QATs
Quality Assessment Tasks

2010 TRIAL HIGHER SCHOOL CERTIFICATE EXAMINATION

BIOLOGY – MAPPING GRID

Exam Section	Question	Marks	Syllabus/Course Outcomes	Content	Targeted Performance Bands	Answer
Section I: Part A: Multiple Choice	1	1	H9	9.3.2.2.3	2-4	C
	2	1	H6	9.2.2.2.3	2-4	B
	3	1	H4	9.4.3.2.3	2-4	B
	4	1	H9	9.3.4.2.1	3-5	D
	5	1	H6	9.2.1.2.1	3-5	C
	6	1	H6	9.2.2.2.6	4-6	A
	7	1	H9	9.3.3.2.3	2-4	A
	8	1	H14	9.4.3.2.2	2-4	B
	9	1	H1	9.3.4.2.3	4-6	A
	10	1	H6	9.2.3.2.8	2-4	D
	11	1	H1	9.4.3.2.1	3-5	C
	12	1	H14	9.2.1.2.8	3-5	C
	13	1	H6	9.4.4.2.3	4-6	D
	14	1	H4, H8	9.4.2.2.2	2-4	B
	15	1	H10	9.3.1.2.3	3-5	A
	16	1	H5	9.2.2.3.5	3-5	D
	17	1	H9	9.3.4.2.2	3-6	C
	18	1	H6	9.2.2.2.4	3-5	C
	19	1	H1, H4	9.4.3.3.2	3-5	B
	20	1	H4, H8	9.3.5.2.1	3-6	A
Section I: Part B: Extended Response	21	3	H6, H14	9.2.1.2.9	2-5	
	22	5	H4, H8	9.4.3.3.1, 9.4.3.3.4, 9.4.5.2.3, 9.4.7.2.1, 9.4.7.2.2	3-6	
	23	6	H1, H10, H2	9.3.1.2.2, 9.3.1.3.4	2-6	
	24	5	H4, H6, H14	9.2.3.2.7, 9.2.3.3.3	2-6	
	25(a)	1	H6, H13	9.2.2.2.2	3-6	
	25(b)	3	H6, H13	9.2.2.2.2	3-6	
	26	5	H3, H4, H6, H9	9.3.5.2.2	3-6	
	27	6	H13, H14	9.4.6.3.2	2-5	
	28	6	H4, H6, H14	9.2.3.2.1, 9.2.3.3.5	3-6	
	29	7	H1, H6, H9, H10	9.3.3.2.5, 9.3.4.2.4, 9.3.4.2.7	2-5	
	30	8	H6, H13, H14	9.4.4.2.1, 9.4.4.2.4, 9.4.5.2.1, 9.4.5.2.2	2-6	

Exam Section	Question	Marks	Syllabus/Course Outcomes	Content	Targeted Performance Bands
Part II Option 1 9.5	31a	4	H13	9.5.2.2.1	2-4
	31b	5	H11, H12, H13	9.5.3.3.1	2-5
	31c	7	H3, H13	9.5.3.2.5, 9.5.3.3.3, 9.5.6.3.3	2-6
	31d	4	H7, H14	9.5.6.3.2	3-6
	31e	5	H6, H13, H14	9.5.7.2.3, 9.5.7.3.3	3-6
Part II Option 2 9.6	32a	4	H13	9.6.1.2.3	3-5
	32b	5	H11, H12	9.6.2.3.1	2-6
	32c	7	H4, H13	9.6.6.3.1	2-6
	32d	4	H4, H6, H7	9.6.1.2.3, 9.6.5.2.2	3-6
	32e	5	H4, H7	9.6.3.2.3	3-6
Part II Option 3 9.7	33a	4	H9, H13	9.7.4.2.1, 9.7.4.2.2	2-4
	33b	5	H11, H12	9.7.1.3.1	2-6
	33c	7	H3, H4, H9	9.7.7.2.1, 9.7.7.3.1	2-6
	33d	4	H2, H9, H13	9.7.3.2.1, 9.7.3.2.2	3-6
	33e	5	H1, H6, H7	9.7.6.2.3	3-6
Part II Option 4 9.8	34a	4	H13	9.8.1.2.6	2-5
	34b	5	H12, H14	9.8.2.3.2	2-6
	34c	7	H4, H8, H10	9.8.5.3.1	2-6
	34d	4	H6, H7, H9	9.8.4.2.2	3-6
	34e	5	H10, H13	9.8.3.2.3	2-6
Part II Option 5 9.9	35a	4	H13	9.9.8.2.3, 9.9.8.2.4	2-5
	35b	5	H11, H12	9.9.3.3.4	2-5
	35c	7	H4, H5	9.9.1.3.2	2-6
	35d	4	H6, H13	9.9.4.2.5	3-6
	35e	5	H4, H13	9.9.5.2.3	3-6

QATs
Quality Assessment Tasks

2010 TRIAL HIGHER SCHOOL CERTIFICATE EXAMINATION

BIOLOGY – MARKING GUIDELINES

Section I
Part A – 20 marks
Questions 1-20 (1 mark each)

Question	Correct Response	Outcomes Assessed	Targeted Performance Bands
1	C	H9	2-4
2	B	H6	2-4
3	B	H4	2-4
4	D	H9	3-5
5	C	H6	3-5
6	A	H6	4-6
7	A	H9	2-4
8	B	H14	2-4
9	A	H1	4-6
10	D	H6	2-4
11	C	H1	3-5
12	C	H14	3-5
13	D	H6	4-6
14	B	H4, H8	2-4
15	A	H10	3-5
16	D	H5	3-5
17	C	H9	3-6
18	C	H6	3-5
19	B	H1, H4	3-5
20	A	H4, H9	3-6

Section I
Part B – 55 marks

Question 21 (3 marks)
Outcomes Assessed: H6, H14
Targeted Performance Bands: 2-5

Criteria	Marks
• Describes two responses to high temperatures	3
• Describes one response OR • Identifies two responses	2
• Identifies one response	1

Sample answer

Eucalypts leaves hang vertically – this reduces the surface area exposed to direct sunlight, keeping the plant cooler.

Boab trees shed their leaves in hot summers so reducing surface area to absorb less heat.

Question 22 (5 marks)
Outcomes Assessed: H4, H8
Targeted Performance Bands: 3-6

Criteria	Marks
• Identifies issues in statement, provides points for and against, including relevant examples	4-5
• Identifies issues and provides some points for or against	2-3
• Identifies issues in statement	1

Sample answer
Being an island continent, Australia with adequate quarantine regulations, can more easily prevent entry of harmful pathogens. An example of this is the fact that Australia is free of Rabies and foot and mouth disease, both of which are common in many countries.
Public health programs together with vaccination programs help control diseases. Public health programs educate the public on ways to prevent infection e.g. diseases like AIDS have been controlled through advertisements warning against sharing of needles and having sex without condoms, and provision of needle disposal facilities in public places.
Provision of vaccination programs has reduced the occurrence of diseases like diphtheria.
Despite all these strategies, the incidence of infectious disease is still a problem as new strains of pathogens form e.g. MDR (multidrug resistant) golden staph in hospitals has evolved as microbes have increased their resistance to antibiotics.

Question 23 (6 marks)
23 (a) (3 marks)
Outcomes Assessed: H2, H10
Targeted Performance Bands: 2-5

Criteria	Marks
• Structure identified • Description of at least two different variations in anatomy • Statement showing how variations in anatomy provide evidence to support evolutionary theory	3
• Two of above	2
• One of above	1

Sample answer
The pentadactyl limb is found in most vertebrates. It has a basic pattern of bones consisting of 1 long bone → 2 long bones → 5 digits
This has been modified in different animals to fulfil different functions in different environments. E.g. in birds the forelimb is modified as a wing with the loss of some digits and the elongation of certain bones. In whale flippers a more streamlined shape to move through water has been obtained by shortening the pentadactyl limb bones as for birds.
Having different modifications of the same basic structure is an example of divergent evolution and supports the idea of evolution from a common ancestor.

23 (b) (3 marks)
Outcomes Assessed: H1
Targeted Performance Bands: 4-6

Criteria	Marks
• Technology identified • Evolutionary relationship described before technology • Evolutionary relationship described after technology	3
• Two of above	2
• One of above	1

Sample answer
Birds are believed to have evolved from reptiles. Lizards and crocodiles were believed to be more closely related to each other than to birds. New technologies such as comparing the biochemistry of DNA show that crocodiles are more closely related to birds than they are to lizards.

Question 24 (5 marks)
24 (a) (2 marks)
Outcomes Assessed: H6
Targeted Performance Bands: 2-4

Criteria	Marks
• Outlines two effects of aldosterone	2
• Outlines one effect of aldosterone	1

Sample answer
Aldosterone increases active reabsorption of sodium ions from the filtrate in the nephron. This leads to an increased reabsorption of water by osmosis.

24 (b) (3 marks)
Outcomes Assessed: H4, H14
Targeted Performance Bands: 3-6

Criteria	Marks
• Describes two consequences of lack of aldosterone • Links to statement on importance of HRT	3
• Two of above	2
• One of above	1

Sample answer
Lack of aldosterone can lead to Addison's disease with symptoms such as low blood pressure and salt craving. HRT involves administering fludrocortisones and would reduce these symptoms and allow the sufferer to lead a normal life.

Question 25 (4 marks)

25 (a) (1 mark)

Outcomes Assessed: H6, H13

Targeted Performance Bands: 3-6

Criteria	Mark
• Describes structure of haemoglobin	1

Sample answer

Haemoglobin (Hb) is a protein found in red blood cells.

25 (b) (3 marks)

Outcomes Assessed: H6, H13

Targeted Performance Bands: 3-6

Criteria	Marks
• Describes role of haemoglobin and • Explains adaptive advantage	3
• Describes role • Identifies adaptive advantage	2
• Describes role OR • Identifies adaptive advantage	1

Sample answer

Haemoglobin (Hb) is responsible for carrying O_2 around body in blood. The adaptive advantage of (Hb) is that it increases the O_2 carrying capacity 1000's of times compared to blood without Hb (each Hb molecule is made of 4 haemaglobin units which can combine with one O_2 molecule.

Question 26 (5 marks)
Outcomes Assessed: H3, H4, H6, H9
Targeted Performance Bands: 3-6

Criteria	Marks
• Names a transgenic species • Describes process used • Gives reasons for production of species	4-5
• Names a transgenic species • Describes process used OR • Gives reasons for production of species	2-3
• Names a transgenic species	1

Sample answer
Bt cotton ('Ingard') is a transgenic species. The cotton has a gene from a bacterium – *Bacterium thuringiensis* (Bt) – inserted. This makes the cotton more resistant to insect pests as the gene produces a toxin which makes the cotton resistant to these insect pests. This means that farmers need to spend less spraying crops with insecticides.
The gene was cut from the Bt DNA using restriction enzymes. The gene was inserted into the DNA of the cotton plant via a second bacteria which acted as a vector.

Question 27 (6 marks)
27 (a) (4 marks)
Outcomes Assessed: H13
Targeted Performance Bands: 2-5

Criteria	Marks
• Bar/column graph used • Axes labelled + units appropriate • Data plotted correctly	4
• Bar/column graph used • Axes labelled and/or units appropriate OR • Data plotted correctly	2-3
• Line graph drawn – other aspects correct	1

Sample answer
Bar/column graph drawn – 1 mark.
Axes – age groups on X or Y axis, all age groups and males and females shown, units (rates per 100 000 population).
Indicate incidence and mortality e.g. use of key.
Data plotted with reasonable accuracy.

27 (b) (2 marks)
Outcomes Assessed: H14
Targeted Performance Bands: 2-4

Criteria	Marks
• Trends described with supporting data	2
• Trends described	1

Sample answer
In both males and females incidence increases with age e.g. in males 40-54 yr olds rate is 250/100000. This increases to 2800 /100000 in 75+ yrs.
Incidence is greater in males than females in each age group e.g. in 55-64 yrs incidence is 600 in males and 200 in females.

Question 28 (6 marks)
28 (a) (3 marks)
Outcomes Assessed: H6, H14
Targeted Performance Bands: 3-6

Criteria	Marks
• 3 valid points to include function of water in body and consequences of changes in concentration	3
• 2 valid points to include function of water in body and consequences of changes in concentration	2
• 1 valid point to include function of water in body and consequences of changes in concentration	1

Sample answer
Water is the main solvent in all cells and body fluids. Water therefore provides a medium in which all chemical reactions can occur. Changes in water concentration will result in a change in solute concentration e.g. salts. These changes will upset the osmotic equilibrium in cells and tissues, causing loss or gain of water from the cells. Changes in water concentration can also alter the pH.

28 (b) (3 marks)
Outcomes Assessed: H6, H7
Targeted Performance Bands: 3-6

Criteria	Marks
• Identifies nitrogenous waste • Describes property of waste e.g. toxicity • Links property of waste to water conservation	3
• Two of above	2
• One of above	1

Sample answer
Locusts in arid terrestrial conditions need to conserve water. They produce uric acid as their nitrogenous waste. This has relatively low toxicity, allowing it to be stored for periods of time in the body before excretion. It can be excreted in semi-solid form which means that water can be conserved by the insect.

Question 29 (7 marks)

29 (a) (4 marks)

Outcomes Assessed: H6, H9

Targeted Performance Bands: 2-5

Criteria	Marks
• Describes at least three sources of variation	4
• Describes two sources of variation	3
• Lists 3+ causes of variation	2
• Lists 1-2 causes of variation	1

Sample answer

Mutations – random changes to DNA caused by e.g. radiation exposure. This results in variation as new allelescan be formed.
Crossing-over – sections of DNA are randomly exchanged between chromatids during the first division of meiosis, resulting in a rearrangement of the alleles to be passed on.
Random fertilisation – sperm/eggs all contain different genetic information (because of events during meiosis) and so which sperm fertilises which egg is also a source of variation.

29 (b) (3 marks)

Outcomes Assessed: H1, H2, H10

Targeted Performance Bands: 2-5

Criteria	Marks
• Describes punctuated equilibrium • Describes Darwin's theory as a gradual process • Makes comparison	3
• Two of above	2
• One of above	1

Sample answer

Darwin's theory proposed that changes occur gradually over a long period of time. New findings suggest that evolution may occur more quickly over shorter periods of time, with long periods of time between these periods of change when very little change occurs – (stasis) this is punctuated equilibrium.

Question 30 (8 marks)
Outcomes Assessed: H6, H13
Targeted Performance Bands: 2-6

Criteria	Marks
• Identifies barriers to infection, non-specific immune responses and specific immune responses (the 3 lines of defence) • Describes effect on pathogen in each case	7-8
• Identifies one line of defence in detail, with outline of other mechanisms	5-6
• Identifies one line of defence with outline of other mechanisms	3-4
• Outlines some mechanisms involved	1-2

Sample answer

Preventing the entry of pathogens is the role of structures such as the skin and mucus. The skin provides a physical barrier, being made of layers of dead cells. The dry conditions of the skin also help inhibit growth of pathogens. If pathogens are inhaled they may stick to the mucus lining the respiratory tract. The pathogens and mucus are then moved by cilia up to the throat where it is swallowed (to be destroyed by acid in stomach) or coughed out.
If the pathogen gets through these barriers (e.g. if skin is cut) then non-specific mechanisms help protect the body. These include phagocytosis – specialised white blood cells which recognise and engulf foreign particles, secreting enzymes onto these to destroy them.
If pathogen starts to grow inside the body the immune system is activated.
The pathogen will be engulfed by a macrophage which displays a portion of the pathogen – the antigen – on its surface. Specific helper-T cells are activated when they recognise the shape of the antigen. The helper-T cells then divide and activate cytotoxic (killer) T cells or B cells. The killer-T cells destroy the pathogen by releasing chemicals which kill it. The B cells divide into antibody producing plasma cells. Antibodies destroy pathogens in a variety of ways, such as causing the pathogens to clump together and attracting phagocytes to engulf the clumps of pathogens.

Section II
Question 31 – Communication (25 marks)

31 (a) (4 marks)
Outcomes Assessed: H13
Targeted Performance Bands: 2-4

Criteria	Marks
• Correctly describes structure and function of both cornea and retina	4
• Correctly describes structure and/or function of cornea and/or retina	1-3

Sample answer
Cornea – transparent layer over front of eye – function to refract light.
Retina – layer of rods and cones at back of eye – converts light impulses to nerve (electrochemical) messages

31 (b) (5 marks)
Outcomes Assessed: H11, H12, H13
Targeted Performance Bands: 2-5

Criteria	Marks
• Outline of appropriate procedure • Description of accommodation stated or implied • Justification statement – refer to validity and reliability	5
• Outline of appropriate procedure • Description of accommodation stated or implied • Justification statement – refer to validity or reliability	4
• Outline of appropriate procedure • Description of accommodation stated or implied • Justification statement – in general terms	3
• Outline of appropriate procedure • Description of accommodation stated or implied	2
• Outline of appropriate procedure OR • Description of accommodation stated or implied	1

Sample answer
Accommodation – the focussing of light from different distances onto retina- was modelled using a light ray box which produced parallel rays of light and different thickness convex lenses. The focal lengths of each lens (distance from lens to where rays of light converge) was measured for each lens.

The procedure was justified because:
(a) it was valid – the convex lens shape is same as found in our eye and accommodation occurs when our lens changes its thickness
(b) it was reliable – our findings were replicated by each group of students thus results were consistent in a large number of trials

31 (c) (7 marks)
Outcomes Assessed: H3, H4, H13
Targeted Performance Bands: 2-6

Criteria	Marks
• Describes at least TWO technologies for both hearing and vision problems • Evaluates technologies for both hearing and vision	6-7
• Describes technology for hearing OR • Vision and identifies technologies for other • Overall evaluation statement	4-5
• Brief description of one technology OR • Identifies 1-3 technologies	1-3

Sample answer

Both sight and hearing are important for communication and problems with either of these could adversely affect a person's ability to communicate effectively. So the use of technology to correct problems is important as it will allow an individual to communicate and function more effectively within society.

Vision problems.

Cataracts (clouding of the lens due to e.g. diabetes) can lead to blindness. This can be treated by removal of the cloudy lens and implanting a plastic one in its place.

Myopia (short-sight) is an inability to focus on distant objects clearly (due e.g. to the eyeball being too long). This can be corrected by wearing concave lens (either in glasses or in contacts).

With corrected vision individuals can lead a more independent life (as blind people are more likely to be reliant on others e.g. driving).

Hearing problems.

Hearing can be affected by problems with the middle or inner ear. With middle ear deafness sound waves may have difficulty reaching the inner ear. The wearing of hearing aids amplifies the sound vibrations so aiding hearing. With damage to the inner ear e.g. by infection, the wearing of a cochlear implant can help. This technology picks up sound in a microphone and changes this into electric signals which are passed to the auditory nerve in the cochlea via an electrode.

Both these technologies can allow people to hear speech and improve their quality of life. Hearing has a safety role – hearing possible dangers approaching. Being able to hear is also important in speech development and so these technologies may help people to speak.

31 (d) (4 marks)

Outcomes Assessed: H7, H14

Targeted Performance Bands: 3-6

Criteria	Marks
• Sound frequencies of two mammals described and a possible explanation for each example	4
• 1-3 correct descriptions and/or explanations	1-3

Sample answer (Note – description can be implied in comparison)

Human hearing is between approx 20-20 000Hz

A kangaroo rat hears sound waves between 30 and 50000 Hz but is especially sensitive to the low frequency sounds. This may be because its predators e.g. owl wing beat, produces these low frequency sounds so the kangaroo rat can avoid being caught.

The dolphin produces sounds between 1000 and 100 000 Hz – the high frequencies are used in echolocation allowing dolphins to detect prey in low visibility situations.

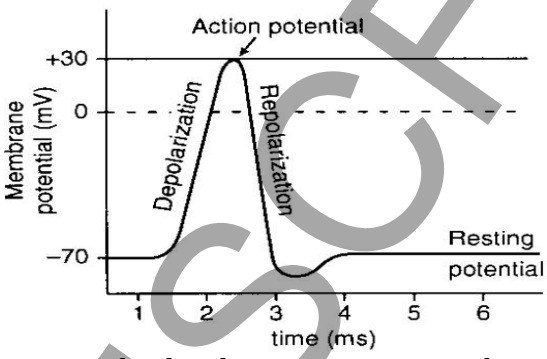
31 (e) (5 marks)

Outcomes Assessed: H6, H13, H14

Targeted Performance Bands: 3-6

Criteria	Marks
• Graph drawn with axes labelled appropriately • Line graph drawn to correct shape • Two relevant points or labels to explain action potential • Correct reference to threshold level	5
• Four of above	4
• Three of above	3
• Two of above	2
• One of above	1

Sample answer



The depolarization occurs as the sodium pump in the axon membrane stops and sodium ions flood into the neurone. The Na-pump restarts and repolarisation occurs. Unless the level of the stimulus reaches a 'threshold level' no depolarisation occurs so not all stimuli will create an action potential.

Question 32 – Biotechnology (25 marks)

32 (a) (4 marks)
Outcomes Assessed: H13
Targeted Performance Bands: 2-5

Criteria	Marks
• Describes change in animal and plant group, identifying favourable trait in each example	4
• Describes change in animal and/or plant group, identifying favourable trait in one or both examples	1-3

Sample answer
Sheep – merino sheep bred using sheep from Spain with other strains to produce merinos that gave high quality wool and could survive Australian conditions.
Wheat – Federation wheat was produced by crossing drought-resistant strains with fast-growing strains to produce a wheat that gave good yields in Australian conditions.

32 (b) (5 marks)
Outcomes Assessed: H11, H12
Targeted Performance Bands: 2-6

Criteria	Marks
• Outline of appropriate procedure • Description of fermentation stated or implied • Justification statement – refer to validity, reliability and accuracy	5
• Outline of appropriate procedure • Description of fermentation stated or implied • Justification statement – refer to validity, reliability and accuracy	4
• Outline of appropriate procedure • Description of fermentation stated or implied • Justification statement – in general terms	3
• Outline of appropriate procedure • Description of fermentation stated or implied	2
Outline of appropriate procedure OR • Description of fermentation stated or implied	1

Sample answer
A fermentation vessel was set up containing a mix of yeast, sugar and water and was sealed to create anaerobic conditions. A glass tube ran from the vessel to a test tube containing clear limewater. The reaction vessel was left at 30°C for 24 hours.
The procedure was justified because it was both valid, reliable and accurate.
(a) Validity – the fermentation flask created conditions favourable for fermentation – live yeast with energy source and anaerobic conditions and warmth.
(b) It was reliable – our findings were replicated by each group of students thus results were consistent in a large number of trials.

32 (c) (7 marks)
Outcomes Assessed: H4, H13
Targeted Performance Bands: 2-6

Criteria	Marks
• Describes at least TWO case studies, including details and outcomes in each • Evaluation for each case studies	6-7
• Describes technology for one case study and identifies technologies for other • Overall evaluation statement	4-5
• Brief description of one technology OR • Identifies 1-2 technologies	1-3

Sample answer

Medicine – biotechnology research led to production of human hormones such as insulin in bacteria. A synthetic version of the human insulin gene was inserted into E.coli bacteria, using a plasmid as a carrier.

This application has had a significant impact on society. Previously insulin was extracted from other animals and this could result in allergic reactions in patients suffering diabetes. It was also harder to produce in large quantities. The technology means insulin is more readily available to more people so more people can now better manage the diabetes disease, with much fewer allergic reactions.

Aquaculture – has been used in production of pharmaceuticals (readily available medicines). Biotechnology techniques have been used to isolate Alginic acid (alginate) from brown algae such as Laminaria. The chemical has been used as a thickening agent but recent research has shown that stem cells or insulin producing cells coated with alginate can reduce chances of these cells being rejected when injected into other humans. This is important research as it could help future treatment of diabetes through transplant of insulin producing cells with reduced risk of rejection.

32 (d) (4 marks)
Outcomes Assessed: H4, H6, H7
Targeted Performance Bands: 3-6

Criteria	Marks
• Both processes described with at least two comparisons	4
• Both processes described with one comparison	3
• Both processes described	2
• One process described	1

Sample answer (Note- description can be implied from comparison)
Recombinant DNA technology involves moving one piece of DNA from its normal position to a new position, possibly in a different species. Artificial selection involves selecting and breeding different strains of organisms (of same species) each of which has a desired trait or feature, to produce offspring which will hopefully have a combination of desired traits or features.
Difference - Recombinant DNA technology is a very rapid and more recent process and can be used more easily in transfer of DNA between species. Artificial selection has been used for 1000's of years and is more difficult to move DNA between species. It is a slower process than recombinant DNA technology.
Similarity – Both processes are designed to produce new strains with selected, desired traits or features.

32 (e) (5 marks)
Outcomes Assessed: H4, H7
Targeted Performance Bands: 3-6

Criteria	Marks
• Method described (including two points) • Appropriate example used • At least two benefits explained	5
• Four of above	4
• Three of above	3
• Two of above	2
• One of above	1

Sample answer
Strain isolation involves separation of a particular strain and growing it for human benefit. One technique involves streaking a sample onto a plate and growing a mass of microorganisms. A very small sample is removed and transferred to another new sterile plate ('subsampling'). This is repeated until individual colonies are grown, each of which represents a different strain.
Benefits of this technique is that strains with favourable traits are produced and increased yields of products can be obtained. For example, the original strain of Penicillium (P.notatum) only produced very small amounts of penicillin. X-rays were used to create new mutations and, by using strain isolation techniques, strains of Penicillium are now being isolated with yields increased by 25 000 times.

Question 33 – Genetics: The Code Broken? (25 marks)

33 (a) (4 marks)

Outcomes Assessed: H9, H13

Targeted Performance Bands: 2-4

Criteria	Marks
• Correctly describes two benefits and 2 limitations of HGP	4
• Correctly describes 1-3 benefits and/or limitations of HGP	1-3

Sample answer

Benefits

– could lead to improving society's ability to diagnose inherited diseases.

- help in matching potential organ donors to recipients, reducing risk of rejection.

Limitations

– because some genes overlap other genes, identification of some genes could be difficult.

- difficult to determine how genes affect things like behaviour and many gene functions are unknown

33 (b) (5 marks)

Outcomes Assessed: H11, H12

Targeted Performance Bands: 2-6

Criteria	Marks
• Outline of appropriate procedure • Description of DNA structure stated or implied • Justification statement – refer to validity and reliability	5
• Outline of appropriate procedure • Description of DNA structure stated or implied • Justification statement – refer to validity or reliability	4
• Outline of appropriate procedure • Description of DNA structure stated or implied • Justification statement – in general terms	3
• Outline of appropriate procedure • Description of DNA structure stated or implied	2
• Outline of appropriate procedure OR • Description of DNA structure stated or implied	1

Sample answer

Model was constructed using 4 different coloured pegs, to represent the 4 nitrogerous bases – A, C, T, G string represented the phosphate molecule and cardboard represented the deoxyribose sugar. Using information collected from several sources, we constructed nucleotides (sugar + phosphate+ base) with base attached to sugar. These were then joined together to make the DNA model by attaching sugar to phosphate and forming 2 chairs, with bases in middle, A pairing with T and G with C.

The procedure was justified because:

(a) it was valid – the model was based on accurate information and reflected that information

(b) it was reliable because each group of students made similar models.

33 (c) (7 marks)
Outcomes Assessed: H3, H4, H9
Targeted Performance Bands: 2-6

Criteria	Marks
• Describes TWO named technologies • Application of each to agriculture described • Evaluates potential for each	5-7
• Two technologies described but potential not evaluated	3-4
• Brief description of one technology OR • TWO technologies named	1-2

Sample answer

Cloning in animals, results in production of offspring genetically identical to the original organism. It involves removal of a nucleus from an egg cell and replacing it with the nucleus from a cell from the organism to be cloned. This cell is placed in a surrogate mother who gives birth to the clone. The technology has the potential to very significantly impact on agriculture, producing large numbers of offspring e.g. cattle with high milk yields – thus increasing potential food production. (However the technology is currently unreliable and expensive so its current impact is more limited).

Selective breeding involves selection (by humans) of 2 individuals to make or produce offspring with particular desirable traits. It has been done for 1000's of years.
Pigs for example, have been selectively bred for traits such as more meat, smaller tusks and lower levels of aggression (easier to handle).
While this technology has led to increases in production, its use is limited because the amount of change is restricted by the total available gene pool.

33 (d) (4 marks)

Outcomes Assessed: H2, H9, H13

Targeted Performance Bands: 3-6

Criteria	Marks
• Describes both patterns of inheritance with appropriate example • Some comparisons made	4
• Describes both patterns of inheritance • Appropriate example OR • Some comparisons made	3
• One pattern of inheritance described with example	2
• One pattern of inheritance described	1

Sample answer

Dihybrid independent inheritance involves two pairs of alleles carried on separate chromosomes so each pair of alleles is inherited or passed on independently of the other pair. For example, if two individuals heterozygous for both traits are crossed it results in a 9:3:3:1 ratio in offspring.

Let R= round seed, r= wrinkled seed. Y= yellow seed, y= green seed

RrYy x RrYy

Gametes	RY	Ry	rY	ry
RY	RRYY	RRYy	RrYY	RrYy
Ry	RRYy	RRyy	RrYy	Rryy
rY	RrYY	RrYy	rrYY	rrYy
ry	RrYy	Rryy	rrYy	rryy

Predicted ratio 9 round, yellow; 3 wrinkled yellow; 3 round green; 1 wrinkled green

In linked inheritance the two pairs of alleles are on the same chromosome and so as the gametes are formed in meiosis, the two alleles on same chromosome are usually inherited together. In a few cases, if crossing over occurs between the two alleles then a few recombinants will appear. If no crossing over occurs between the two alleles, then:-

RrYy x RrYy

Gametes	RY	ry
RY	RRYY	RrYy
ry	RrYy	rryy

This gives a 3:1 ratio of round, yellow to wrinkled green.

33 (e) (5 marks)

Outcomes Assessed: H1, H6, H7

Targeted Performance Bands: 3-6

Criteria	Marks
• Description of transposons • How operate is described • Impact on genome explained	4-5
• Outline of what transposons are and how operate	2-3
• Transposon described OR • Impact described	1

Sample answer

Transposons (transposable genetic elements) are sections of DNA that can move from one part of genome to another.

They work by 'cut and paste' or 'copy and paste'. In cut and paste, the section of DNA is removed from the DNA molecule and moved to another part (can be on same molecule or different one). In copy and paste, the DNA section forms a copy of itself which is then moved to another part of the DNA.

Their impact on the genome can be significant – they have been shown to disable some genes by 'jumping' into the sequence of bases that constitutes the gene disrupting the code and the polypeptide formed.

Question 34 – The Human Story (25 marks)

34 (a) (4 marks)
Outcomes Assessed: H13
Targeted Performance Bands: 2-5

Criteria	Marks
• Correctly describes at least two characteristics of prosimians and apes	4
• Describes characteristic(s) of prosimians and/or apes	1-3

Sample answer

(i) prosimians have elongated faces with a wet snout, and eyes adapted for nocturnal life e.g. retina only contains rods

(ii) apes lack tail and arms are longer than legs

34 (b) (5 marks)
Outcomes Assessed: H12, H14
Targeted Performance Bands: 2-6

Criteria	Marks
• Describes at least two techniques used to ensure validity/relevance • Assessment of reliability • Shows use in determining relationship	4-5
• Validity or reliability addressed well • Refers to use in determining relationships	2-3
• Validity or reliability outlined	1

Sample answer

Information on DNA-DNA hybridisation was located from text resources and the internet. The information was assessed for relevance by checking that the information was on the selected topic, was presented in a reputable journal or text which was recently published. The author of the article needed to be a scientist who would have specialist knowledge of this technology.
The information was reliable as we discovered similar information in a variety of different sources. The resources we used were well referenced and with a bibliography.

The information obtained in our research involved analysis of different DNA. The more similar the DNA, the closer the relationship. So chimp DNA is 97.6% similar to humans but rhesus monkey is only 91% the same, therefore we are more closely related to chimps than rhesus monkeys.

34 (c) (7 marks)
Outcomes Assessed: H4, H8, H10
Targeted Performance Bands: 2-6

Criteria	Marks
• At least three different aspects of cultural evolution included • Correct comparison between human and primate in each case • Evaluation statement	6-7
• At least three different aspects of cultural evolution included • Some correct comparison between human and primate OR • Good comparison of two aspects	4-5
• Compares one aspect of cultural evolution OR • Identifies 1 or 2 differences	1-3

Sample answer
Human cultural evolution is important as it helps to explain the greater variation and complexity of human society compared to primate social organisation. It has also impacted on the role that natural selection plays in evolution, in that sometimes the principles of 'survival of the fittest' do not occur in the more complex society of humans.

Communication
Humans have a complex system of communication where artificial selection now plays a role. It includes complex language development and the use of art as a means of symbolic communication. While it is believed apes communicate to a high degree and have been shown to be able to learn sign language, the structure of their sound producing organs (e.g. larynx) means they cannot produce the complexity of sound that humans can. This difference has meant that humans have been able to develop their intelligence and consciousness beyond the level of apes.

Tool development
While some apes have been shown to use very simple tools (e.g. sticks to extract honey from hives), only humans have been able to take this skill to a level where humans can now significantly modify their environment. It also means that humans became more efficient in gathering food (e.g. with axes and spears).

Care of young
Primates generally have long gestation periods and have a prolonged juvenile stage, with adults caring for their young. However in humans this care of young – well into teenage years – is much longer than in apes (3-6 years). This is because human culture has become so much more complex and takes longer to learn.

34 (d) (4 marks)
Outcomes Assessed: H6, H7, H9
Targeted Performance Bands: 3-6

Criteria	Marks
• Describes each process with appropriate examples	4
• 1-3 correct descriptions and/or examples	1-3

Sample answer
Polymorphism is where two or more forms of a particular genetic trait are found in the same type of organisms. For example, humans have the ABO blood type system where, depending on the
genes inherited, they can be one of 4 different blood types – A, B, AB or O.
Clinal gradation is where there is a gradual change in the frequency of genes in a population from one habitat (or geographical area) to another. For example skin colour in humans where, in areas of high UV radiation, darker skin pigmentation has an advantage over light skin colour.

34 (e) (5 marks)
Outcomes Assessed: H10, H13
Targeted Performance Bands: 2-6

Criteria	Marks
• Out of Africa model described • Alternative model described • At least two differences explained	4-5
• Two models outlined • Difference(s) identified	2-3
• One valid statement made	1

Sample answer
Out of Africa Model proposed that *Homo erectus* first evolved in Africa then migrated out to other parts of the planet by land and sea. At a later date *H.sapiens* evolved in Africa and also migrated out and replaced existing hominin species around the world.
The Theory of Regional continuity also proposes that *H.erectus* evolved in Africa and migrated out to colonise other parts of the planet. However the theory differs to the Out of Africa model in that it denies that *H. sapiens* only evolved in Africa. This model states that *H.sapiens* would have evolved simultaneously in the different, scattered populations of *H.erectus*

Question 35 – Biochemistry (25 marks)

35 (a) (4 marks)
Outcomes Assessed: H13
Targeted Performance Bands: 2-5

Criteria	Marks
• Correctly describes two structural features of thylakoids and stroma	4
• Correctly describes structure(s) of thylakoids and/or stroma	1-3

Sample answer
Thylakoids – flattened interconnected discs, chlorophyll embedded in phospholipid bilayer.
Stroma – dense fluid-filled area of chloroplast, contains DNA/RNA/ribosomes.

35 (b) (5 marks)
Outcomes Assessed: H11, H12
Targeted Performance Bands: 2-5

Criteria	Marks
• Outline of appropriate procedure • Justification statement – refer to validity, accuracy and reliability	5
• Outline of appropriate procedure • Justification statement – refer to validity, accuracy or reliability	4
• Outline of appropriate procedure • Justification statement – in general terms	3
• Outline of appropriate procedure	2
• Procedure identified	1

Sample answer

Spinach leaves were ground in acetone and a drop of the chlorophyll extract was placed on filter paper and the different pigments separated by chromatography.
The different absorption spectra were identified by the different colours e.g. carotene – orange/yellow.
The procedure was justified for the following reasons:
- it was valid because the solvent used extracted the pigments and the chromatography separated the pigments with different colours, which together make up the action spectrum
- it was reliable as we found the results obtained by other groups were consistent with ours

35 (c) (7 marks)
Outcomes Assessed: H4, H5
Targeted Performance Bands: 2-6

Criteria	Marks
• Describes at least three materials that could be replaced • Evaluates for each material described	6-7
• Describes at two materials that could be replaced • Evaluates for one material described	4-5
• Describes one material and evaluates OR • Identifies 1-2 materials with no evaluation	1-3

Sample answer

Petrol is a non-renewable resource that could run out. Sugars obtained in photosynthesis can be fermented to produce ethanol which can then be used to replace petrol (up to 10% of petrol can be replaced by ethanol in Australia) The potential use for this replacement is limited because of the amount of land needed to produce enough biomass to produce ethanol – this reduces land available for food production.

Electricity production from burning fossil fuels. Timber/trees grown using energy from photosynthesis could be burnt as a substitute for fossil fuels. This is not a practical solution as trees are too slow growing to replace the amount of material that would need to be burnt to cope with current demands and can only be used in certain circumstances.

Ethene – this is a raw material needed for production of plastics such as polythene. It is currently extracted from fossil fuels (petroleum). However it is possible to convert ethanol (from fermentation as mentioned above) into ethene by dehydration. However the same limitations as mentioned for ethanol will apply so the potential to replace these materials is currently very limited.

35 (d) (4 marks)
Outcomes Assessed: H6, H13
Targeted Performance Bands: 3-6

Criteria	Marks
• Correctly describes features of both and allows comparison to be made (can be implied)	4
• 1-3 correct descriptions of photosystems I and/or II	1-3

Sample answer

Photosystem I	Photosystem II
Absorbs red light (around 700nm)	Absorbs red light at 680nm
NOT involved in oxygen production	Involves oxygen production
Produces NADPH - accepts electrons from II	Provides electrons for use in I

35 (e) (5 marks)

Outcomes Assessed: H4, H13

Targeted Performance Bands: 3-6

Criteria	Marks
• Correct definition of 'half-life' • Examples of isotopes and how used	4-5
• Correct definition of 'half-life' • One example of use	2-3
• One of above	1

Sample answer

Half-life is the time taken for 50% of the radioisotope to decay.
Isotopes are used a lot in biochemistry to trace the movement of molecules in biochemical pathways.
For example Phosphorus-32 has a half-life of about 14 days and is used in study of ATP formation.
The chemical behaviour of the radioactive P-32 is the same as the non-radioactive phosphorus. Therefore tracers are used because they will not affect the biochemical pathway – in this case ATP formation.
Carbon-14 tracer has been used to show the pathway of carbon from CO_2 to glucose.
The advantage of tracers is that the presence of the radioactive material is easy to detect compared to non radioactive sources.