



A Level Biology

Richard Banks July 2021

Eduqas specification.

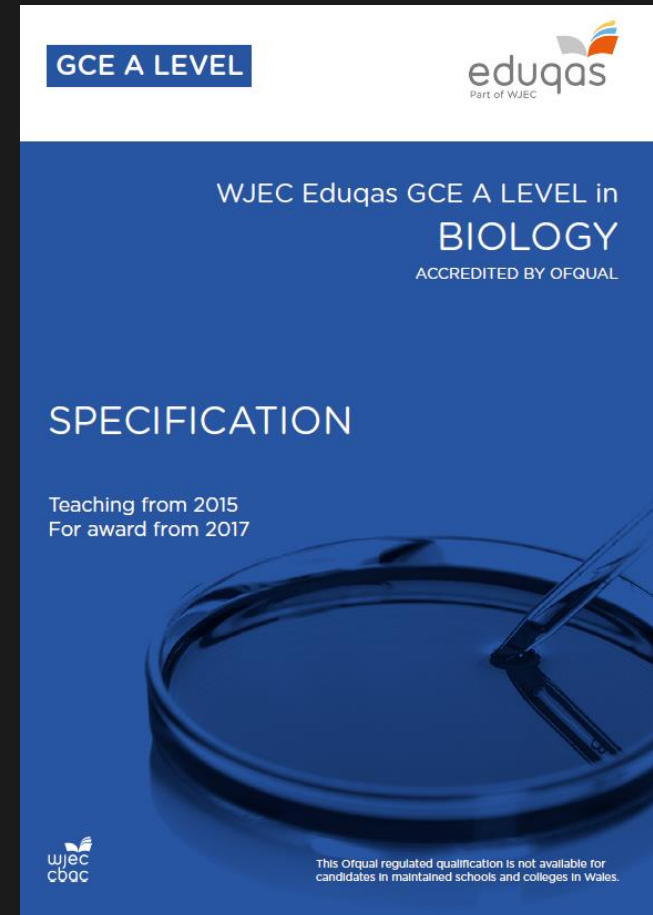
Run by WJEC which is the Welsh
examining board.

Main Content of the Course

- Here is a brief summary of the topics we cover over the two-year course. If you want to find out more about each of these topics, you can find the full specification on the EDUQAS website:
- https://www.eduqas.co.uk/qualifications/biology-as-a-level/#tab_overview

Course Structure

- The programme of study is broken down into 4 main sections:
- Core Concepts
- Energy For Life
- Continuity of Life
- Requirements for Life



Breakdown of contents

- Each Component is broken down into topics, that interrelate to one another and you will be familiar with lots of these subject areas having studied them at GCSE.
- However, at A level you will study them in greater depth and build your skills of application and analysis along with using your mathematical and problem solving, to develop as a learner.

Core Concepts

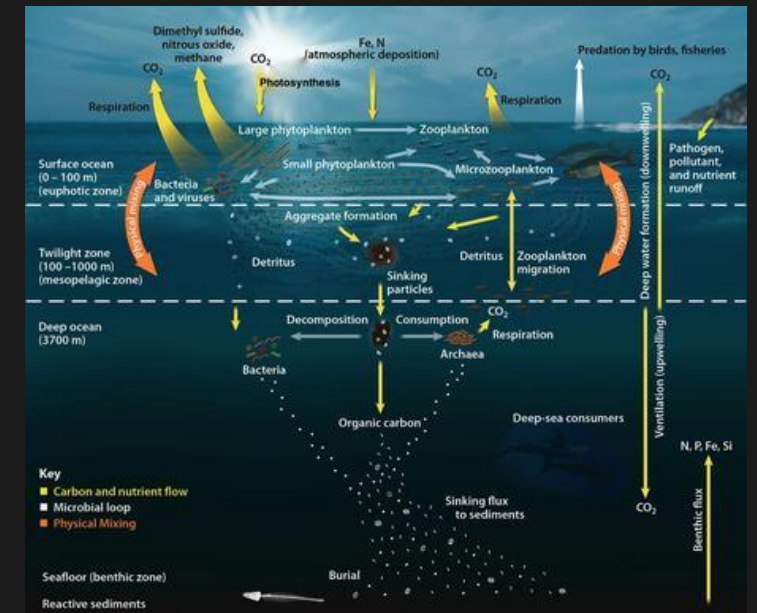
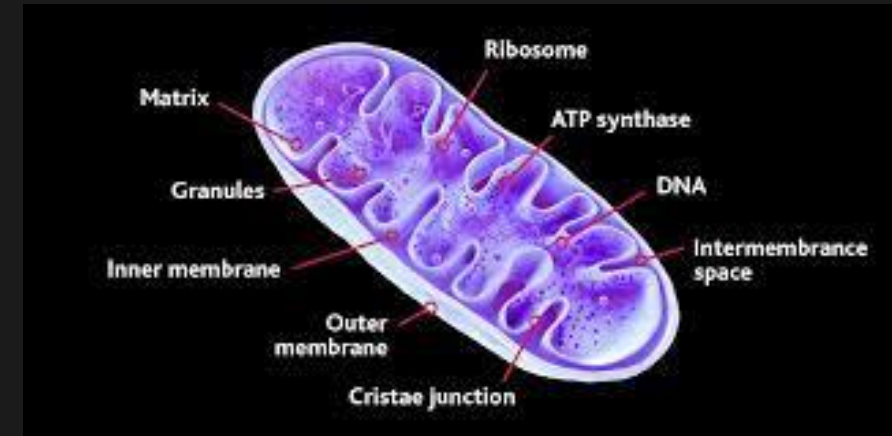
- Core Concepts include the following topics:
- 1. Biological compounds
- 2. Cell structure and organisation
- 3. Cell membranes and transport
- 4. Enzymes
- 5. Nucleic acids and their functions

Core Concepts

- We begin with teaching the core concepts.
- These underpin everything else that you will study across the two years of your A level course, and you will keep returning to them.
- The 5 core concept topics can be tested in any of the 3 component papers sat at the end of the course.

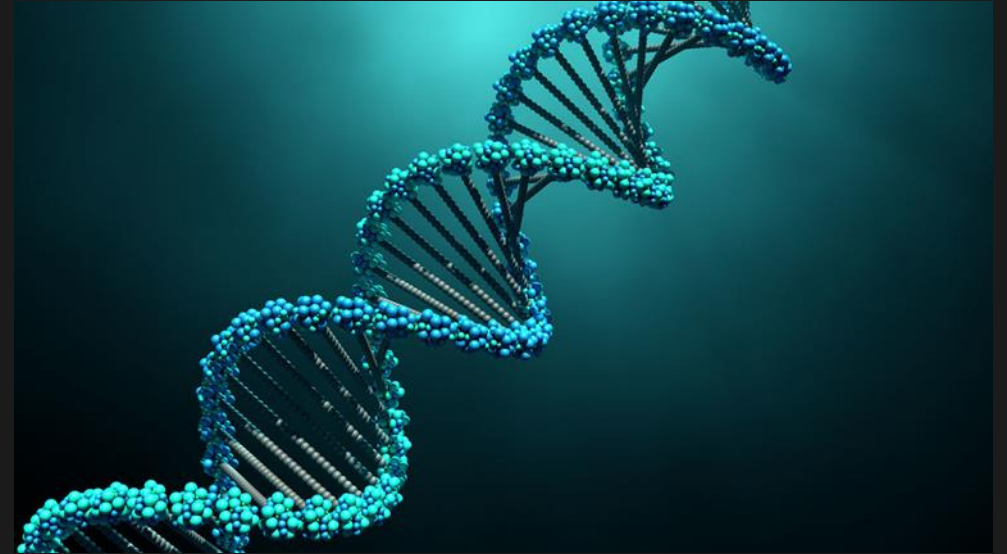
Component 1: Energy for Life

- This component includes the following topics:
- 1. Importance of ATP
- 2. Photosynthesis
- 3. Respiration
- 4. Microbiology
- 5. Population size and ecosystems
- 6. Human impact on the environment
- Core Concepts will be included in the assessment.



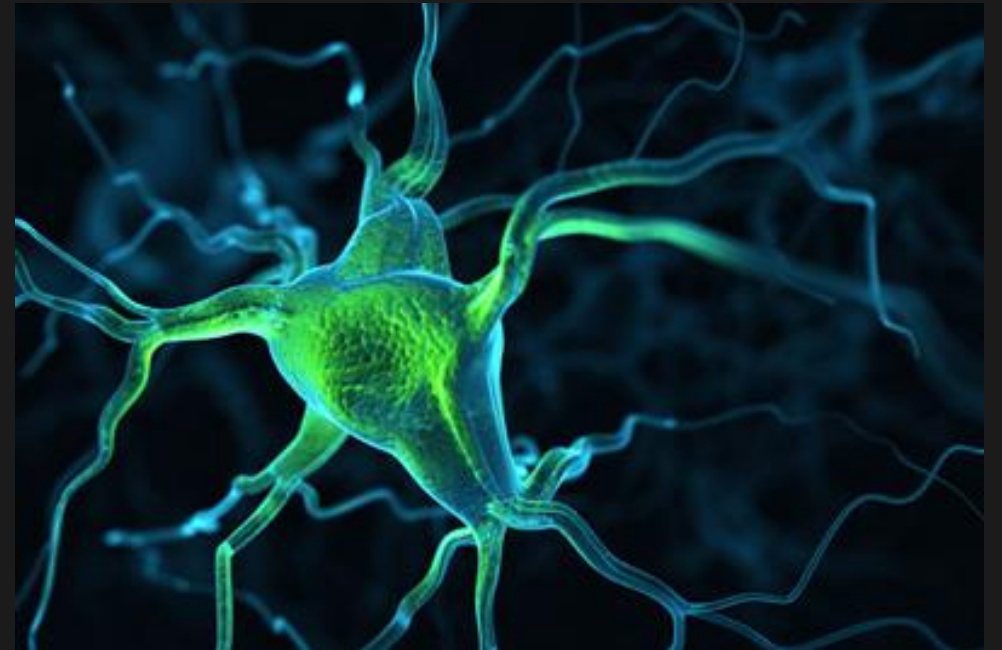
Component 2 Continuity of Life

- This component includes the following topics:
- 1. Evolutionary history & classification
- 2. Mitosis & Meiosis
- 3. Sexual reproduction in humans
- 4. Sexual reproduction in plants
- 5. Inheritance
- 6. Variation and evolution
- 7. Application of reproduction and genetics
- Core Concepts will be included in the assessment.



Component 3: Requirements for Life

- This component includes the following topics:
- 1. Adaptations for gas exchange
- 2. Adaptations for transport
- 3. Adaptations for nutrition
- 4. Homeostasis and the kidney
- 5. The nervous system
- 6. Human Musculoskeletal Anatomy
- Core Concepts will be included in the assessment.





Key Assessments

Key Assessments

- The assessments are all terminal, at the end of the course. There are 3, 2 hour papers one for each of the components:

Component 1: Energy for Life
Written examination: **2 hours**
33⅓ % of qualification
100 marks

A range of short and longer structured compulsory questions. Assessment of Core Concepts will also be included.

Component 2: Continuity of Life
Written examination: **2 hours**
33⅓ % of qualification
100 marks

A range of short and longer structured compulsory questions. Assessment of Core Concepts will also be included.

Component 3: Requirements for Life
Written examination: **2 hours**
33⅓ % of qualification
100 marks

Section A: 80 marks
A range of short and longer structured compulsory questions based on the compulsory content of the component. Assessment of Core Concepts will also be included.

Section B: 20 marks
Short and longer structured questions from a choice of 1 out of 3 options: Immunology and Disease; Human Musculoskeletal Anatomy or Neurobiology and Behaviour

Practical Endorsement

- This is a non examined part of the course and does not contribute to the final grade.
- Assessment of practical competency
- Reported separately and not contributing to final grade.

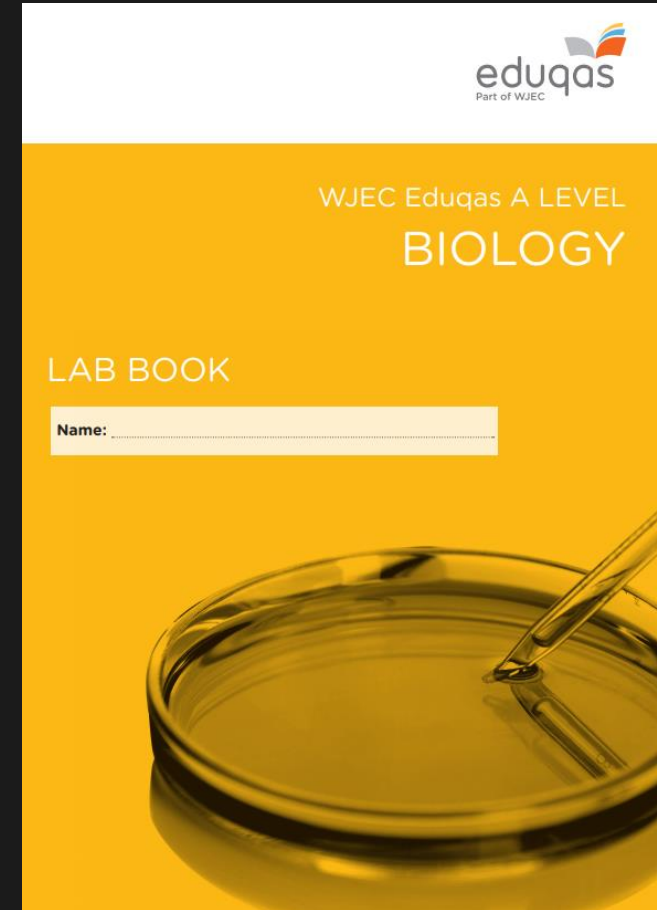


Practical Endorsement

- Throughout the 2 year course you will undertake a significant amount of practical work. Whilst carrying these out you will have the opportunity to demonstrate the 5 required competencies. Once you have achieved those competencies you will be awarded your practical endorsement alongside your final A level grade.

Practical Endorsement Competencies

- 1. Follows written procedures
- 2. Applies investigative approaches and methods when using instruments and equipment
- 3. Safely uses a range of practical equipment and materials
- 4. Makes and records observations
- 5. Researches, references and reports



Other Assessments through the course

- Regular end of topic tests, based on past paper questions to build your skills and confidence in answering A level questions
- End of year 1 mock exam
- Mock exam in November/December of year 2



Who Studies Biology?

Typical Student Profile

- Students that do well in Biology generally tend to take other science based A levels alongside their Biology. Chemistry compliments Biology and there are areas of study in Chemistry that strengthen your understanding of biological processes.
- Other subjects successful Biology students tend to take include: Psychology, Maths, Environmental Science, and Geology.



What to be aware of when studying Biology

- The course is diverse and covers all aspects of Biology including plant biology.
- It covers global scale interactions with units on Ecology & Human Impact on the Environment, whilst also considering the molecular with individual units on general Biochemistry, Enzymes, Nucleic Acids and Genetic Technologies

What to be aware of when studying Biology

- The A level course differs to the GCSE course in that there is more of an emphasis on the molecular element of biological sciences.
- The A level course develops your skills of application. 45% of the questions on the exam papers are based on the application of your knowledge to new and novel contexts that you will have not studied in class.
- There is also a greater emphasis on handling data and using mathematical skills to process numerical information.



Example of Tasks

Current First Year Lessons

- The first years are currently studying the Microbiology topic. Like many topics this takes about 10 hours of classroom/laboratory time.
- There is a mixture of lesson activities within each topic, which allow you to develop the skills you need to flourish as a biologist.

For each topic there is a Study Pack

- This has a range of tasks for you to complete in class time and in your independent study time.

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Component 1: Energy for Life

1.4 Microbiology

Learning objectives

From AS learners will need to revise their work on prokaryotes.

(a) The classification of bacteria according to their shape and by their reaction to the Gram stain as determined by their cell wall structure, including the preparation and examination of bacteria stained using gram technique.

(b) The methods by which microorganisms can be cultured in the laboratory

(c) The conditions necessary for bacterial growth and the principles of aseptic technique.

(d) The methods used to monitor population growth in microorganisms including viable count, using serial dilutions, plating and counting colonies.

Maths skills

Students will make use of appropriate units; using expressions in decimal and standard form; using ratios, fractions, and percentages; using logarithms; using significant figures; finding arithmetic means; constructing and interpreting of tables and diagrams; translating information between graphical, numerical and algebraic forms; plotting variables from experimental data; determining the intercept on a graph; drawing and using the slope of a tangent to a curve as a measure of rate of change.

SPECIFIED PRACTICAL WORK

Investigation into the numbers of bacteria in fresh and stale milk, using techniques of serial dilution, plating and counting colonies.

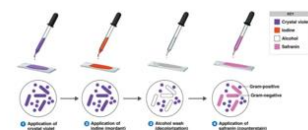


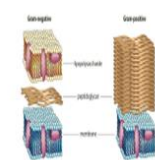
Key word	Definition
Prokaryote	
Peptidoglycan	
Gram stain	
Nutrient media	
aerobes	
obligate aerobes	
anaerobes	
Aseptic technique	
Serial dilution	
Cell counts (total & viable)	



Gram Staining

- Why do we need to stain microbes?
- Outline the procedure for Gram Staining, including the counterstain with Safranin.
- Describe the differences in the cell walls of Gram positive and Gram negative bacteria and explain how the stains are taken up differently.





Growing Bacteria student sheet

Growth Factors for Microbial growth:

Growth factor	How it affects the growth of the bacterial population
Temperature	
pH	
Oxygen (aerobes) (facultative aerobes) (Anaerobes)	
Osmosis	
Nutrients	
Other Chemical requirements	

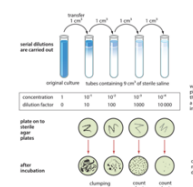
Culture media used for Microbes:

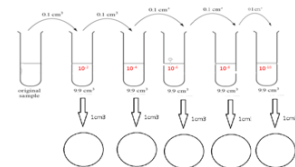
Defined Media	
Undefined Media	
Selective Media	

Serial Dilutions

Use the images below to help you describe:

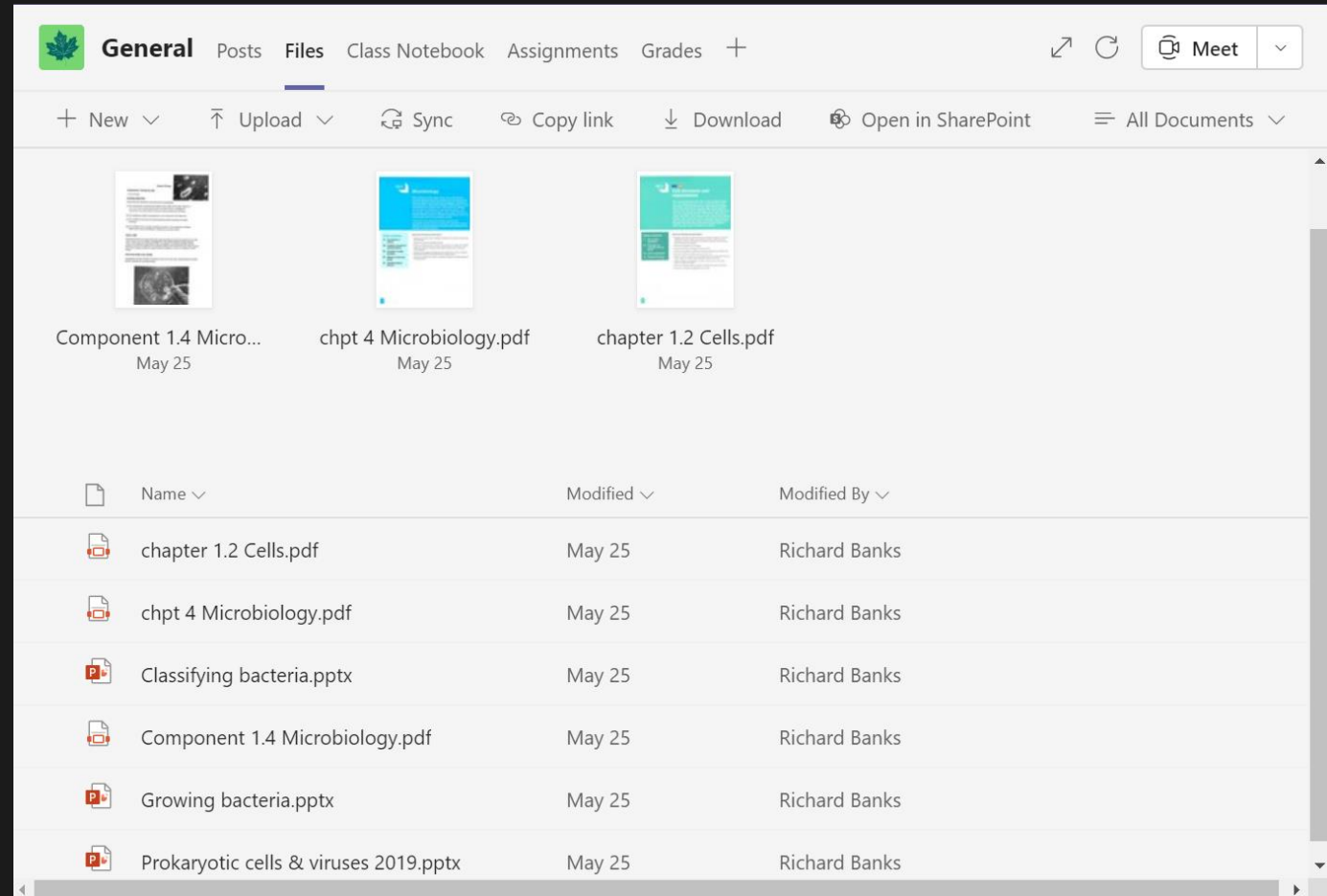
- How you would set up a x10 serial dilution series
- How you would set up a x100 serial dilution series
- How you would use a serial dilution series to estimate the number of viable microbes in a sample.





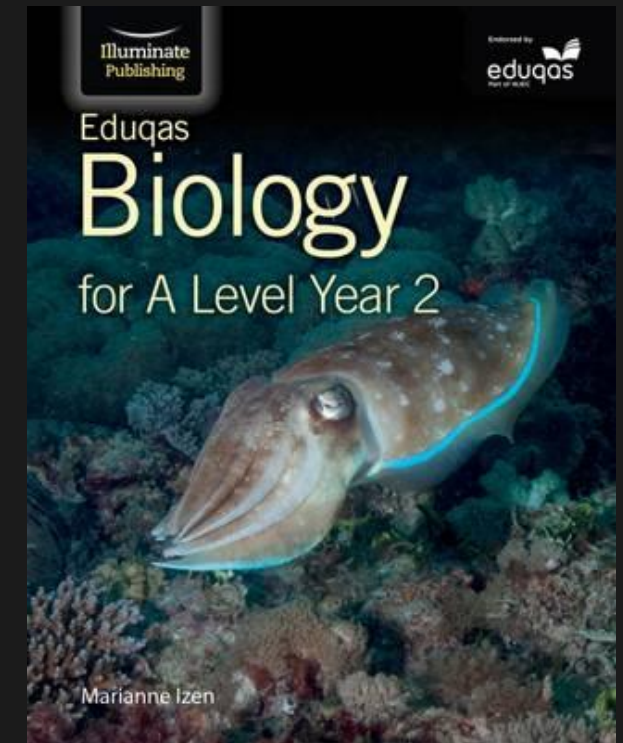
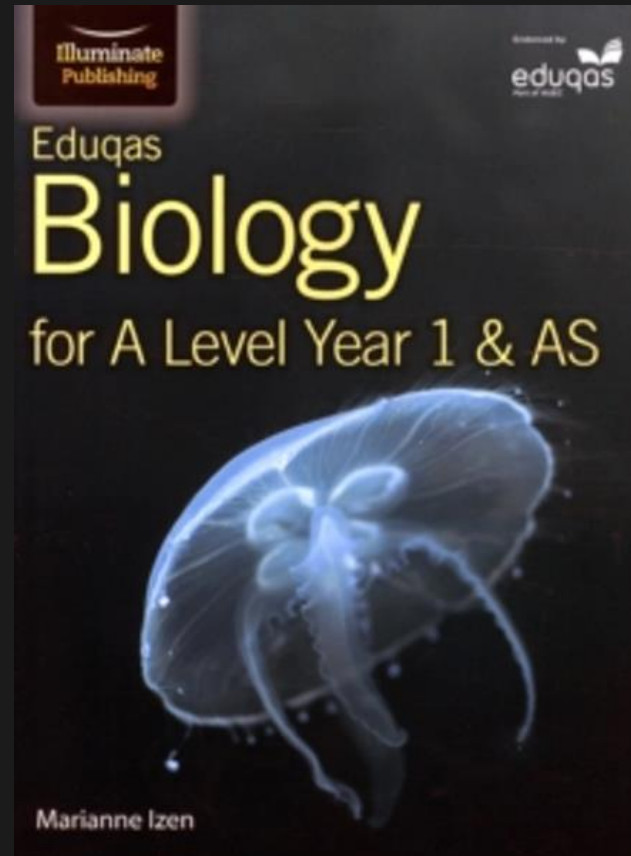
Other Resources

- We use Microsoft Teams and class resources are stored electronically in a class Team. Here you will find extra resources to help you with your studies.



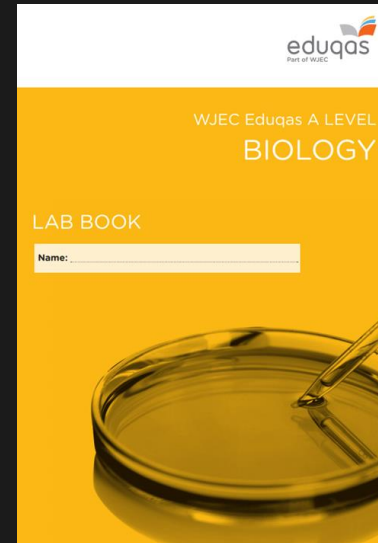
Other Resources

- We also have class copies of the course textbook available.



Practical tasks

- As you work towards your practical endorsement, there are a number of practical tasks to complete.
- Practical procedure questions also form a significant part of the assessment in the exam, so the lab time is an essential learning opportunity for you.



Q1.

- (a) A student used a dilution series to investigate the number of cells present in a liquid culture of bacteria.

Describe how he made a 1 in 10 dilution and then used this to make a 1 in 1000 dilution of the original liquid culture of bacteria.

(3)

Q1.

- (a) A student used a dilution series to investigate the number of cells present in a liquid culture of bacteria.

Describe how he made a 1 in 10 dilution and then used this to make a 1 in 1000 dilution of the original liquid culture of bacteria.

Mark schemes

Q1.

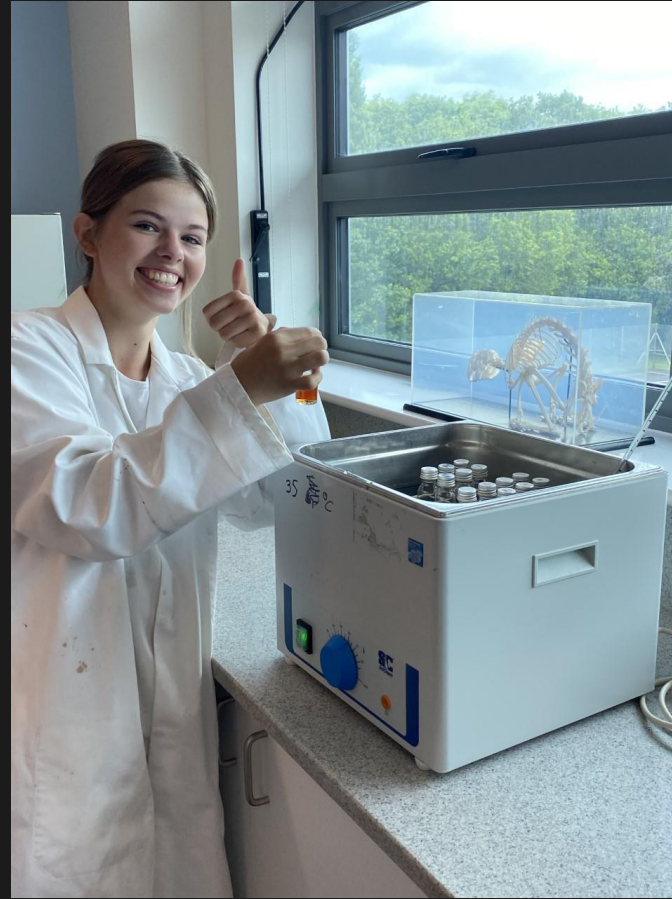
- (a) 1. Add 1 part (bacteria) culture to 9 parts (sterile) liquid (to make 10^{-1} dilution);
Accept water / nutrient / broth for liquid
2. Mix (well);
Accept stir
3. Repeat using 9 parts fresh (sterile) liquid and 1 part of 10^{-1} and 10^{-2} dilutions to make 10^{-3} dilution;
OR
Add 1 part 10^{-1} (suspension) to 99 parts (sterile) liquid (to make 10^{-3} dilution);
Accept water / nutrient / broth for liquid
Reject 1 part (undiluted) culture added to 999 parts liquid

Estimating the Number of Bacteria in a Yoghurt Drink

- This is the practical the first year students have just completed. They had to take a sample of a yoghurt drink and dilute it so they can culture the sample and then grow them on in a petri dish on specialist nutrient agar.

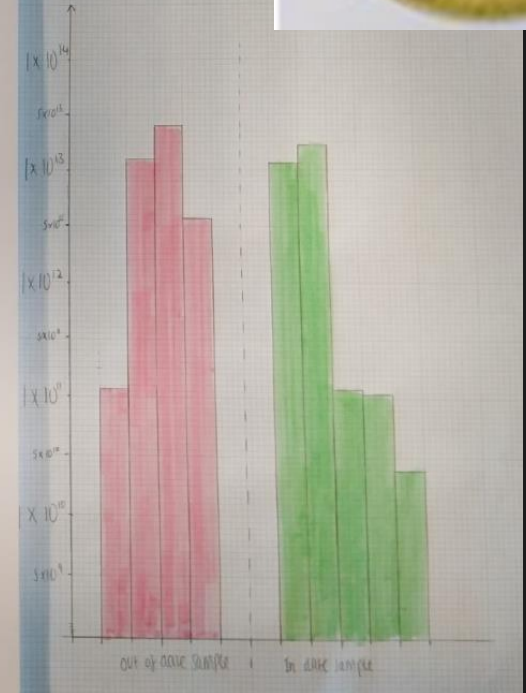
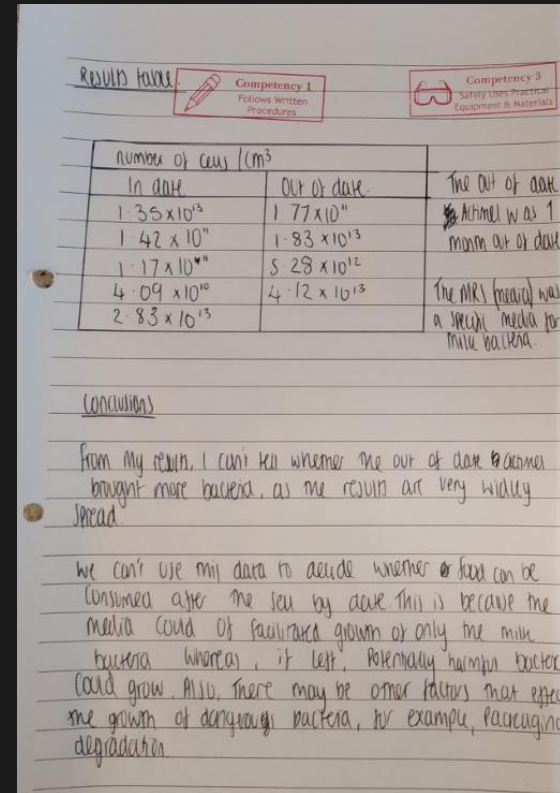


Estimating the Number of Bacteria in a Yoghurt Drink



Analysis of data

- Once the bacteria have incubated for a few days, they will have grown as discrete colonies and they can be counted and from that an estimation of the numbers of bacteria present in the sample can be made. This is then written up in a lab book and assessed against the practical competencies.

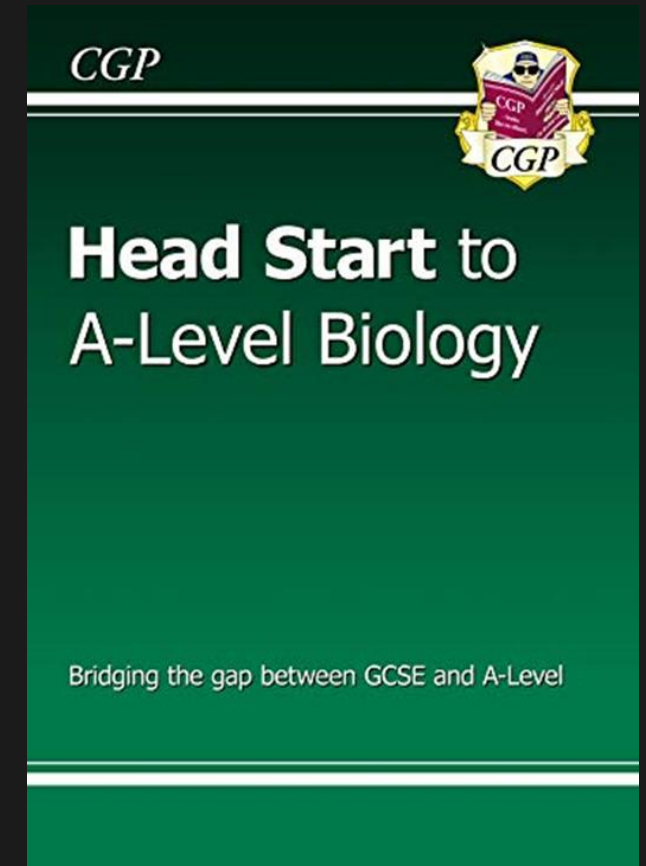
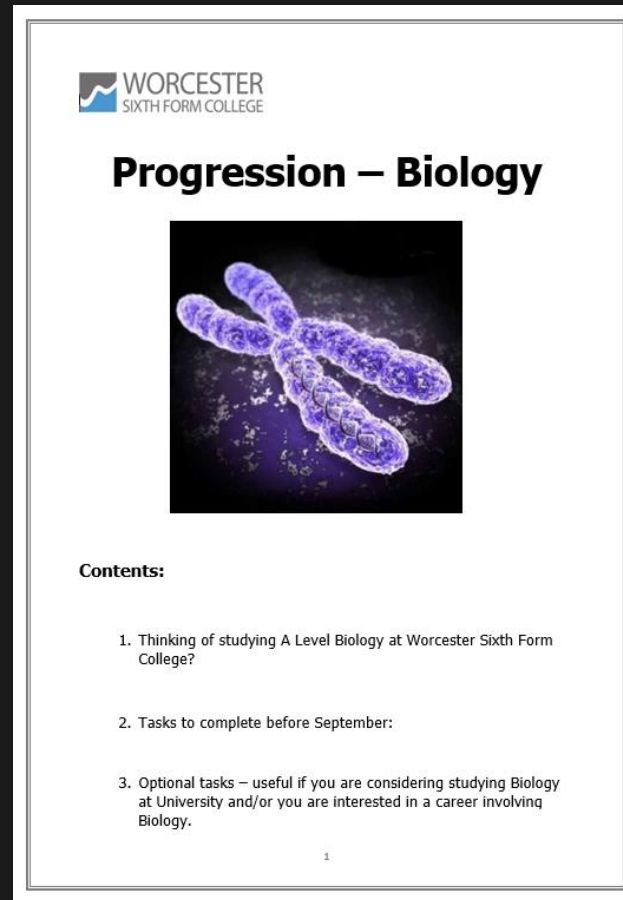




Summer Preparation

Summer Preparation

- There is the bridging task which has been sent to your schools.
- CGP Head start, activities to keep you in touch with your biology.





What to expect in the first few lessons.

What to expect in the first few lessons.

- We will start with some orientation lessons, helping you to find your way around the lab and Science department.
- We will focus on some practical lab skills and use the microscopes early on in the sequence of lessons.
- We will also get you to order your lab coat and safety goggles for future practicals.
- We will start with the Core concepts topics and in the first half term we will cover Cell Structure and Biochemistry topics.



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Core Concepts

CC 2 Cell structure and organisation (*A2 Core concepts)



Specification objectives:

1. Recognise, describe and explain the functions of cellular structures: the nucleus, including the nuclear envelope, chromatin and nucleolus, rough and smooth endoplasmic reticulum, mitochondria, chloroplasts, ribosomes, lysosomes, Golgi body, centrioles, plasmodesmata.
2. Describe how organelles are interrelated.
3. Describe the structure of prokaryotic cells and viruses.
4. Describe the similarities and differences between prokaryotic and eukaryotic cells.
5. Describe the differences between plant and animal cells.
6. Explain the levels of organisation of living organisms and the meanings of the terms 'tissue', 'organ' and 'system', giving examples in plants and animals.
7. Interpret drawings and photographs of plant and animal cells as seen using electron and light microscopes.
8. Know how to calibrate a light microscope and determine the sizes of structures.
9. Know how to calculate the magnification of an image.

Suggested independent learning tasks

1. Complete the key words table in the pack.
2. Complete the zigzags at the back of the pack.
3. Make a poster to show the differences between eukaryotic (animal and plant), prokaryotic cells and viruses.
4. Complete the questions in chapter 2 in your textbook.

Maths skills covered

Converting between units of measurement

Calculating the volume of a cell



**Lab coats
must be worn
in this area**



Progression- What can I do with A level Biology?

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- These are a list of Biology related degree courses that students followed after leaving Worcester Sixth Form in 2019 & 2020:
- Biology, Biomedical Science, Marine Biology.
- Biochemistry, Human Biology, Natural Sciences, Paleo-evolution.
- Medicine, Dentistry, Nursing, Physiotherapy, Radiography, Occupational Therapy.
- Dietetics/nutrition.
- Veterinary Science.

Skills development

- Analytical thinking, problem solving.
- Application of knowledge. Applying your knowledge from different areas.
- Development of mathematical skills.
- Developing IT skills.
- Working in a team.