

Transition to Advanced Level Biology

Contents:

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Reading List

The books below are all popular science books and great for extending your understanding of Biology.

Richard Dawkins: The Selfish Gene

The Blind Watchmaker. Unweaving the Rainbow Climbing Mount Improbable The Ancestor's Tale

Steve Jones: Y: The Descent of Men

In the Blood: God, Genes and Destiny

Almost Like a Whale: The 'Origin of Species' Updated The Language of the genes

Matt Ridley:

Genome: The Autobiography of a Species in 23 Chapters

The Red Queen: Sex and the Evolution of Human Nature

The Language of Genes

Francis Crick: Discoverer of the Genetic Code

Nature Via Nurture: Genes, Experience and What Makes Us Human

James Watson:

DNA: The Secret of Life

The Double Helix: Personal Account of the Discovery of the Structure of DNA

Lewis Thomas:

The Lives of a Cell: Notes of a Biology Watcher.

The Medusa and the Snail: More Notes of a Biology Watcher Barry Gibb: The Rough Guide to the Brain (Rough Guides Reference Titles)

Charles Darwin: The origin of species

Armand Marie Leroi: Mutants: On the Form, Varieties and Errors of the Human Body David

S. Goodsell: The Machinery of Life

Ernst Mayr: This Is Biology: The Science of the Living World

George C. Williams: Plan and Purpose in Nature

Steve Pinker: The Language Instinct

Edward O Wilson: The Diversity of Life

Richard Leaky: The Origin of Humankind

Bill Bryson: A Short History of Nearly Everything

Oliver Sachs: The Man Who Mistook His Wife For A Hat Daniel Chamovitz: What A Plant Knows

Websites

1. <http://www.ibiblio.org/virtualcell/index.htm>—An interactive cell biology site
2. <http://www.accessexcellence.org/RC/VL/GG> A website showing illustrations of many processes of biotechnology
3. <http://www.uq.oz.au/nanoworld>—Visit the world of electron-microscopy
4. <http://www.dnai.org/a/index.html>—Explore the genetic code
5. <http://nobelprize.org>—Details of the history of the best scientific discoveries
6. <http://nature.com>—The site of the scientific journal
7. <http://royalsociety.org> Podcasts, news and interviews with scientists about recent scientific developments
8. <http://www.nhm.ac.uk> – The London Natural History Museum’s website with lots of interesting educational material
9. <http://www.bmj.com>— The website of the British Medical Journal
10. http://www.bbc.co.uk/news/science_and_environment - The BBC news page for Science and the Environment

Film Recommendations

Gorillas in the Mist (1988)

Inherit the Wind (1960)

Andromeda Strain (1971)

Lorenzo’s Oil (1992)

Something the Lord Made (2004)

There are some great TV series and box sets available too, you might want to check out: Blue Planet, Planet Earth I and II,, Icarus, Blackfish, The Ascent of Man, Catastrophe, Frozen Planet, Life Story, The Hunt and Monsoon.

Tasks

Research activities:

The Big Picture is an excellent publication from the Wellcome Trust. Along with the magazine, the company produces posters, videos and other resources aimed at students studying for GCSEs and A Level. For each of the following topics, you are going to produce one page of notes.

Topic 1: The Cell

<http://bigpictureeducation.com/cell>

The cell is the building block of life. Each of us starts from a single cell, a zygote, and grows into a complex organism made of trillions of cells. In this issue, we explore what we know – and what we don't yet know – and what we don't yet know – about the cells that are the basis of us all and how they reproduce, grow, move, communicate and die.

Topic 2: The Immune System

<http://bigpictureeducation.com/immune>

The immune system is what keep us healthy in spite of many organisms and substances that can do us harm. In this issue, we explore how our bodies are designed to prevent potentially harmful objects from getting inside and what happens when bacteria, viruses, fungi or other foreign organism or substances breach these barriers.

Topic 3: Exercise, Energy and Movement

<http://bigpictureeducation.com/exercise-energy-and-movement>

All living things move. Whether it's a plant growing towards the sun, bacteria swimming away from a toxin or you walking home, anything alive must move to survive. For humans though, movement is more than just survival – we move for fun, to compete and to be healthy. In this issue we look at the biological systems that keep us moving and consider some of the biological systems that keep us moving and consider some of the psychological, social and ethical aspects of exercise and sport.

Topic 4: Populations

<http://bigpictureeducation.com/populations>

What's the first thing that pops into your mind when you read the word population? Most likely it's the ever-increasing human population on earth. The term population isn't just used to describe humans; it includes other animals, plants and microbes too. In this issue, we learn more about how populations grow, change and move, and why understanding them is so important.

Task 2: Research

1. DNA and the Genetic Code

In living organisms nucleic acids (DNA and RNA) have important roles and functions related to their properties. The sequence of bases in the DNA molecule determines the structure of proteins, including enzymes.

The double helix and its four bases store the information that is passed from generation to generation. The sequence of the base pairs adenine, thymine, cytosine and guanine tell ribosomes in the cytoplasm how to construct amino acids into polypeptides and produce every characteristic we see. DNA can mutate leading to diseases including cancer and sometimes anomalies in the genetic code are passed from parents to babies in diseases such as cystic fibrosis, or can be developed in unborn fetuses such as Downs Syndrome.

Read the information on these websites:

<http://www.bbc.co.uk/education/guides/z36mmp3/revision>

<http://www.s-cool.co.uk/a-level/biology/dna-and-genetic-code>

And take a look at these videos: <http://ed.ted.com/lessons/the-twisting-tale-of-dna-judith-hauck> <http://ed.ted.com/lessons/where-do-genes-come-from-carl-zimmer>

Produce a wall display to put up in your classroom in September. You might make a poster or do this using PowerPoint or similar. Your display should use images, keywords and simple explanations to:

- Define gene, chromosome, DNA and base pair
- Describe the structure and function of DNA and RNA
- Explain how DNA is copied in the body
- Outline some of the problems that occur with DNA replication and what the consequences of this might be.

2. Evolution

Transfer of genetic information from one generation to the next can ensure continuity of species or lead to variation within a species and possible formation of new species. Reproductive isolation can lead to accumulation of different genetic information in populations potentially leading to formation of new species (speciation). Sequencing projects have read the genomes of organisms ranging from microbes and plants, to humans. This allows the sequences of the proteins that derive from the genetic code to be predicted. Gene technologies allow study and alteration of gene function in order to better understand organism function and to design new industrial and medical

processes.

Read the information on these websites (you could make more Cornell notes if you wish):

<http://www.bbc.co.uk/education/guides/z237hyc/revision/4>

<http://www.s-cool.co.uk/a-level/biology/evolution>

And take a look at these videos:

<http://ed.ted.com/lessons/how-to-sequence-the-human-genome-mark-j-kiel>

<http://ed.ted.com/lessons/the-race-to-sequence-the-human-genome-tien-nguyen>

Produce a one page revision guide for an Year 12 Biology student that recaps the key words and concepts in this topic. Your revision guide should:

- Describe speciation
- Explain what a genome is
- Give examples of how this information has already been used to develop new treatments and technologies.

3. Biodiversity

The variety of life, both past and present, is extensive but the biochemical basis of life is similar for all living things. Biodiversity refers to the variety and complexity of life and may be considered at different levels. Biodiversity can be measured, for example, within a habitat or at the genetic level. Classification is a means of organising the variety of life based on relationships between organisms and is built around the concept of species. Originally classification systems were based on observable features but more recent approaches draw on a wider range of evidence to clarify relationships between organisms. Adaptations of organisms to their environments can be behavioural, physiological and anatomical.

Adaptation and selection are major factors in evolution and make a significant contribution to the diversity of living organisms.

Read the information on these websites (you could make more Cornell notes if you wish):

<http://www.scool.co.uk/alevel/biology/ecological-concepts>

<http://www.s-cool.co.uk/a-level/biology/classification>

And take a look at these videos:

<http://ed.ted.com/lessons/why-is-biodiversity-so>

[important-kim-preshoff](http://ed.ted.com/lessons/can-wildlife-adapt-to-climate-change-erin-eastwood)

<http://ed.ted.com/lessons/can-wildlife-adapt-to-climate-change-erin-eastwood>

Write a persuasive letter to an MP, organisation or pressure group promoting conservation to maintain biodiversity.

Your letter should:

- Define what is meant by species and classification
- Describe how species are classified
- Explain one way scientists can collect data about a habitat, giving an example
- Explain adaptation and how habitat change may pose a threat to niche species.

4. Exchange and Transport

Organisms need to exchange substances selectively with their environment and this takes place at exchange surfaces. Factors such as size or metabolic rate affect the requirements of organisms and this gives rise to adaptations such as specialised exchange surfaces and mass transport systems. Substances are exchanged by passive or active transport across exchange surfaces. The structure of the plasma membrane enables control of the passage of substances into and out of cells.

Read the information on these websites:

<http://www.s-cool.co.uk/a-level/biology/gas-exchange><http://www.s-cool.co.uk/a-level/biology/nutrition-and-digestion/revise-it/human-digestive-system>

And take a look at these videos: <http://ed.ted.com/lessons/insights-into-cell-membranes-via-dish-detergent-ethan-perlstein> <http://ed.ted.com/lessons/what-do-the-lungs-do-emma-bryce>

Create a poster or display to go in your classroom in September. Your poster should either: compare exchange surfaces in mammals and fish, or compare exchange surfaces in the lungs and the intestines. You could use a Venn diagram to do this.

Your poster should:

- Describe diffusion, osmosis and active transport
- Explain why oxygen and glucose need to be absorbed and waste products removed
- Compare and contrast your chosen focus.

5. Cells

The cell is a unifying concept in biology, you will come across it many times during your two years of A level study. Prokaryotic and eukaryotic cells can be distinguished on the basis of their structure and ultrastructure. In complex multicellular organisms, cells are organised into tissues, tissues into organs and organs into systems. During the cell cycle genetic information is copied and passed to daughter cells. Daughter cells formed during mitosis have identical copies of genes while cells formed during meiosis are not genetically identical.

Read the information on these websites:

<http://www.s-cool.co.uk/a-level/biology/cells-and-organelles>

<http://www.bbc.co.uk/education/guides/zvjycdm/revision>

And take a look at these videos:

<https://www.youtube.com/watch?v=gcTuQpuJyD8>

<https://www.youtube.com/watch?v=L0k-enzoeOM>

<https://www.youtube.com/watch?v=qCLmR9-YY7o>

Produce a one page revision guide to share with your class in September summarising one of the following topics: Cells and Cell Ultrastructure, Prokaryotes and Eukaryotes, or Mitosis and Meiosis.

Whichever topic you choose, your revision guide should include:

- Key words and definitions
- Clearly labelled diagrams
- Short explanations of key ideas or processes.

6. Biological Molecules

Biological molecules are often polymers and are based on a small number of chemical elements. In living organisms carbohydrates, proteins, lipids, inorganic ions and water all have important roles and functions related to their properties. DNA determines the structure of proteins, including enzymes. Enzymes catalyse the reactions that determine structures and functions from cellular to whole-organism level. Enzymes are proteins with a mechanism of action and other properties determined by their tertiary structure. ATP provides the immediate source of energy for biological processes.

Read the information on these websites :

<http://www.s-cool.co.uk/a-level/biology/biological->

[molecules-and-enzymes](#)

<http://www.bbc.co.uk/education/guides/zb739j6/revision>

And take a look at these videos:

[https://www.youtube.com/watch](https://www.youtube.com/watch?v=H8WJ2KENIK0)

[?v=H8WJ2KENIK0](https://www.youtube.com/watch?v=H8WJ2KENIK0)

<http://ed.ted.com/lessons/activation-energy-kickstarting-chemical-reactions-vance-kite>

Krabbe disease occurs when a person doesn't have a certain enzyme in their body. The disease effects the nervous system. Write a letter to a GP or a sufferer to explain what an enzyme is.

Your poster should:

- Describe the structure of an enzyme
- Explain what enzymes do inside the body

7. Ecosystems

Ecosystems range in size from the very large to the very small. Biomass transfers through ecosystems and the efficiency of transfer through different trophic levels can be measured. Microorganisms play a key role in recycling chemical elements.

Ecosystems are dynamic systems, usually moving from colonisation to climax communities in a process known as succession. The dynamic equilibrium of populations is affected by a range of factors. Humans are part of the ecological balance and their activities affect it both directly and indirectly. Effective management of the conflict between human needs and conservation help to maintain sustainability of resources.

Read the information on these websites:

<http://www.bbc.co.uk/education/guides/z7vqtfr/revision>

<http://www.s-cool.co.uk/a-level/biology/ecological-concepts>

And take a look at these videos:

[https://www.youtube.com/watch](https://www.youtube.com/watch?v=jZKIHe2LDP8)

[?v=jZKIHe2LDP8](https://www.youtube.com/watch?v=jZKIHe2LDP8)

[https://www.youtube.com/watch](https://www.youtube.com/watch?v=E8dkWQVFAoA)

[?v=E8dkWQVFAoA](https://www.youtube.com/watch?v=E8dkWQVFAoA)

Produce a newspaper or magazine article about one ecosystem (e.g. the arctic, the Sahara, the rainforest, or something closer to home like your local woodland, nature reserve or shore line).

Your article should include:

- Key words and definitions
- Pictures or diagrams of your chosen ecosystem.
- A description of the changes that have occurred in this ecosystem
- An explanation of the threats and future changes that may further alter this ecosystem.

8. Control Systems

Homeostasis is the maintenance of a constant internal environment. Negative feedback helps maintain an optimal internal state in the context of a dynamic equilibrium. Positive feedback also occurs. Stimuli, both internal and external, are detected leading to responses. The genome is regulated by a number of factors. Coordination may be chemical or electrical in nature

Read the information on these websites:<http://www.s-cool.co.uk/a-level/biology/homeostasis>
<http://www.bbc.co.uk/education/topics/z8kxpv4>

And take a look at these videos:

<https://www.youtube.com/watch?v=x4PPZCLnVkA>
<https://www.youtube.com/watch?v=x4PPZCLnVkA>

Produce a poster to display in your classroom in September summarising one of the following topics: Temperature Control, Water and the Kidneys, Glucose, or The Liver.

Your poster should include:

- Key words and definitions
- Clearly labelled diagrams
- Short explanations of key ideas or processes.

9. Energy for Biological Processes

In cellular respiration, glycolysis takes place in the cytoplasm and the remaining steps in the mitochondria. ATP synthesis is associated with the electron transfer chain in the membranes of mitochondria and chloroplasts in photosynthesis energy is transferred to ATP in the light- dependent stage and the ATP is utilised during synthesis in the light-independent stage.

Read the information on these websites:

<http://www.bbc.co.uk/education/guides/zcxrd2p/revision>
<http://www.s-cool.co.uk/a-level/biology/respiration>

And take a look at these videos:

https://www.youtube.com/watch?v=00jbG_cfGuQ

<https://www.youtube.com/watch?v=2f7YwCtHcgk>

Produce an A3 annotated information poster that illustrates the process of cellular respiration and summarises the key points.

Your poster should include:

- Both text and images
- Be visually stimulating
- Key words and definitions
- Clearly labelled diagrams
- Short explanations of key ideas or processes

10. Scientific and Investigative Skills

As part of your A level you will complete a practical assessment. This will require you to carry out a series of practical activities as well as planning how to do them, analysing the results and evaluating the methods. This will require you to: use appropriate apparatus to record a range of quantitative measurements (to include mass, time, volume, temperature, length and pH), use appropriate instrumentation to record quantitative measurements, such as a colorimeter or photometer, use laboratory glassware apparatus for a variety of experimental techniques to include serial dilutions, use of light microscope at high power and low power, including use of a graticule, produce scientific drawing from observation with annotations, use qualitative reagents to identify biological molecules, separate biological compounds using thin layer/paper chromatography or electrophoresis, safely and ethically use organisms, use microbiological aseptic techniques, including the use of agar plates and broth, safely use instruments for dissection of an animal organ, or plant organ, use sampling techniques in fieldwork.

Produce a glossary for the following key words:

accuracy, anomaly, calibration, causal link, chance, confounding variable, control experiment, control group, control variable, correlation, dependent variable, errors, evidence, fair test, hypothesis, independent, null hypothesis, precision, probability, protocol, random distribution, random error, raw data, reliability, systematic error, true value, validity, zero error,

Task 3

Science communication is essential in the modern world and all the big scientific companies, researchers and institutions have their own social media accounts. Here are some of our top tips to keep up to date with developing news or interesting stories:

Follow on Twitter:



- A level Biology – A hub for GCSE and A Level Biology students
@flagellum_bio
- A Level Biology – alevelbiology.co.uk provides resources for AQA, OCR and Edexcel A-Level Biology. @alevelbiologyuk
- David Chalk –daily revision tips for Biology
@teacherchalky1
- Understanding Biology – news stories relating to A Level knowledge and understanding
- @a_level_biology
- Sci Curious – feed from writer and Bethany Brookshire tweeting about good, bad and weird neuroscience
- @scicurious
- Carl Zimmer – Science writer Carl blogs about the life sciences @carlzimmer
- Virginia Hughes – science journalist and blogger for National Geographic, keep up to date with neuroscience, genetics and behaviour
- @virginiahughes
- Maryn McKenna – science journalist who writes about antibiotic resistance @marynmck
- Molecular Biology - latest news, research, books and journals in molecular biology, cell biology, genetics, stem cells, cancer and biotechnology
- @molecular

Find on Facebook:



- Nature - the profile page for nature.com for news, features, research and events from Nature Publishing Group
- Marine Conservation Institute – publishes the latest science to identify important marine ecosystems around the world.

- National Geographic - since 1888, National Geographic has travelled the Earth, sharing its amazing stories in pictures and words.
- Science News Magazine - Science covers important and emerging research in all fields of science.
- BBC Science News - The latest BBC Science and Environment News: breaking news, analysis and debate on science and nature around the world.

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. A suggested mark scheme is provided for you to check your answers.

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.

- What is meant by the term 'species'?

.....
(2)

- Describe how a new species may arise:

.....

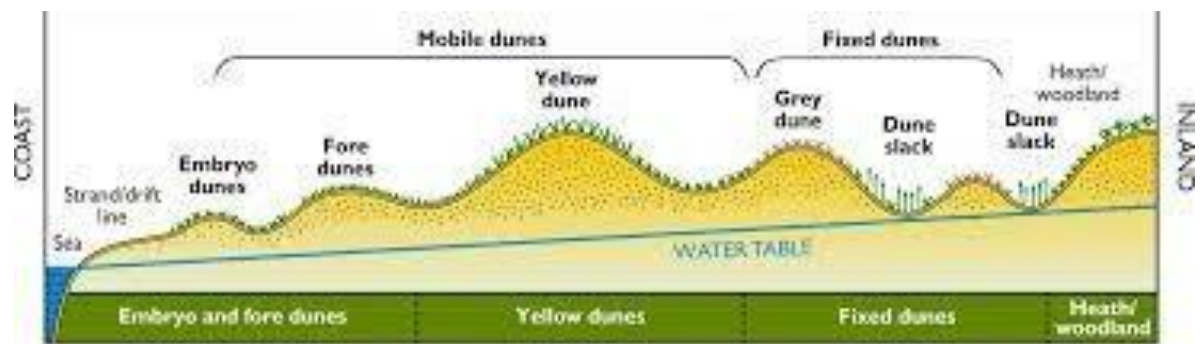
.....

.....

(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:



- 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.

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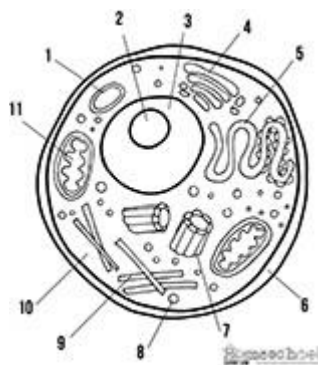
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(6)

4. Every living organism is made of cells.



a) Label the following parts of the animal cell:

2

5

8

(3)

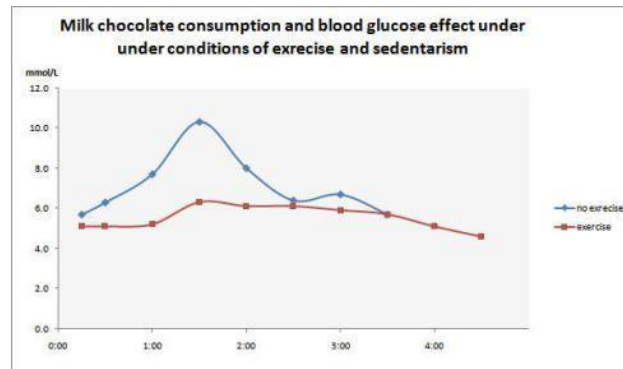
b) Describe how the structure of the cell membrane is related to its function?

.....

.....

.....
(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:



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

.....
(1)

- (b) Explain 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.

.....

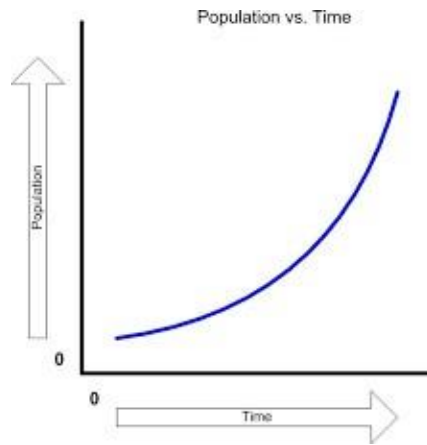
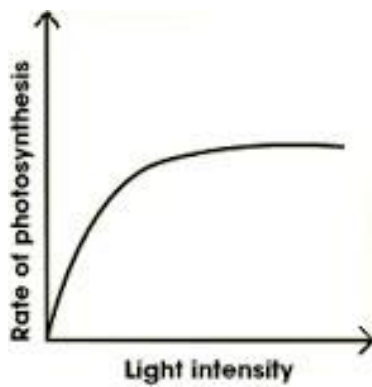
.....

.....

.....

(3)

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



.....

.....

.....

..... (4)

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