

NSW INDEPENDENT TRIAL EXAMS – 2009
BIOLOGY HSC TRIAL EXAMINATION
MARKING GUIDELINES

Section I – Part A

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B	D	A	B	C	B	C	D	C	D	B	A	A	C	D

Section I – Part B

Question 16

Criteria	Marks
Correctly explains how the Darwin/Wallace theory of natural selection could account for the provided example of divergent evolution.	3

Answer may include:

Brown bears and Polar bears illustrate divergent evolution.

-a group of Brown bears became geographically isolated from the rest of the population (1 mark).

Due to new selection pressures acting (1 mark), certain characteristics were selected for, such as:

- lighter coat for camouflage in snow and ice,
- higher body fat to keep warm and
- thus adapted bears **survived to reproduce**.

The isolated group evolved via natural selection into Polar bears.

Question 17(a)

Criteria	Marks
Correctly names ONE Australian endotherm and ONE Australian ectotherm studied.	2

Answer may include:

An example of an endotherm is the red kangaroo (1 mark); and an example of an ectotherm is the *bearded dragon* lizard (1 mark).

Question 17(b)

Criteria	Marks
Correctly completes the table by: • describing a response of each of these named animals to a change in ambient temperature, and • explaining how each response assists in temperature regulation for each of the named animals.	4

Answer will vary depending on the species chosen in part (a).

IMPORTANT NOTE: ecto/endo answers may be similar.

	Response to increase in environmental temperature	Way in which the response assists in regulating body temperature.
Ectotherm eg: <i>bearded dragon</i>	Seeks shade, feeds during the night (nocturnal)	Attempts to maintain ideal metabolic rate behaviourally
Endotherm eg: <i>red kangaroo</i>	Licks paws for cooling via evaporation/seek shade, diurnal activity	Retains body temp at approximately 37 °C for metabolism

Question 18(a)

Criteria	Marks
Accurately defines <i>active transport</i> .	1

Answer may include: Active transport uses energy to move substances against a concentration gradient.

Question 18(b)

Criteria	Marks
Correctly explains why diffusion and osmosis are inadequate in removing nitrogenous wastes.	2

Answer may include: Diffusion and osmosis are both examples of passive transport and therefore are too slow for the normal functioning of the body.

Osmosis only deals with the movement of water not the nitrogenous wastes.

Question 18(c)

Criteria	Marks
Correctly describes a mechanism that marine animals use to help maintain water balance.	1

Answer may include: Drink large quantities of water; excrete salt through their gills or salt glands.

Question 19(a)

Criteria	Marks
Student outlines the procedure that they used.	1

Answer will vary depending on the investigation carried out.

Question 19(b)

Criteria	Marks
Student describes any results that they obtained.	1

Answer will vary depending on the investigation carried out.

Question 19(c)

Criteria	Marks
Student suggests how they could improve the reliability of their results.	1

Answer will vary depending on the investigation carried out. eg. control variables, replicates

Question 19(d)

Criteria	Marks
Student describes ONE limitation of the model when using it to explain the process of natural selection.	1

Answer will vary depending on the investigation carried out. eg. visual aid vs 'not a real representation'

Question 20(a)

Criteria	Marks
Correctly explains why all of the daughters in the first generation are "carriers" of haemophilia.	1

Answer may include: All daughters must receive one "X" chromosome from each parent. Therefore they must receive one of their X chromosomes from the father who is carrying the haemophilia gene (X').

Question 20(b)

Criteria	Marks
Correctly explains why the inheritance of this gene does not produce Mendelian ratios.	1

Answer may include: Mendel: the factors he chose showed simple dominant/recessive characteristics. However, sex-linked genes do not display the phenotype ratios predicted by Mendelian genetics.

Question 20(c)

Criteria	Marks
Correctly outlines ways in which the environment may effect the expression of this gene in the human population.	2

Answer may include: Most individuals with haemophilia are males. If they die before they reach reproductive age due to environmental influences e.g. falling causing bleeds, accidents, etc, then the gene for haemophilia will be carried by females and rarely be expressed in the human population.

Improvement in medicine allows clotting factors to be produced artificially/obtained from blood donors.

Question 21

Criteria	Marks
Correctly explains why humans would hybridise crops such as wheat and maize.	3

Answer may include: Hybridisation definition/explanation –

- Hybridisation involves breeding two different species or different members of the same species to produce offspring with desirable characteristics.
- For example wheat has been hybridised to produce large heads, have resistance to disease, etc (1 mark).
- Farmers cross plants with desirable characteristics e.g. higher yield (1 mark).
- This produces new plants that yield more grain, disease resistance, etc (1 mark).

Question 22(a)

Criteria	Marks
Student provides a good explanation of how their chosen strategy has controlled or prevented disease. The answer must be appropriate to the disease mentioned.	2

Answer will vary depending on the strategy chosen.

For example, public health programs such as immunization may limit the prevalence of disease.

Question 22(b)

Criteria	Marks
Correctly explains why the emphasis has changed from treatment and control of plant and animal diseases to management and prevention.	2

Answer may include:

- Preventing disease is preferable to treating an outbreak.
- Genetically modified crops have been produced so that the plants do not have to be sprayed for diseases and pests.
- Quarantine restrictions have been used to manage plant and animal diseases or prevent them from spreading.
- These measures are also financially sound. It costs far less to prevent diseases from occurring than it costs to control and treat them.

Question 23(a)

Criteria	Marks
Correctly outlines the evidence that led to the Beadle and Tatum <i>one gene one protein</i> hypothesis.	2

Answer may include:

- Beadle and Tatum used bread mould to investigate nutritional mutations.
- They irradiated bread mould with X-rays and produced mould that was unable to produce a specific amino acid.
- The mould was unable to grow unless the amino acid was added.
- They showed that genes controlled biochemical processes.
- Their hypothesis was that for each gene there was one enzyme or protein.

Question 23(b)

Criteria	Marks
Correctly explains why the hypothesis was later changed to <i>one gene one polypeptide</i> .	1

Answer may include:

- The enzymes that they studied consisted of one polypeptide, but many enzymes consist of chains of polypeptides.
- Therefore, the hypothesis was changed to the *one gene, one polypeptide* hypothesis.

Question 23(c)

Criteria	Marks
Correctly explains how the results of the experiment performed by Beadle and Tatum can be used as evidence for the mutagenic nature of radiation.	2

Answer may include: They used x-rays to induce mutations in the DNA of bread mould, causing a permanent and harmful change. This is evidence that X-rays induce mutations in DNA.

Question 24

Criteria	Marks
Accurately discusses some of the difficulties in defining the terms <i>disease</i> and <i>health</i> .	3

Answer may include: The difficulties of defining the terms health and disease could include:

- It's possible for a person to be healthy and have a disease at the same time;
- The terms are used in general conversation and have different meanings to the scientific definitions;
- Health varies with age, sex, or even on a daily basis;
- Disease can cover a broad range of descriptions such as minor ailments, cuts, toothache, etc.

Any three points of the above - 3 marks.

Question 25(a)

Criteria	Marks
Correctly names the model.	1

Answer may include: 'Lock and key' hypothesis.

Question 25(b)

Criteria	Marks
Correctly explains the role of enzymes in metabolism.	3

Answer may include: Enzymes are biological *catalysts*. They reduce the activation energy for some chemical reactions. They are not consumed by the reaction and can be used over again.

Question 25(c)

Criteria	Marks
Discusses the usefulness of models such as the example given to explain biological concepts.	2

Answer may include: For example, models are good for giving visual representation of concepts making them easier to understand. Conversely they have limitations in that they don't always show the complete picture, etc.

Question 26(a)

Criteria	Marks
Names a disease that can occur in humans from an imbalance of microflora.	1

Answer may include: Thrush/Candidiasis, some types of eczema.

Question 26(b)

Criteria	Marks
Correctly lists any symptoms that the disease named in (a) could produce.	1

Answer may include: Itching, redness, soreness, discharge.

Question 26(c)

Criteria	Marks
Correctly names the type of pathogen that causes this disease.	1

Answer may include: Yeast/fungi.

Question 26(d)

Criteria	Marks
Correctly identifies a defence barrier that normally prevents the entry of disease and explains how it protects the body.	2

Answer may include:

- Mucous membranes/chemical barriers - acidic environment prevents yeasts from overpopulating
- These yeasts are sensitive to low pH.
- Any change in the pH balance could allow them to overpopulate and cause problems.

Question 27

Criteria	Marks
Accurately explains the adaptive advantage of haemoglobin.	3

Answer may include:

- Haemoglobin is an iron-based molecule that has a high affinity for oxygen.
- Oxygen binds loosely to haemoglobin to form oxyhaemoglobin.
- The presence of haemoglobin in red blood cells increases the blood's capacity to carry and transport oxygen.
- Organisms with blood containing haemoglobin are able to deliver oxygen to cells more efficiently than other organisms with blood that has no haemoglobin.
- This allows them to more efficiently carry out respiration and metabolic activities.

Question 28(a)

Criteria	Marks
Outlines the main components of the immune response.	6

Answer may include: The main components of the immune response are:

- *T-cells* that are a kind of lymphocyte. They are passed through the thymus gland. Some produce toxic substances that destroy cells that have been invaded by a virus. Others help the B-cells to divide rapidly.
- *B-cells* a kind of lymphocyte produced in the bone marrow. When it recognises an antigen, it divides repeatedly to produce a mass of identical cells that work as antibody producers.
- *Antibodies* are proteins that the body produces when it detects antigens. Each antibody is specific for its own particular type of antigen. They clump together onto antigens so that they can be more easily recognised and destroyed by macrophages

1 mark each for name and 1 mark for each correct role.

Question 28(b)

Criteria	Marks
Correctly outlines the role of TWO types of T lymphocyte.	4

Answer may include:

- *Killer T-cells* attack and destroy macrophages that have engulfed an antigen. They produce cytotoxins.
- *Helper T-cells* secrete chemicals that stimulate cloning in B and T cells.
- *Memory T-cells* remain in the body and reactivate quickly with subsequent infections by the same antigen.
- *Suppressor T-cells* stop the reaction when the antigen is destroyed.

2 marks for correct names of two and 2 marks for the corresponding correct roles.

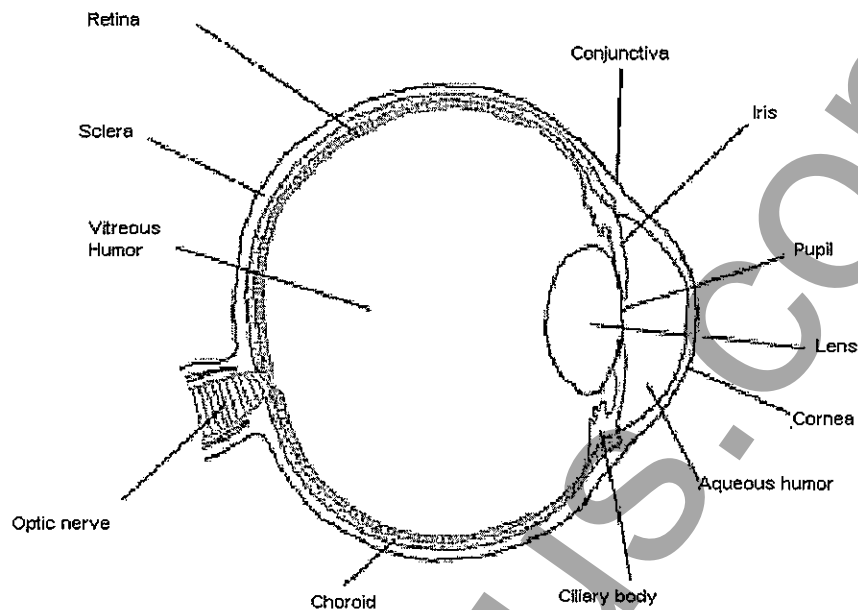
Section II

COMMUNICATION

Question 29(a)(i)

Criteria	Marks
Labels THREE parts of the eye.	3
Labels TWO parts of the eye.	2
Labels ONE part of the eye.	1

Answer may include: Any three of the following labels:



Question 29(a)(ii)

Criteria	Marks
Provides a description of the structure and function of ONE of the parts of the eye labelled on the diagram.	2 – 3
Provides some information about the structure and/or function of ONE of the parts of the eye labelled on the diagram.	1

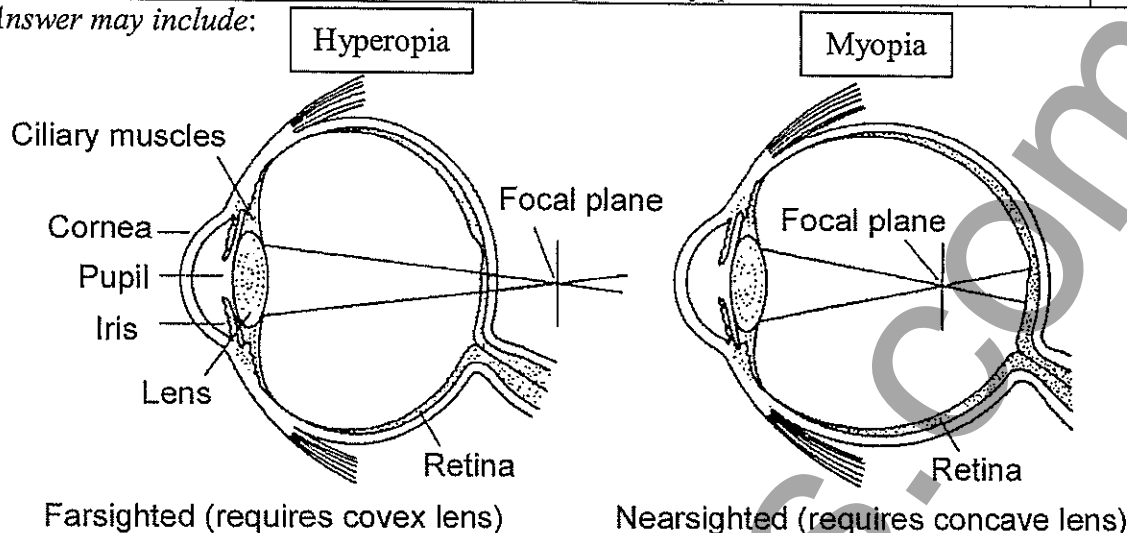
Answer will depend on the component selected, however, some information about the retina has been provided.

- The retina contains light sensitive photoreceptor cells called rods and cones.
- The retina is considered part of the central nervous system.
- The optics of the eye create an image of the visual world on the retina, which serves much the same function as the film in a camera.
- Light striking the retina initiates a cascade of chemical and electrical events that ultimately trigger nerve impulses.
- These are sent to various visual centers of the brain through the fibers of the optic nerve.

Question 29(b)(i)

Criteria	Marks
- Distinguishes between hyperopia and myopia. - Provides accurate diagrams.	5 – 6
- Provides some information about hyperopia and myopia. - Provides diagrams.	3 – 4
Provides some relevant information about hyperopia and myopia.	1 – 2

Answer may include:



Myopia is short-sightedness:

- results from an elongated eyeball
- distant objects are not seen as clearly because the light from them is focused at a point in front of the retina.

Hyperopia is the opposite of myopia:

- It is the result of either a short eyeball or an insufficient ability of accommodation.
- Distant objects can be viewed easily, but close objects are focused behind the retina.

Question 29(b)(ii)

Criteria	Marks
Identifies how BOTH conditions can be corrected.	2
Identifies how ONE of the conditions can be corrected.	1

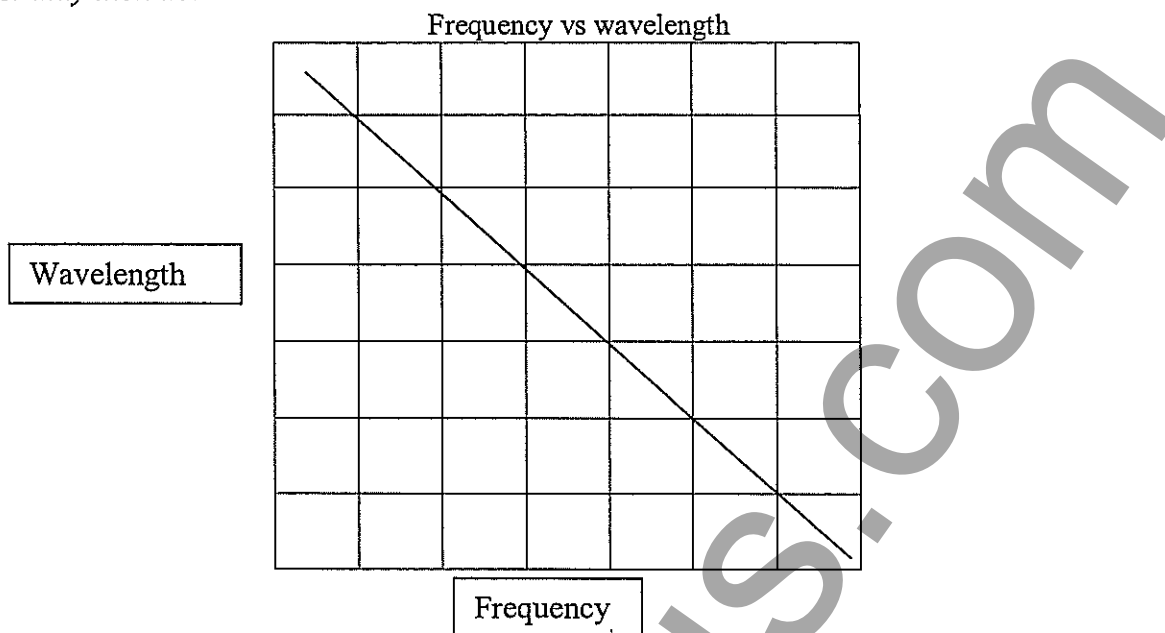
Answer may include:

- Myopia can be corrected with a concave lens;
- Hyperopia can be corrected with a convex lens;
- Laser surgery.

Question 29(c)(i)

Criteria	Marks
Provides a graphical representation of the relationship between frequency and wavelength. Appropriately labels the graph.	2
Provides a graphical representation of the relationship between frequency and wavelength but does not label the graph.	1

Answer may include:

**Question 29(c)(ii)**

Criteria	Marks
Correctly identifies the relationship.	1

Answer may include: The longer the wavelength the lower the pitch.

Question 29(c)(iii)

Criteria	Marks
Provides an accurate outline of the role of the sound shadow cast by the head in the location of sound.	2 – 3
Provides some information about the role of the sound shadow cast by the head in the location of sound.	1

Answer may include:

- Humans can locate the direction of a sound because the sound is heard more loudly by the ear nearest to it and also fractionally earlier.
- The brain uses reflections from within the pinna to determine the direction of sounds.
- Sounds from in front and beside are enhanced on their way to the auditory canal. Sounds from behind are reduced.

Question 29(d)

Criteria	Marks
- Provides an accurate outline of the structure of neurones. - Identifies the function of neurones.	5
- Briefly outlines the structure of neurones. - Provides some information about the function of neurones.	3 – 4
Provides some information about the structure and/or function of neurones.	1 – 2

Answer may include:

- A neurone consists of an input region of branching dendrites. The dendrites provide a large surface area that collects signals.
- The cell body is surrounded by dendrites and contains a nucleus and organelles.
- The axon leads out to the cell body and passes the signals to the synapse (gap) between the neurone and the next neurone.
- Nerves carry electrical messages from receptors to the brain and from the brain to effectors, such as muscles and glands.

BIOTECHNOLOGY**Question 30(a)(i)**

Criteria	Marks
Identifies the THREE essentials of gene manipulation.	3
Identifies TWO essentials of gene manipulation.	2
Identifies ONE essential of gene manipulation.	1

Answer may include:

- Cutting and joining DNA;
- Monitoring the cutting and joining;
- Transforming hosts with recombinant DNA.

Question 30(a)(ii)

Criteria	Marks
Describes one of the essentials of gene manipulation.	2 – 3
Provides some relevant information about an essential of gene manipulation.	1

Answer may include: cutting and joining DNA.

- The DNA that is required is cut from a long strand of DNA (a chromosome), using a restriction enzyme.
- A plasmid (circular piece of DNA from bacteria) is cut open using the same restriction enzyme.
- The human gene that has been cut out is then mixed with the bacterial plasmids in a test tube.
- As they have been cut with the same enzyme, the cut ends of the plasmid and the end of the human gene match.
- DNA ligase is used to stick the ends together

Question 30(b)

Criteria	Marks
- Identifies ONE ethical issue associated with biotechnology. - Provides a comprehensive evaluation of the issue.	5
- Identifies ONE ethical issue associated with biotechnology. - Provides an adequate evaluation of the issue.	3 – 4
- Identifies ONE ethical issue associated with biotechnology. - Provides some relevant information about the issue.	1 – 2

Answer may include:

- Development of genetically modified organisms. Increased yield vs loss of biodiversity.
- Potentially increasing the allergenicity of otherwise safe foods.
- Animal cloning i.e. playing god; Dolly the sheep died at a young age from multiple health issues.
- Gene cloning i.e. 'designer' babies, loss of individuality.

Question 30(c)(i)

Criteria	Marks
Provides an accurate outline of the difference between DNA and RNA.	3
Provides some relevant information about the difference between DNA and RNA.	1 – 2

Answer may include:

- DNA is double stranded, RNA is single stranded;
- DNA contains deoxyribose sugar (the 2' carbon has no hydroxyl group). RNA has ribose sugar in its backbone. This makes RNA less stable;
- DNAs bases are T, A, G and C; in RNA thymine is replaced with uracil.

Question 30(c)(ii)

Criteria	Marks
Provides an accurate outline of how forensic scientists can use DNA analysis to identify people.	3
Provides some information of how forensic scientists can use DNA analysis to identify people.	1 – 2

Answer may include:

- Suitable samples are needed from the scene and need to be handled correctly.
- DNA analysis of the sample and analysis of suspect samples can be performed to prove innocence or guilt.
- This is done by using DNA markers.
- Individuals demonstrate distinct patterns or markers when the probes bind to sample DNA.
- The patterns formed by the sample can be compared to the evidence.
- The more common sites where the probe binds, the greater the chance that the samples came from the same person.

Question 30(d)

Criteria	Marks
Identifies an ancient Australian Aboriginal use of biotechnology.	1

Answer may include: Domesticating dingoes; using fire to germinate seeds, etc.

Question 30(e)

Criteria	Marks
Provides a comprehensive description of the application of biotechnology in ONE of the areas listed.	4 – 5
Provides a description of the application of biotechnology in ONE of the areas listed.	2 – 3
Provides some relevant information.	1

Answer may include:

- Details of the process;
- The organism or tissue involved;
- The outcome of the biotechnological process;
- Evaluates the efficiency of the process.

Question 30(f)

Criteria	Marks
Identifies the product of a fermentation process AND the microorganism responsible for this.	2
Identifies the product of a fermentation process.	1

Answer may include:

- Alcohol fermented from sugars by yeast.;
- Yogurt is fermented by certain bacteria.

GENETICS: THE CODE BROKEN?

Question 31(a)

Criteria	Marks
Identifies differences between gametic and somatic cells.	2
Identifies a difference between gametic and somatic cells.	1

Answer may include: Somatic cells are diploid (two of each chromosome); gametic cells are haploid (only have one set of each chromosome). Somatic cells are body cells; gametic cells are sex cells.

Question 31(b)

Criteria	Marks
• Provides a comprehensive discussion of the difference between dihybrid crosses of link and non-linked traits.	5
• Provides a discussion of the difference between dihybrid crosses of link and non-linked traits.	4
• Provides a description of a dihybrid cross, OR, • Provides a description of the difference between linked and non-linked traits.	3
• Provides some information about dihybrid crosses. OR, • Gene linkage	1 – 2

Answer may include:

Description of the following data:

F₁

	rf	rf
RF	Rfrf	Rfrf
RF	Rfrf	Rfrf

F₂ for linked genes

Rfrf x Rfrf

	RF	rf
RF	RFRF	Rfrf
rf	rFRF	rfrf

3:1 dominant : recessive phenotypes

F₂ for non linked genes

	RF	Rf	rF	Rf
RF	RFRF	RFRf	RFrF	RFrF
Rf	RfRF	RfRf	RfrF	Rfrf
rF	rFRF	rFRf	rFrF	rFrF
rf	rFRF	rfrf	rfrF	rfrf

Question 31(c)

Criteria	Marks
Provides a comprehensive explanation of how the use of recombinant DNA technology can identify the position of a gene on a chromosome.	4
Provides a brief explanation of how the use of recombinant DNA technology can identify the position of a gene on a chromosome.	2 – 3
Provides some relevant information about how the use of recombinant DNA technology can identify the position of a gene on a chromosome.	1

Answer may include:

- A probe is a sequence of DNA complementary to the gene or part of the gene that can be produced, cloned and labelled with fluorescent dye.
- This sequence is called a probe. Probes bond to single stranded DNA complementary to the probe.
- Because the probe will bind to the gene being located and is labelled with a fluorescent marker, viewing the coupled probe/gene under fluorescent light will allow the gene to be located.
- This can be used to determine the specific chromosome and where on the chromosome the gene is.

Question 31(d)

Criteria	Marks
Shows how germ line and somatic mutations differ.	2
Provides ONE relevant point.	1

Answer may include: Germ line mutations are passed on to the offspring as they occur in the sperm and ova of animals. In animals the somatic cells are distinct from germ cells. Somatic cells are body cells and mutations in these cells will not be passed on to the offspring.

Question 31(e)

Criteria	Marks
Describes the history of selective breeding of ONE species for agricultural purposes.	4
Outlines the history of selective breeding of ONE species for agricultural purposes.	2 – 3
Provides few of the major points in the history of selective breeding of ONE species for agricultural purposes.	1

Answer may include: Horses were wild before 3,500 BC.

- In the 2,000 years following they were used for war and then working on the land.
- Over time horses were bred for more specific tasks such as pulling carts, racing and jumping in a range of climates.
- This resulted in different domesticated breeds such as the draught horse.

Question 31(f)

Criteria	Marks
Provides a comprehensive description of a current use of gene therapy.	5
Provides a brief description of a current use of gene therapy.	3 – 4
Provides a basic outline of a current use of gene therapy.	1 – 2

Answer will vary but should refer to a genetic disease, a form of cancer or AIDS.

For example, cystic fibrosis:

- Cystic fibrosis is caused by a defective recessive gene;
- Gene therapy attempts to place normal copies of the gene into cells that are affected;
- Studies show that to prevent the problems in the lungs of CF, only 5-10% of normal gene expression is required;
- Normal genes are cloned in bacteria;
- Several ways of transferring the gene have been tested;
- These include vectors such as liposomes, viral vectors, etc;
- Viral vectors have the normal gene inserted into them. The viruses are first made harmless before the insertion. The viruses are put into a solution and then dripped into the lung through a tube. The virus enters the lung cell nucleus and inserts itself into human DNA. The lung cell will then produce the correct protein and function properly.
- This process is still relatively inefficient. Too few cells take up the vector and express the gene.

Question 31(g)

Criteria	Marks
Provides an accurate outline of the evidence which suggests the presence of ancestral vertebrate gene homologues in lower animal classes.	2 – 3
Identifies some of the evidence which suggests the presence of ancestral vertebrate gene homologues in lower animal classes.	1

Answer may include:

- Similar DNA sequences regulating the development of an organism (homeobox genes);
- The gene cascade for skeletal and neurological development in limbs in vertebrates;
- Homologue genes for amphibians are able to regulate the corresponding genes in mammals;
- Cellular processes such as protein synthesis are almost universal;
- Genes for DNA repair are similar in all eukaryotic organisms.

THE HUMAN STORY

Question 32(a)

Criteria	Marks
- Effectively distinguishes between absolute and relative dating techniques. - Provides relevant examples.	3
- Provides some relevant information about absolute and relative dating techniques. - May provide some examples.	1 – 2

Answer may include:

Relative dating estimates the order of prehistoric and geological events using stratigraphic rules and observing where fossils lay in the geological record i.e. which layer of the stratified bands of rock fossils are present.

Absolute dating is determining the specific date of archaeological and palaeontological samples. It is usually based on the physical or chemical properties of the samples. Examples of absolute dating include radiocarbon dating and potassium-argon dating.

Question 32(b)

Criteria	Marks
Provides an accurate outline of the general classification hierarchy.	3
Provides some relevant information about the classification hierarchy.	1 – 2

Answer may include: Kingdom, phylum, class, order, family, genus, species.

The classification hierarchy is a progression from least specific to most specific. Organisms in phylum share some general characteristics while organisms further along the progressions are more closely related. Species is the most specific and organisms in this level of classification are able to produce viable offspring.

Question 32(c)

Criteria	Marks
- Provides a comprehensive discussion of recent changes to the classification of primates. - Provides detailed and accurate reference to advances in technology that allowed this change.	4
- Provides a discussion of recent changes to the classification of primates. - Provides reference to advances in technology that allowed this change.	2 – 3
Provides some relevant information about recent changes to the classification of primates.	1

Answer may include:

- The traditional way of classifying primates is based on the similarity of anatomy;
- Recent methods of classification are based on genetic differences, possible because of genome sequencing;
- African apes are thought to be much closer to humans than Asian apes and African apes are no longer classified with Asian apes;
- Apes used to be in the Pongidae family while humans were in the Hominidae family. Advances in molecular biology have made it possible to analyse proteins and it was found that African apes should be in the Hominidae family, Asian apes should be in the Pongidae family;
- Further advances (e.g. DNA hybridisation) have shown that chimps are closer to humans than they are to gorillas;
- Gibbons and orang-utans have been separated due to technological advances. While they were classified as Pongidae, gibbons have now been removed into their own family – Hylobatidae.

Question 32(d)(i)

Criteria	Marks
Provides a comprehensive assessment of the evolutionary significance of the similarities and differences by completing the table.	5
Provides a basic assessment of the evolutionary significance of the similarities and differences.	3 – 4
Provides an outline of the evolutionary significance of the similarities and differences.	1 – 2

Answer may include: (1 mark each)

	<i>Humans</i>	<i>Orang-utan</i>
<i>Care of young</i>	Very close family groups where both parents take care of the child Other family members also look after the child	<i>Close</i> <i>Cling to their mothers chest for the first two years</i>
<i>Length of juvenile stage</i>	<i>12 years approx.</i>	Females 10 years Males 11-13 years
<i>Development of and size of social groups</i>	<i>Large</i> <i>Family and friends</i>	Semi-solitary Ranging adolescents of both sexes. As sub-adults co-sex travelling groups Adult females live in home areas that overlap with other adult females' areas (that may be related) and an adult male with whom they mate
<i>Development and use of tools</i>	Complex	<i>Very basic</i>
<i>Communication system</i>	<i>Complex language and thought.</i>	Vocal calls

Question 32(d)(ii)

Criteria	Marks
Provides a comprehensive assessment of the evolutionary significance of the similarities and differences.	4
Provides a basic assessment of the evolutionary significance of the similarities and differences.	2 – 3
Provides an outline of the evolutionary significance of the similarities and differences.	1

Answer may include: Primates are less culturally developed than humans.

Due to, in part, their reliance on scent markings and body language as opposed to oral communication.

The complexity of social groupings and communication methods directly impacts on the level of cultural development.

A more advanced culture with complex communication methods is more likely to pass on complex information such as knowledge of tools, etc.

Question 32(e)

Criteria	Marks
Provides a discussion of the possible effect on human evolution of all THREE factors.	5 – 6
Provides a discussion of the effect on human evolution of TWO of the factors.	3 – 4
Provides a discussion of the effect on human evolution of ONE of the factors.	1 – 2

Answer may include:

Increased population mobility:

- Humans spread out due to climate change and in search of prey;
- They used boats and land bridges formed due to the ice age;
- Isolated groups developed changes due to their environment acting as a selecting factor.
- These changes are less likely to occur nowadays as there is no existing barrier due to air travel.
- This may lead to the concept of race to cease to exist.

Modern medicine:

- The effect is less mortality and greater life expectancy;
- Because some diseases no longer act as selecting agents, genetic defects are more likely to be passed on to the next generation. This means that these genes that, before modern medicine would have been eliminated, now stay in the gene pool;
- Birth control means that the fittest no longer produce the most offspring as it is reducing the number of offspring from individuals.

Genetic engineering:

- Genetic manipulation has increased the production of agricultural goods e.g. through the genetic manipulation of some crops it is possible to produce crops that are herbicide resistant, are high in nutrients, or are resistant to or kill pests;
- Genetic engineering has also led to an increase in the survival rate of humans e.g. control of genetic diseases like haemophilia and phenylketonuria. These diseases can now be controlled and in turn this will lead to the frequency of the genes that code for the diseases to change. These factors directly affect future evolution.

BIOCHEMISTRY**Question 33(a)(i)**

Criteria	Marks
Provides a comprehensive discussion of the importance of Van Niel's hypothesis.	3
Provides a brief discussion of the importance of Van Niel's hypothesis.	2
Provides one relevant point about the importance of Van Niel's hypothesis.	1

Answer may include: The bacteria Van Niel studied used H_2S not H_2O in photosynthesis and did not produce O_2 . Instead they produced sulphur. They still needed CO_2 for photosynthesis. Van Niel hypothesised that the H_2S is split and the hydrogen is used in the production of carbohydrates. The sulphur is released as a solid. He suggested that all photosynthetic organisms need hydrogen. He stated that the source of this hydrogen varied. Green plants obtained their hydrogen from water. This hypothesis was important as it was one of the first ideas about the mechanism of photosynthesis.

The ideas before Van Niel's work were that in the photosynthetic reaction the carbon dioxide was split and the O_2 was released. The carbon was then added to a water molecule to make carbohydrates.

Question 33(a)(ii)

Criteria	Marks
Outlines the part of photosynthesis that is light dependent.	2

Answer may include: Light energy penetrates the chloroplast and reached the thylakoid membrane. The light is 'captured' by chlorophyll via an excited electron. This is stored in the high-energy phosphate bond of ATP

Question 33(b)

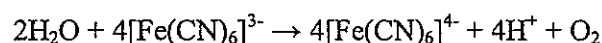
Criteria	Marks
Correctly identifies the average size of a chloroplast.	1

Answer may include: 3µ wide, 6µ long.

Question 33(c)

Criteria	Marks
Provides an accurate outline of the evidence that confirmed Van Niel's hypothesis, referring in detail to Hill and Scarisbrick, and Ruben.	3 – 4
Provides an outline of the evidence that confirmed Van Niel's hypothesis, briefly referring to Hill and Scarisbrick, and Ruben.	2
Provides some relevant information about evidence that confirmed Van Niel's hypothesis.	1

Answer may include: Hill and Scarisbrick showed that when chloroplasts are supplied with a chemical (not carbon dioxide) that will accept hydrogen in the presence of light, oxygen is given off. The reaction is known as the Hill reaction and is as follows:



They proved that oxygen was given off when carbon dioxide is not present.

Ruben used an isotope of oxygen to track what happened to the oxygen during the photosynthetic reaction. Ruben watered plants with water that contained ^{18}O . He then used a mass spectrometer to see where the ^{18}O ended up. The isotope was found in the oxygen gas produced by the plant but not in the glucose formed.

Question 33(d)

Criteria	Marks
Provides an accurate outline of the calvin cycle.	4
Provides a basic outline of the main steps of the calvin cycle.	2 – 3
Provides some relevant information about the main steps of the calvin cycle.	1

Answer may include:

- Three phases- carbon fixation, reduction, regeneration.
Students should describe each in appropriate detail, including the ATP molecules generated

Question 33(e)(i)

Criteria	Marks
Identifies a conclusion drawn by Julius Robert Mayer.	1

Answer may include: Plants convert light energy to chemical energy using the equation: $\text{CO}_2 + \text{H}_2\text{O} + \text{sunlight} \rightarrow \text{O}_2 + \text{organic matter}$.

Question 33(e)(ii)

Criteria	Marks
Identifies evidence that Mayer built upon to form the conclusion.	1

Answer may include: Plants, in the presence of light, used carbon dioxide and water to produce oxygen, and in the process grew.

Question 33(f)

Criteria	Marks
Provides an accurate outline of the discoveries of Englemann.	4
Provides a brief outline of the discoveries of Englemann.	2 – 3
Provides some relevant information about the discoveries of Englemann.	1

Answer may include: Engelmann observed bacteria moving to the chloroplasts of a strand of spirogyra algae. He hypothesised that the bacteria were moving towards the oxygen generated by photosynthesis. He did this by shining thin rays of light, using a modified microscope, on the alga. He observed that the bacteria moved to where the spirogyra was green.

In 1882 he performed an experiment where he modified a microscope with a prism that could produce a microscopic spectrum on a microscope slide. The device could also act as a micro-spectroscope, distinguishing and measuring wavelengths of light. He used the device to illuminate a strand of Cladophora with the spectrum. He added an oxygen seeking bacteria, which moved to the parts illuminated by violet and red light. These parts therefore had the higher oxygen concentration. He had produced an action spectrum, showing the regions where chlorophyll absorbs light.

Question 33(g)

Criteria	Marks
Provides a timeline with at least FIVE improvements in microscopy.	5
Provides a timeline with at least FOUR improvements in microscopy.	4
Provides a timeline with at least THREE improvements in microscopy.	3
Provides a timeline with at least TWO improvements in microscopy.	2
Provides at least ONE improvement in microscopy.	1

Answer may include:

- 1300s – the art of grinding lenses developed in Italy;
- 1590 – Hans and Zacharias Janssen make a microscope by placing lenses in a tube;
- 1667 – Robert Hooke studies objects with microscope;
- 1675 – Leeuwenhoek uses microscope to describe the cells and bacteria;
- 1700s – several innovations, for example combining two types of glass to reduce chromatic effect;
- 1830 – Lister reduces the problem of spherical aberration by using several weak lenses used together at certain distances;
- 1878 – Ernst Abbe formulates a mathematical theory that relates wavelength of light to resolution;
- 1886 – lenses made by Zeiss that could resolve structures at the limit of what was possible for visible light;
- 1924 – Lacassagne created the first autoradiographic method;
- 1930 – Lebedeff – first interference microscope;
- 1931 – Ruska – first transmission electron microscope;
- 1934 – Zernike – invented the phase contrast microscope;
- 1952 – Nomarski – invented a system for differential interference contrast for light microscopes;
- 1981 – Gerd Binnig and Heinrich Rohrer invent the scanning tunneling microscope. It gives three dimensional images down to the atomic level.

MAPPING GRID – BIOLOGY HSC TRIAL EXAMINATION 2009

Question	Marks	Outcome tested	Syllabus reference	Target performance bands
1	1	6	9.4.4	3
2	1	6	9.2.3	3
3	1	6	9.4.2	3
4	1	6	9.2.1	3
5	1	7, 10	9.3.5	4
6	1	6	9.2.2	4
7	1	10	9.3.2	4
8	1	6	9.3.4	3
9	1	6	9.2.1	3
10	1	1	9.3.3	3

11	1	4	9.4.3	4
12	1	4, 6	9.4.6	4
13	1	9	9.3.1	2
14	1	3, 4	9.4.5	3
15	1	8	9.3.3	3
16	3	10	9.3.1	4
17	6	8	9.2.1	4
18	4	6	9.2.3	5
19	4	2, 12, 14	9.3.1	4
20	4	6, 7, 9	9.3.3	4
21	3	10	9.3.2	4
22	4	4, 8	9.4.7	4
23	5	7, 9, 14	9.3.4	5
24	3	1	9.4.1	2-3
25	6	2	9.2.1	5
26	5	6	9.4.2	5
27	3	6	9.2.2	3
28	10	6	9.4.5	6
29(a)	25	6,7	9.5.1	3
29(b)		4,3	9.5.3	4
29(c)		6,13	9.5.5	3
29(d)		6,3	9.5.7	5
30(a)	25	3,4,5	9.6.5	5
30(b)		4,3,5	9.6.7	4
30(c)		1,2,3	9.6.4, 9.6.6	4
30(d)		4,7	9.6.1	2-4
30(e)		3,4,1	9.6.6	4
30(f)		4,3	9.6.3	3
31(a)	25	9,6	9.7.3	3
31(b)		12,13,11,14	9.7.3	4
31(c)		3,2,1	9.7.4	4
31(d)		9,6	9.7.6	3
31(e)		1,4,7	9.7.7	3
31(f)		1,3,4	9.7.5	4-5
31(g)		1,2,4,10	9.7.8	3
32(a)	25	2,3	9.8.2	3
32(b)		1,2	9.8.1	2
32(c)		10,3	9.8.1	3
32(d)		10	9.8.5	4-5
32(e)		10,3,4	9.8.6	4
33(a)	25	1,2,3	9.9.4	3
33(b)		2,1,6	9.9.8	3
33(c)		1,2	9.9.4	2
33(d)		2	9.9.6	3-4
33(e)		1,2,6	9.9.2	2
33(f)		1,2,6	9.9.3	3
33(g)		1,2,6	9.9.3	4-5