a diagram

Give (AO1)
Produce an answer from recall or from given information

Identify (AO1)
Name or otherwise characterise

Label (AO1)
Provide appropriate names on a diagram

List (AO1)
List a number of features or points without further elaboration

Name (AO1)
Identify using a recognised technical term

Outline (AO1)
Set out main characteristics

Relate (AO1)
Give a technical term or its equivalent

State (AO1)
Express in clear terms

Deduce (AO2)
Draw conclusions from information provided

Design (AO2)
Set out how something will be done

Apply (AO2)
Put into effect in a recognised way

Calculate (AO2)
Work out the value of something

Consider (AO2)
Review and respond to given information

Determine (AO2)
Use given data or information to obtain an answer

Estimate (AO2)
Assign an approximate value

Explain (AO2)
Give reasons

Show (AO2)
Provide structured evidence to reach a conclusion

Sketch (AO2)
Draw approximately

Analyse (AO3)
Separate information into components and identify their characteristics

Argue (AO3)
Present a reasoned case

Assess (AO3)
Make an informed judgement

Comment (AO3)
Present an informed opinion

Criticise (AO3)
Access worth against explicit expectations

Debate (AO3)
Present different perspectives on an issue

Develop (AO3)
Take forward or build upon given information

Evaluate (AO3)
Judge from available evidence

Explore (AO3)
Investigate without preconceptions about the outcome

Justify (AO3)
Support a case with evidence

Predict (AO3)
Give a plausible outcome

Suggest (AO3)
Present a possible case

Some of these command words are much more common than others; use the MLE to determine the most common question type.

AS Biology Unit 1 Checklist

3.1.1 Disease				
Topic	**Syllabus Statement – What I need to know:**	**Notes**	**Revised**	**Exam Q**
Pathogens	• Pathogens include bacteria, viruses and fungi. • How pathogens enter the body and cause disease.			
Lifestyle	• Risk factors for cancer and coronary heart disease. • Difference between correlations and causal relationships.			

3.1.2 Digestion				
Topic	**Syllabus Statement – What I need to know:**	**Notes**	**Revised**	**Exam Q**
The digestive system	• The structure & location of oesophagus, stomach, small and large intestines and rectum including glands associated - the salivary glands and the pancreas. • Definition of digestion.			
Proteins	• The functions of proteins. • The general structure of an amino acid • Condensation and the formation of peptide bonds linking together amino acids to form polypeptides. • The relationship between primary, secondary, tertiary and quaternary structure, and protein function. • The biuret test for proteins.			
Enzyme action	• Function of enzymes (catalysts which lower activation energy) enzyme-substrate complexes, active site, complementary shape. • The lock and key and induced fit models. • Why is the induced fit model a better explanation?			
Enzyme properties	• Effects of temperature, competitive and non-competitive • inhibitors, pH and substrate concentration. • How to analyse graphs of enzyme action.			
Carbohydrates & Carbohydrate digestion	• The structure of alpha-glucose and the linking of alpha-glucose by glycosidic bonds formed by condensation to form maltose and starch. • Formation of sucrose and lactose. • Digestion of starch - the role of salivary and pancreatic amylases and of maltase located in the intestinal epithelium. • Digestion of disaccharides by sucrase and lactase. • Lactose intolerance • Biochemical tests using Benedict's reagent for reducing sugars and non-reducing sugars. • Iodine/potassium iodide solution for starch.			

3.1.3 Cells and Transport				
Topic	**Syllabus Statement – What I need to know:**	**Notes**	**Revised**	**Exam Q**
Cells	• The structure of an epithelial cell from the small intestine as seen with an optical microscope. • The appearance, structure and function of plasma membrane, including cell-surface membrane, microvilli, nucleus, mitochondria, lysosomes, ribosomes, endoplasmic reticulum, Golgi apparatus • Transmission v scanning electron microscopes.			

	• The difference between magnification and resolution. • Cell fractionation and ultracentrifugation			
Plasma Membranes	• The structure of triglycerides (both saturated and unsaturated0 and phospholipids. • The emulsion test for lipids. • The arrangement of phospholipids, proteins and carbohydrates in the fluid-mosaic model of membrane structure. • The role of the microvilli in increasing the surface area of cell-surface membranes.			
Diffusion	• Diffusion and effect of surface area, difference in concentration and the thickness of the exchange surface (Fick's Law). • The role of carrier proteins and protein channels in facilitated diffusion.			
Osmosis	• Osmosis and water potential			
Active Transport	• The role of carrier proteins and the transfer of energy in the transport of substances against a concentration gradient.			
Absorption	• Absorption of the products of carbohydrate digestion. The roles of diffusion, active transport and co-transport involving sodium ions.			
Cholera	• Cholera structure (prokaryotic cell) • Causes and symptoms of cholera. • Oral rehydration solutions (ORS) and ethical issues			

3.1.4/5 Lungs and heart				
Topic	**Syllabus Statement – What I need to know:**	**Notes**	**Revised**	**Exam Q**
Lung Function	• The structure of the human gas exchange system - alveoli, bronchioles, bronchi, trachea and lungs. • The features of the alveolar epithelium as a gas exchange surface. • The exchange of gases in the lungs. • Calculation of pulmonary ventilation • The mechanism of breathing.			
The biological basis of lung disease	• The course of infection, symptoms and transmission of pulmonary tuberculosis. • The effects of fibrosis, asthma and emphysema on lung function. • Explain the symptoms of these diseases and conditions affecting the lungs in terms of gas exchange and respiration • Risk factors for lung disease.			
Heart structure and function	• The structure of the human heart and its blood vessels • Pressure and volume changes and associated valve movements during the cardiac cycle. • Myogenic stimulation of the heart and transmission of a subsequent wave of electrical activity. • Roles of the SAN, AVN and bundle of His. • Cardiac output as the product of heart rate and stroke volume. • Analyse and interpret graphs data relating to pressure and volume changes during the cardiac cycle.			
The biological basis of heart	• Atheroma as the presence of fatty material within the walls of arteries. • The link between atheroma and the increased risk of			

3.2.1 Variation of living organisms				
Topic	**Syllabus Statement – What I need to know:**	**Notes**	**Revised**	**Exam Q**
Investigating Variation	• Importance of and methods of random sampling • Definition of standard deviation			
Causes of Variation	• Examples of biotic and abiotic factors • Difficulty of establishing causes of variation			
disease	aneurysm and thrombosis. • Myocardial infarction and its cause in terms of an interruption to the blood flow to heart muscle. • Risk factors associated with coronary heart disease: diet, blood cholesterol, cigarette smoking and high blood pressure. • Describe and explain data relating to the relationship between specific risk factors and the incidence of coronary heart disease.			

3.1.6 Immunology				
Topic	**Syllabus Statement – What I need to know:**	**Notes**	**Revised**	**Exam Q**
Phagocytes	• Phagocytosis and the role of lysosomes and enzymes			
Antigen/ Antibody	• Definition of antigen and antibody • Antibody structure and the formation of an antigen-antibody complex.			
B/T Cells	• Differences between humoral and cellular responses as shown byB cells and T cells			
Memory Cells	• The role of plasma cells and memory cells in producing a secondary response.			
Changing Pathogens	• The effects of antigenic variability in the influenza virus and other pathogens on immunity.			
Vaccines	• The use of vaccines to provide protection for individuals and populations against disease. • Ethical issues relating to vaccines (eg MMR)			
Monoclonal Anitbodies	• The use of monoclonal antibodies in enabling the targeting of specific substances and cells. • Ethical issues relating to monoclonal antibodies (animal testing, clinical trials).			

AS Biology Unit 2 Checklist

3.2.2 DNA and genes				
Structure of DNA	• Structure of nucleotides (base, deoxyribose, phosphate) • Specific base pairing and hydrogen bonds			
Genes and Polypeptides	• Definition of gene and allele • Coding and non-coding DNA (introns and exons) • Triplet code and amino acids • Effect of mutations on protein function			
DNA and chromosomes	• Structure of chromosomes including histones • Difference between prokaryotic and eukaryotic chromosomes			
Meiosis	• Importance of meiosis in producing genetically different cells • Formation of haploid cells			

	• Independent segregation of homologous chromosomes			

3.2.3 Genetic Diversity				
Genetic Diversity	• The influence of the following on genetic diversity o selection for high-yielding breeds of domesticated animals and strains of plants o the founder effect o genetic bottlenecks.			

3.2.4 Variety of Life				
Haemoglobin	• Haemoglobin structure (quaternary protein). • The role of haemoglobin in the transport of oxygen. • The loading, transport and unloading of oxygen in relation to the oxygen dissociation curve. • The effects of carbon dioxide concentration. • Compare haemoglobin in different organisms and relate to environment.			
Carbohydrates	• Basic structure of β-glucose • Linking of β-glucose by glycosidic bonds in condensation reactions to form cellulose • The basic structure and functions of starch, glycogen and cellulose.			
Cells	• Compare plant and animal cell • Structure of a leaf palisade cell, cell wall and chloroplast.			

3.2.5 DNA replication and cell division				
Topic	**Syllabus Statement – What I need to know:**	**Notes**	**Revised**	**Exam Q**
DNA replication	• Explain semi-conservative replication of DNA: o Breaking of hydrogen bonds between nucleotides o Attraction of new nucleotides and base pairing o Role of DNA helicase and polymerase • Experimental evidence for semi conservative replication (Meselsohn Stahl)			
Mitosis	• Importance of mitosis in growth and repair. • Explain events at each stage of mitosis. • Recognise stages from images			
Cell Cycle	• Stages of cell cycle – replication of DNA during interphase • Relate cell cycle to cancer treatment			

3.2.6 cellular organisation				
Cell differentiation	• Examples of specialised cells adapted for particular functions • Organisation of cells → tissues → organs → systems			

3.2.7 Exchange & Transport				
Size and surface area	• Relationship between size and surface area to volume ratio • Adaptations of transport and exchange systems to increasing size • Affect of size of organisms on heat transfer			
Gas exchange	• Gas exchange o across the body surface of a single-celled organism			

	○ in the tracheal system of an insect (tracheae and spiracles) ○ across the gills of a fish (gill lamellae and filaments including the countercurrent ○ principle) ○ by leaves of dicotyledonous plants (mesophyll and stomata). • Compromise between efficient gas exchange and limiting water loss in insects and xerophytic plants.			
Mass transport	• Over large distances, efficient supply of materials is provided by mass transport.			
The blood system	• Structure of mammalian circulation sytem (names of blood vessels for heart, kidneys and liver) • Structure and function of arteries, arterioles, veins and capillaries. • Formation of tissue fluid and its return to the circulatory system			
Passage of water through a plant	• The structure of a dicotyledonous root in relation to the pathway of water from root hairs through the cortex and endodermis to the xylem. • Apoplastic and symplastic pathways. • Transpiration and the effects of light, temperature, humidity and air movement. • The roles of root pressure and cohesion-tension in moving water through the xylem.			

3.2.8 Classification				
Topic	**Syllabus Statement – What I need to know:**	**Notes**	**Revised**	**Exam Q**
Principles of taxonomy	• Explain meaning of hierarchical system. • Recall taxa: Kingdom, Phylum, Class, Order, Family, Genus, Species. • How phylogenetic groups are developed • Definition of species and associated difficulties. •			

3.2.9 Advances in classification				
DNA	• Comparing DNA to establish relationships between species • Use of DNA hybridisation			
Proteins	• Comparing amino acid sequences in proteins • Immunological comparisons to investigate variation in proteins.			
Behaviour	• Role of courtship behaviour in successful mating and species recognition.			

3.2.10 Adaptation and selection				
Antibiotics	• Purpose of antibiotics • How they work – specifically inhibiting cell wall formation.			
Genetic variation in bacteria	• Definition of mutation and effect on variation. • Mutations in bacteria may result in resistance to antibiotics. • Transfer of antibiotic resistance via vertical and horizontal transmission (conjugation) • The difficulty of treating tuberculosis and MRSA.			

3.2.11 Biodiversity				
Species Diversity	• Definition of species diversity • Influence of deforestation and agriculture on species diversity.			
Index of diversity	• Purpose of the index of diversity • Calculation of index of diversity (given the formula)			

Kerboodle – GCSE to AS level summer work

www.kerboodle.com

Username: summerbiology
Password: fortismere
School code: phm6

Read through the AS 'digital book' chapters 1 and 3
Also read the following from the 'resources' tab:

Presentation: Organised success in Biology

Presentation: Wider reading in Biology

Presentation: Use of language in Biology assignments

Worksheet: Taking notes in Biology practicals

Worksheet: Wider reading in Biology

Worksheet: Using the internet effectively

Worksheet: Critical thinking in Biology

Further Reading and useful Learning Resources

Useful websites

www.mrothery.co.uk – Lots of different resources for AQA Biology

www.spolem.co.uk – interactive tests, worksheets and internet links.

www.bbc.co.uk/education/asguru/studyskills/biology The guru has gone but useful links provided.

www.biologymad.com – good for animations and other resources, be guided by specification.

www.s-cool.co.uk – notes, revision questions and summaries

www.biology-online.org

www.fkelly.co.uk

www.revision-notes.co.uk

www.dr-evans.com/advancedbiology

www.biochem4schools.org

www.kscience.co.uk

www.biologyguide.net