BOARD OF STUDIES
NEW SOUTH WALES

1995 HSC

EXAMINATION REPORT

BIOLOGY

Includes:
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• Examiners' comments

1995 HIGHER SCHOOL CERTIFICATE EXAMINATION

BIOLOGY

EXAMINATION REPORT

In 1995 14797 candidates presented for the HSC Biology examination. This represents a considerable fall in numbers from 1994 but it appeared that it was generally weaker candidates who had chosen other subjects.

General Comments

As has been the case in the past the greatest problem with most candidates is a lack of precise knowledge. Most have a general (although often confused) notion about most topics but few seem to appreciate that the essence of science is precision – near enough is not good enough. It is necessary to distinguish here between actual mistakes and imprecision. This lack of precision was well illustrated in answers to Q18 (on Koch's postulates). Of the 75% of candidates who knew what the question was about only about one third could state the postulates clearly. The remainder knew what the question was asking but confused, e.g., "disease" with "micro-organism" as in 'The disease must be able to be isolated and cultured'. Other students made careless statements, e.g., 'The micro-organism must be present in a diseased organism' rather than 'The micro-organism must be present in every case of the disease'. Similar examples occurred in Q20 where crossing over and random segregation were confused and Q21 where gametes were given instead of genotypes. Insisting on precision is not pedantry, learning to be precise is the most important lesson which can be learnt from a scientific education.

During the marking it again became apparent that some books used by candidates and teachers contain incorrect material. Teachers are again urged not to depend on single sources for their information in situations where they do not feel completely confident. As well as consulting several books teachers should also take advantage of services such as the Science Alliance at the University of Sydney which gives teachers the opportunity to get expert advice when they have technical questions.

In this new expanded Examiner's Report samples of marking schemes and sample candidate responses are shown for the first time. In looking at these it is important to remember that the mark schemes devised for HSC examinations are designed to rank students' responses. Thus mark schemes for individual questions are based on students' responses and may require more or less information than is immediately obvious on reading the question. The sample answers provided simulate those given by candidates and include misspellings and incorrect grammatical constructions where these occurred.

Multiple Choice Questions (1-15)

Candidates found these generally quite easy, the only questions which gave problems were 1, 5, 8 and, to a lesser extent 10. Answers to Q1 were divided almost evenly between (B) 650 million years and the correct answer (C) 5 billion years. Candidates who believe the age of the earth is 650 million years must have only hazy notions about the process of biological evolution and the rates at which change can occur. In question 5 slightly less than 50% of candidates selected the correct option (C) with all other options attracting a significant number of responses. It is not clear why this proved so difficult but suggests that natural selection continues to be a poorly understood concept. In Q8 many candidates selected (D), probably answering the question ".. two *identical* sets of genetic ...". It is re-emphasised that careful reading of questions is essential. In Q10 only about 50% selected the correct option (A) with (C) attracting almost 30% of responses.

Question 16

This did not present any special problems to candidates. Some interpreted 16(b) to relate to marine environments in general rather than specifically relating their answers to situations where environmental salt levels require specific adaptations.

Question 17

This was also quite straightforward. In (b) some candidates attempted to use complexity (from the question) as part of their answer.

Question 18

In marking this question 1 mark was awarded for each of the following responses. Candidates needed to supply only three of these to score full marks:

1.   The agent of disease should always be found in diseased hosts, and never in healthy individuals.

2.   It must be possible to isolate the agent from the diseased host and grow it in pure culture (i.e., in a culture containing only that micro-organism).

3.   The cultured agent should cause the disease symptoms when given to healthy individuals

4.   When re-isolated and cultured from these newly infected hosts, the disease organism should be identified as the same as that present in the original host.

Clearly these are quite difficult statements to write clearly and concisely and some latitude was granted provided there was no ambiguity. One mistake which was not allowed was to confuse 'disease' with 'agent' or 'micro-organism' as in "the disease was cultured".

Candidate responses:

An example of a response scoring full marks is:

(i)   *The micro-organism suspected of causing the disease must be present in every case* (1 mark)

(ii)   *The micro-organism must be able to be cultured from the host and grown in pure culture.* (1 mark)

(iii)   *If the micro-organism from the culture is injected into a healthy host, the same symptoms as before must occur.* (1 mark)

In (i) the candidate has not included the phrase "of the disease" at the end but when the response is given directly after the question we assume that this phrase is implied. In (ii) the host is not specified as "diseased" but again this is implied in an answer of this quality. In (iii) "as before" is accepted to mean those that occurred in the original host.

An example of a response scoring 2 marks is:

(i)   *Isolation – if the micro-organism could be obtained from the diseased host and grown in pure culture (1 mark)*

(ii)   *Re-infection – if micro-organisms from this purely grown culture could be inserted into a healthy host and the disease reappears (1 mark)*

(iii)   *Re-isolation – if the disease in the new host could be isolated and cultured again. (0 marks)*

Although the candidate did not explicitly state in (ii) that the disease had the same symptoms as the original disease the response was accepted. Technically the disease does not reappear in this host but this, also was accepted. (iii) scored no marks, not because the candidate said "could be" rather than "must be" – this was common in answers and was accepted – but rather because the response confuses disease with micro-organism and fails to indicate that the second culture must be shown to be identical with the first.

An example of a response scoring 1 mark is:

(i)   *The micro-organism must be present in every case of the disease* (1 mark)

(ii)   *The micro-organism must be able to be isolated from the diseased host* (0 marks)

(iii)   *When the micro-organism is injected into a healthy host, the host must get the disease* (0 marks)

The answer to (i) gained a mark even though it did not mention that the micro-organism is "suspected of causing the disease" as this would repeat material in the question and as such is not absolutely necessary. The response to (ii) did not mention culturing and so did not score.

Question 19

This was generally well answered.

Question 20

This was not particularly well answered. Many candidates seem confused about the processes of crossing over – the exchange of material between sister chromatids – and random segregation – the migration of individual chromatids. Confusion between mitosis and meiosis was apparent in many responses. Poor answers often contained terms like 'merging genes' which suggest little understanding of the topic.

Question 21

This was generally well answered. Students who had problems showed little or no knowledge of the most fundamental aspects of the topic – genotypes, formation of gametes, the use of Punnet squares.

Question 22

The principal problems encountered here involved imprecise language. Candidates have obviously been exposed to many technical terms which they do not properly understand. Separating cause and effect is another area which clearly causes much confusion.

Question 23

This was generally well answered and may have been too simple.

Question 24

As was the case in Q22 candidates have difficulty expressing immunological concepts clearly. Possibly a general overview of the processes involved should be established before loading students with too much technical detail.

Question 25

In marking this question a scheme was drawn up which identified the types of evidence relevant to the theory of evolution and simple statements which link this evidence to the theory. Candidates could score a maximum of 1.5 marks in each category:

EVIDENCE   SUPPORTING STATEMENT

Fossils   <u>Described</u> examples

                                                    OR

                                            Simple to complex

                                                    OR

                                            Common ancestry

Age of the Earth   Provides time needed

EVIDENCE	SUPPORTING STATEMENT
Any anatomical similarity	Common ancestry
	OR
	Structures modified for different uses
Embryology/gill pouches	Common ancestry
Transitional forms/fossils	Show link between two groups
	OR
	Evolved from water to land
	OR
	Common ancestor
	OR
	Described example

An example of a three mark response is:

Age of the Earth – ample time for changes in the environment and organisms to occur.

Fossils record – the process of simple to complex organism of the same species.

Homologous structure –pentyldactal limbs show organism may have risen from a common ancestor.

Although this response contains several mistakes – 'same species' in the second statement 'pentyldactal' it nevertheless has listed three pieces of evidence and related each to the theory of evolution.

An example of a two mark response is:

Fossils evidence shows a gradual change in certain characteristics over billions of years suggesting common ancestry.

Homologous structures – same structure adapted to different function/environment – common ancestry.

This candidate gave only two pieces of evidence so could score only two marks. Note that the same statement – common ancestry – gained 1/2 a mark in each case.

An example of a one mark response is:

Age of the earth.

Fossils.

The candidate has given only two pieces of evidence and has not expanded their answer.

Question 26

The total 5 marks for this question were allocated to part a. Most students were able to answer this part without difficulty. All students' answers were read in their entirety.

Question 27

Most candidates were able to give the common name of a macroscopic parasite but only a few could give the scientific name. Most knew the features of the life cycle of the parasite they had studied although this was not necessarily relevant to the question. The main problems related to candidates giving physiological or behavioural adaptations rather than physical features in their answers to (b). Again it must be emphasised that reading questions carefully and answering what has been asked are essential to scoring good marks.

Question 28

Responses to this question were in the main very good. Graphing skills were good and candidates generally expressed themselves clearly and concisely in (c). There was, however, some confusion over the meaning of technical terms such as exothermic in some answers.

Question 29

The answers to (a) were reasonably good although in answers to (ii) it was not clear whether many candidates were distinguishing genotype from phenotype. In (b) many candidates gave details of Mendel's methods without considering the design of the experiments. It is important to realise that Mendel's importance in the history of genetics is as much to do with the design of his experiments as with the results of these experiments.

Question 30

Many candidates compromised their answers by failing to organise the information they had in an intelligible form. It should be emphasised to students that there is no reason not to use tables just because they have not been asked for explicitly. Many answers contained "key words" which it was apparent were not understood. Few candidates seemed clear on the ways in which the mechanisms function to prevent entry. Two areas of particular confusion were the role of cilia in the alimentary canal and the relationship between pH and acidity, with many describing acid conditions as "high pH".

Question 31

In (a) only one third of candidates could answer (i) correctly and, while most know the phrase "surface area: volume ratio", few seem to grasp what this concept means in relation to heat loss. (b) was generally well answered but a number of candidates contradicted themselves or expressed themselves in such a confused way that answers were difficult to interpret. Candidates should be advised to read their answers and make sure they are coherent and consistent.

The marking scheme for this question was:

(a) (i)   physiological   1 mark

    (ii)   reduce heat loss   1 mark

           AND heat directed to body core/vital organs   1 mark

    (iii) larger animal has lower SA:VOL ratio, reducing heat loss   1 mark

(b) as temp. decreases, O_2 uptake increases   1 mark

An example of a 5 mark answer is:

(a) (i)   *physiological*   1 mark

    (ii)   *constricting blood vessels to reduce blood flow to their*
           extremeties help to reduce heat loss and keep their vital
           body organs warm   2 marks

    (iii) *Antarctic penguins also have a larger body mass than*
           temperate penguins therefore having a small surface area to
           volume ratio (small SA:V ratio) to reduce heat loss   1 mark

(b) *The hotter the environmental temperature is the lower the oxygen*
     consumption is, while the colder the environmental temperature is,
     the higher the oxygen consumption (e.g., at 30^oC 4 ml O_2/gram, at
     25^oC – 6 mlO_2/gram)   1 mark

An example of a 4 mark answer is:

(a) (i)   *physiological adaptation*   1 mark

    (ii)   *by reduce blood flow to the extremeties it would reduce heat*
           loss and thus prevent the penguins freeze to death   1 mark

    (iii) *The larger body mass will have small SA/V ratio thus it*
           could minimise heat loss as this could contribute to the
           animals in Antarctic by preventing it from death due to
           excessive heat loss   1 mark

(b) *As the environmental temperature is increasing the oxygen*
     consumption of an animal will decrease as it does not need to
     consume too much oxygen in order to keep warm. vice versa if the
     temperature is decreasing consumption of oxygen will increase.   1 mark

The candidate scored only one mark in (a) (ii) because he/she failed to indicate that heat
was being re-directed to body core.

An example of a 3 mark answer is:

(a)   (i)   *physiological adaptation is the ability to constrict the blood vessels but constricting them in response to cold is behavioural.*   0 marks

       (ii)   *The penguin attempts to maintain as much of it's body heat as possible. The extremeties lose a lot of heat due to the very large concentration gradient between the penguin and the environment and if warm blood it will be lost almost immediately on their huge surface area. So therefore the penguin shunts blood and doesn't send it to the extremeties so maintains the maximum amount of heat.*   1 mark

       (iii)   *A larger body mass means that their surface area to volume ratio is decreased which means there is less heat lost to the environment there is not as much room for diffusion to occur.*   1 mark

(b)   *As the temperature of the environment decreases, an animal's consumption of oxygen increases, probably due to increased metabolic rate in an attempt to keep itself warm. Respiration rate increases when temperatures are colder.*   1 mark

An example of a 2 mark answer is:

(a)   (i)   *physiological*   1 mark

       (ii)   *this allows penguins to enter freezing waters still able to move their extremeties without them freezing up*   0 marks

       (iii)   *This increases the penguins SA/vol ratio which means it does not lose as much heat to the environment. This means the penguin can function effectively without freezing.*   0 marks

(b)   *As temperature decreases the animals oxygen consumption increases. In the opposite as the temperature of the environment increase the oxygen consumption decreases.*   1 mark

An example of a 1 mark response is:

(a)   (i)   *this is a structural adaptation*   0 marks

       (ii)   *so it wings and feet to do not freeze up and not move as fast*   0 marks

       (iii)   *as a larger surface area loses heat more slowly*   0 marks

(b)   *The lower the temperate the more oxygen is needed and the higher the temperature less oxygen is used.*   1 mark

Electives

In each of the Elective questions one part has been selected for close examination, i.e., a mark scheme and some sample answers are given.

Question 32 The Australian Environment

Candidates seemed reasonably well prepared for this elective and some centres showed very good, detailed knowledge especially in relation to food webs and life cycles. Most candidates used written responses only although in many cases it would have been simpler to draw food webs with arrows showing energy flow. The marking scheme and sample answers for (e) are shown below.

Marking Scheme

e (i)   Complete scientific name of a marsupial species   1 mark

OR

Complete common name of a marsupial species   1 mark

If marsupial but not a species name   0.5 marks

Not a marsupial   0 marks

Examples of 1 mark answers are:

The red kangaroo, <u>Macropus rufus</u>

OR

The yellow-footed rock wallaby

An example of a response scoring 0.5 marks is:

Kangaroo

e (ii)   Description , or map showing where the marsupial can be found   1 mark

One climate factor which is linked to an adaptation of the

marsupial   1 mark

An example of a response scoring 2 marks is:

[(i)   *Desert hopping mouse*]

(ii)   *This small marsupial is found in the arid climatic regions of Australia. It is adapted to the hot desert climate. It loses heat through its large ears and its nocturnal to escape the hot parts of the day.*

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An example of a response scoring 1 mark is:

[(i)   *The yellow footed rock wallaby*]

(ii)   *The yellow footed rock wallaby is distributed in isolated rocky outcrops in the Flinders Ranges in South Australia. It likes the temperatures found there.*

This answer indicates a correct location but fails to relate the climatic factor to a specific adaptation of the wallaby.

e (iii)   The concept of isolation of marsupials in Australia   1 mark

Mention of radiation in Australian environments   ⎫   0.5 marks

   OR   ⎬

Mention of lack of placentals/competition   ⎭   0.5 marks

Reference to a fossil   0.5 marks

An example of a response scoring the full 2 marks is:

When the continents that were part of Gondwana drifted away from each other, the marsupials in Australia were isolated from the others. Since there were few predators, the marsupials thrived and became adapted to our new climate (adaptive radiation). The lack of predators is why we have so many marsupials. Fossils of primitive marsupials are found in other continents, but because of isolation, our marsupials developed in their own way!

This answer scores 1 mark for a reference to isolation, 0.5 marks for reference to radiation and 0.5 marks for reference to fossils.

An example of a response scoring 1.5 marks is:

This is because Australia was isolated from other land masses about 50 million years ago when Australia broke away from Gondwana many small marsupials were stranded. These marsupials were allowed to fill the many environments with the help of adaptive radiation, without any competition or many predators.

This answer scores 1 mark for its reference to isolation ("stranded") of marsupials. It scores 0.5 marks for the mention of radiation of marsupials into many environments. It does not qualify for any further marks although it does refer to "lack of competition" because it has already scored the half mark for radiation. On its own the last statement would have scored a half mark.

An example of a response scoring 1 mark is:

Millions of years ago Australia belonged to a super continent known as Gondwana. Many marsupials roamed about. As Australia broke away, many of the species on the continent moved north with Australia. The climate became warmer, thus fostering the evolution of many marsupials.

Fossils of diprotodon, and platypus teeth have been found in the continents which were once part of Gondwana supporting the above evidence.

This scores 0.5 marks for reference to adaptive radiation. It does not mention, or describe the concept of isolation. It also scores 0.5 marks for reference to a fossil.

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QUESTION 33 Structure and Function of Cells and Tissues

The biological knowledge displayed by candidates attempting this question was generally good in most areas. In (b), however, it was clear that a significant number of candidates did not know a specialised tissue or cell from an animal and answered using plants or micro-organisms. In (d) a number either misread "unicellular" or had not prepared this section. The organisation of answers was often very good with candidates using tables even when not specifically required. The standard of diagrams was also generally good.

The marking scheme and sample answers for (b) are shown below.

Marking Scheme

(b)   (i)   A clear outline drawing of any of the following animal
          tissues or cells (epithelium, muscle, nerve, bone or cartilage)   1 mark

            One specialised structure correctly labelled   1 mark

            A second specialised or unspecialised structure correctly
            labelled   1 mark

            Students were able to gain half marks in each of the above

   (ii)   Function of first structure well described   1 mark

            or poorly described/not labelled   0.5 marks

            Function of second structure well described   1 mark

            or poorly described/not labelled   0.5 marks

An example of a response scoring 5 marks is:
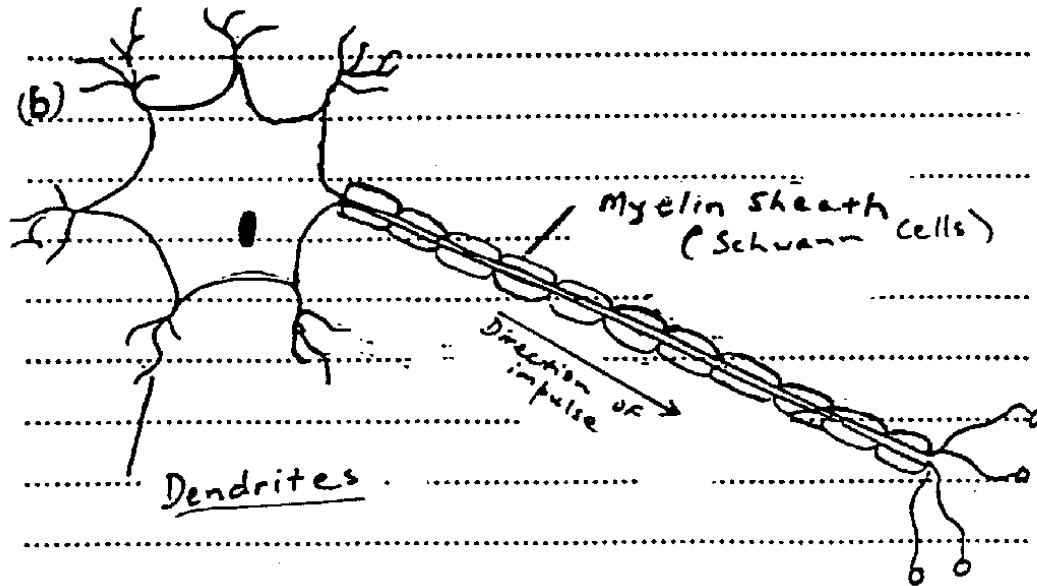
dendrites = Finely branced to pick up stimulus from receptor that is to be transmitted down the motor neurone

myelin sheath (Schwann cells) = insulate the electrical current being transmitted down the axon. It stops electrical currents becoming mixed up or being transmitted between cells and thus allows for effective muscle control.

This answer contained a good drawing of a motor neuron with both dendrites and myelin sheath (two specialised structures) correctly labelled. The description of the functions of these two structures was good at this level. The answer thus scored the maximum 5 marks.

An example of a response scoring 2.5 marks is:

(i) — Muscle Cell

— Long cell
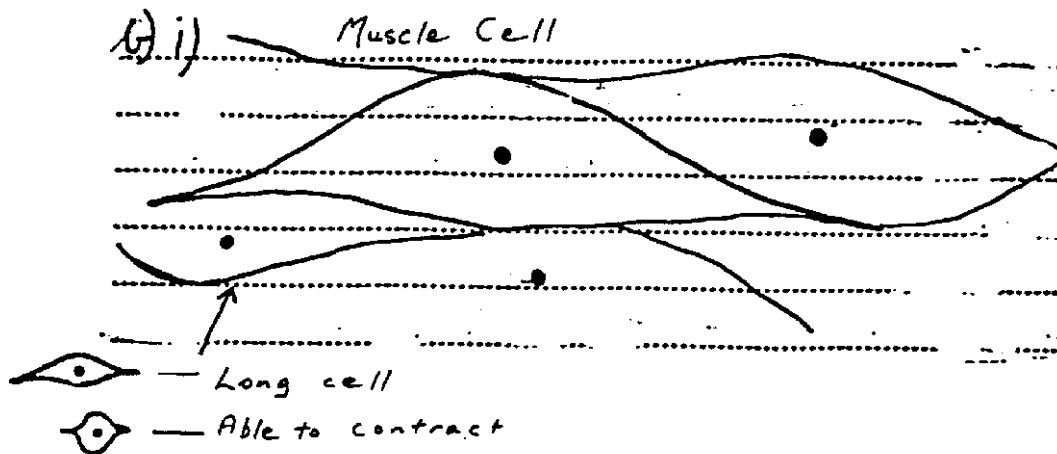
— Able to contract

ii)   *long cell able to stretch to allow movement and flexibility of body*

– able to contract this caused limbs etc to move and operate this is controlled by nervous responses therefore many cell can opperate simultaniously.

This is a reasonable drawing of smooth muscle cells and the candidate scores 1 mark for showing the tapered ends, a continuous membrane and showing at least one structure (the nucleus). Labelling of the "long cell" scores the mark for showing the first specialised structure. The description of function is weak and it is clear the candidate does not understand the difference between skeletal and smooth muscle, nevertheless 0.5 marks was scored for linking muscle cells to movement – a weak description of function.

An example of a response scoring 1.5 marks is:

b.).i) Epithelum

Cell layer
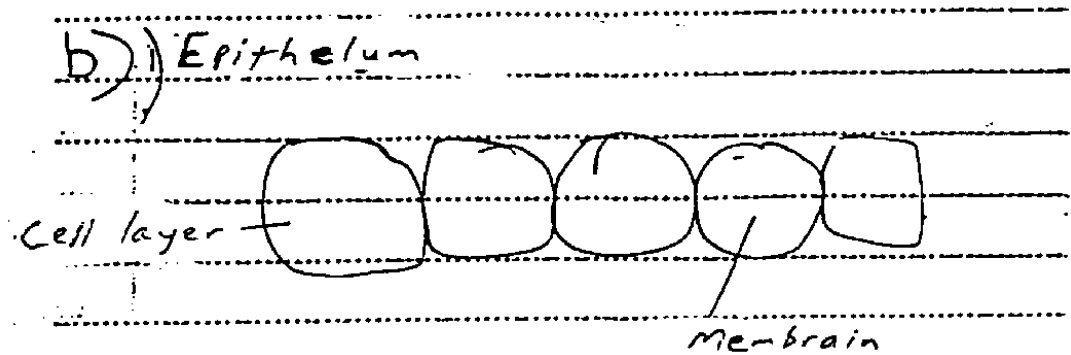
Membrain

ii)   *Epithelium make a good cell layer for covering body – skin protecting body*

        membrain – used to store cell chemicals protects cell.

This is a poor drawing of epithelial tissue but still scores 0.5 marks – the epithelial cells drawn are of regular shape (roughly cuboidal) and have a continuous membrane. The "cell layer" label is incorrect and scores no marks. "Membrane" is a correct label but points to the wrong part of the cell so scores 0.5 marks. The function of the membrane is incorrect and scores no marks. The function of the cell layer is vaguely correct but poorly explained and scores 0.5 marks – even though the label was directed to the wrong structure.

QUESTION 34 Control and Co-ordination

This question was generally well done. It appears, however, that many are selective about what they memorise: learned diagrams are reproduced when, in fact, some modifications are required (f) but basic information like the parts of the brain have not been learned (a)

The mark scheme and sample answers for (b) are given below.

(b) (i) Give the name of a hormone secreted by the pituitary gland   1 mark

Note: 16 hormones are produced/stored in the pituitary gland. Any one of these scores 1 mark. If initials are used in the answer (e.g., FSH for follicle stimulating hormone) then spelling must be correct (no marks for FPH) but otherwise spelling does not count so long as the word(s) can be recognised as a pituitary hormone. No marks can be scored for hormones produced elsewhere in the body.

(ii) Name the organ this hormone acts on   1 mark

Note: If an incorrect hormone was given in (i) a mark was still awarded if the organ named is a target for any of the 16 pituitary hormones, e.g., a candidate might say testosterone – not produced in the pituitary gland – in (i) but give testes – which are a target for a hormone produced by the pituitary in (ii) and so score 1 mark here. If a correct hormone was given in (i) then the organ must be correct for that hormone, e.g., ovary if FSH given in (i). A very common error was to say "whole body" as a target for growth hormone. This is not an organ, to score a mark here candidates should have given a specific structure such as long bones.

(iii) Give a feature of the target cell which makes it respond specifically to this hormone   1 mark

Note: Some variant on the notion of receptor molecules (the simplest and completely correct answer), lock and key model or membrane proteins was wanted here. A common error was to explain the effect of the hormone rather than why the cells can respond, e.g., thyrotropin causes the thyroid to take up iodine and produce thyroxin.

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(iv)   Describe the relationship between the hypothalamus and the
pituitary   3 marks

Note: Candidates needed to make three correct statements about the relationship between the hypothalamus and the pituitary gland. Examples of acceptable statements are:

- The hypothalamus controls the pituitary

- The pituitary stores hormones produced in the hypothalamus

- Blood vessels connect the two organs

- Nerves connect the hypothalamus to the pituitary

- The hypothalamus co-ordinates the nervous and endocrine systems

- There is a feedback system between these two organs.

The most common error was to make a single statement. Although no number of points was specified in the question candidates should be aware that a single statement will not be adequate to explain a relationship such as that between the hypothalamus and pituitary. Another common error was to make statements such as "The pituitary is the master gland" which does not answer the question.

An example of a response scoring 6 marks is:

(b)   (i)   *TSH*

        (ii)   *Thyroid gland*

        (iii)   *The target cells on the thyroid gland react with the TSH. ATP is converted to cyclic AMP and this enabled the organ to respond to the hormone.*

        (iv)   *The hypothalamus is virtually in charge of the 'master gland', the pituitary. It must secrete releasing factors to prompt the anterior pituitary galnd to secrete its hormones and the hypothalamus secretes hormones that enter the blood vis the posterior pituitary gland.*

An example of a response scoring 4 marks is:

(b)   (i)   *ADH*

        (ii)   *kidneys*

        (iii)   *kidney tubules*

        (iv)   *The hypothalamus receives nerve impulses from the brain and central nervous system to release hormones. The hypothalamus sends to the pituitary releasing factors where the pituitary releases the hormones. The hypothalamus may also release hormones which are send down to the pituitary through blood vessels connected between them.*

This answer scores no mark for (iii) and makes only two correct statements in answer to (iv).

An example of a response scoring 3 marks is:

(b) (i) *Anti-diuretic hormone ADH*

  (ii) *kidneys*

  (iii) *reabsorption of water through blood vessels and glomerolous (filter system) network and closeness to blood vessels.* [This was actually crossed out by the candidate and so not marked]

  (iv) *Hypothalamus can regulate the secretory activity of pituitary through special hormones.*

An example of a response scoring 2 marks is:

(b) (i) *oestrogen*

  (ii) *the ovarys and reproductive system in females*

  (iii) *these cells are receptive through their cell membranes to the hormone which stimulates menstruation and the release of eggs from the ovary.*

This answer scores a mark in (ii) as the ovaries do respond to a pituitary hormone and one mark in (iii).

QUESTION 35 Classification and the Species Concept

Candidates attempted most parts of this question reasonably and there was evidence of a higher general level of biological knowledge than in previous years. The only parts which consistently gave difficulties were (f) and (g).

The mark scheme and sample answers for (e) are given below.

(e) No marks were awarded for giving a family name but other answers must relate to the stated family.

  (i) Two correct features which distinguish the stated family from others   1 mark each

  Two correct general features which can be used at family level   0.5 marks each

  (ii) Two correct genus and species names – must be from family stated or if correct family can be inferred from answers (i)-(iii)   0.5 marks each

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(iii)   One correct feature which distinguishes the named species
          from each other   1 mark

          OR

          two general features which can be used to distinguish
          flowering plants at the species level   0.5 marks each

An example of a response scoring 3 marks is:

(e)   *Proteaceae*

        (i)   4 stamens per flower – wiry protruding styles

        (ii)   <u>Banksia serrata</u>, <u>Banksia ericifolia</u>

        (iii)   <u>Banksia serrata</u> has serrated leaves and grey-yellow flowers while <u>B. ericifolia</u> has small smooth leaves and flowers red/orange

The candidate scores only 1 mark in (i) as wiry protruding styles is a feature used for classification at the genus level. In (iii) 1 mark could have been paid for either of the features – leaf structure or flower colour.

An example of a response scoring 2.5 marks is:

(e)   *Epacridaceae*

        (i)   *tube shaped flower, small pointed leaves*

        (ii)   *E rigida, D secundum*

        (iii)   *colour, shape of leaves, trunk size*

In (i) flower shape scores 1 mark. Leaves are seldom a distinguishing feature at the family level, and certainly not for Epacridaceae. 1 mark was awarded in (ii) as the genera could be identified because the family name was given. No marks would have been awarded without this. In (iii) shape of leaves was awarded 0.5 marks as it is a feature often used to distinguish species.

An example of a response scoring 1.5 marks is:

(e)   *One family studied was Eucalyptus*

        (i)   *long green leaves with oil glands and have pink coloured flowers with showy stamens.*

        (ii)   *maculata and amplifolia*

        (iii)   *maculata has narrow leaves with dimpled and spotted bark; amplifolia has oval leaves and bark which comes off in long flakes*

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This answer contains the common error of equating the features of the genus Eucalyptus with those of the family Myrtaceae. If the family Myrtaceae had been given then leaves with oil glands would have been awarded 1 mark in (i). The half mark was awarded for showy stamens as a general feature (flower structure) used to distinguish families. Even if family Myrtaceae had been given showy stamens could still have only scored 0.5 marks as it is not a feature of all, or even the majority, of Myrtaceae. No marks were awarded in (ii) for species names alone. The mark awarded in (iii) could have come from two possibilities: 0.5 marks each for bark type and leaf structure as features useful in distinguishing species (even though the leaf shape given for amplifolia is incorrect); OR 1 mark for a correct comparison of the barks of the two species.

QUESTION 36   The Human Species

No part of this question presented special difficulties to candidates although Lamarkian ideas are still widely accepted by many. An extraordinary conclusion of a substantial number of students was that the use of birth control may lead to humans being unable to reproduce sexually, even to the loss of genitals, leading to the need for more IVF. Many candidates did not appear to know the term polymorphism and biological knowledge was poor for animal features [(a) (i)] suggesting that undue weight has been given to studying past HSC papers rather than the topic itself.

The mark scheme and sample answers for (c) are given below.

(c)   (i)   Upright stance occurred first   1 mark

               Upright stance appeared before brain size started to
               increase   1 mark

An example of a response scoring 2 marks is:

(c)   (i)   *Upright stance would have evolved prior to brain size. The diagram and information about Lucy suggest her upright stance was only minimal variation on humans today. The graph on brain volumes shows a marked increase between Australopithecus (Lucy) and Homo sapiens. This dramatic increase suggests brain size began to increase long after upright stance.*

An example of a response scoring 1 mark is:

(c)   (i)   *By the information given upright stance was evolved first as Lucy is standing upright and she is an Australopithecus. In the graph Australopithecus had small brain volumes which shows us that upright stance was evolved first.*

(c)   (ii)   1 mark for each of TWO different advantages of upright
             stance, maximum 2 marks.

An example of a response scoring 2 marks is:

(ii)   *The arms are free and there is an ability to carry things such as food, offspring
       and weapons. The increased height may have allowed early Homo sapiens to see
       predators and prey from afar. Bipedalism gives an efficient low energy form of
       locomotion over long distances and may also help the ability to radiate heat.*

This scores 1 mark for "arms freed" which is explained with examples and 1 mark for
the explanation of the advantage of bipedalism (low energy locomotion).

An example of a response scoring 1 mark is:

(ii)   *Two advantages*

       less strain on back

       the ability to be able to reach for higher objects example in trees etc.

This scores the 1 mark for "the ability to reach for higher objects".

An example of a response scoring 0 marks is:

(ii)   *the ability to run away from predators*

       the ability to travel long distances.

The first statement is simply incorrect – upright stance is a disadvantage. The second
statement is too vague and needs some further explanation of the effectiveness of
locomotion with upright stance.

QUESTION 37   Genes in Action

This question was generally well done although many candidates had difficulty drawing
a well labelled diagram in (e).

Part (d) had no solution and all students were awarded 2 marks.

The mark scheme and sample answers for (h) are given below.

(i)   A maximum of 3 marks could be obtained in this section
      using any three of the following:

      Base inversion   ⎤
                            ⎬ point mutation
      Base substitution   ⎦

      Base addition   ⎤
                            ⎬ frameshift mutation

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Base deletion   ⌡

Changes in chromosome number, e.g., non-disjunction, Down's syndrome

Changes in chromosomal structure (any 1 chromosome)

A maximum of 2 marks could be scored from any combination of the following weaker responses awarded 0.5 marks each

Permanent

Inheritable

Change in DNA/base sequences

Crossing over

Change in base number

Genetic recombination

(ii)   1 mark was awarded for any two of the following

High energy radiation, e.g., X-rays, UV light, alpha rays, even nuclear waste

AND/OR

Chemical mutagens, e.g., nitrous acid, base analogues, thalidomide

AND/OR

Increase in temperature

An example of a response scoring 5 marks is:

(h)   (i)   *changes in genes such as base substitutions, frameshift mustations; or in chromosomes such as inversion or translocation of a segment of a chromosome*

(ii)   *X-rays, UV rays, chemicals such as acridine dyes in food, herbicides such as DDT and agent orange*

This scored 3 marks for three different types of mutation and 2 marks for two different mutagens.

An example of a response scoring 3 marks is:

(i)   *A point mutation or a chromosomal mutation*

(ii)   *Radiation – x-rays, gamma rays*

Chemicals formaldehyde, acridine dyes

This scores 1 mark for "point mutation" and 2 marks for the two types of mutagen in (ii).

An example of a response scoring 1 mark is:

(i)   *point shift mutation*

         frame shift mutation

(ii)   *radiation*

This scores 1 mark for frame shift mutation. "Radiation" is too general to score a mark.

QUESTION 38   Human Environmental Impact

Attempts at this question were of variable quality and few candidates seemed to have knowledge of all the topics examined. Many did not understand the concept of accumulation of slowly degraded pollutants in the food chain (d). Many candidates did not interpret the stimulus material in (d) correctly or failed to relate it to their answers. In (d(iii) many candidates had difficulty explaining the development of resistant populations. Graphing skills in (f) were poor. Graphing is a "generic" skill and may be required in any question, either core or elective.

The mark scheme and sample answers for (d) are given below.

<table>
<tr><td>(i)</td><td colspan="2">Explanation of how DDT entered sea – washed into waterways, rivers etc.</td><td>1 mark</td></tr>
<tr><td>(ii)</td><td colspan="3">Explanation of why DDT is still found in human tissues – looking for three separate factors:</td></tr>
<tr><td></td><td>•</td><td>how DDT enters (eating fish etc)</td><td>0.5 marks</td></tr>
<tr><td></td><td>•</td><td>DDT accumulates in tissues</td><td>1 mark</td></tr>
<tr><td></td><td>•</td><td>DDT not broken down or excreted easily</td><td>0.5 marks</td></tr>
<tr><td>(iii)</td><td colspan="3">Explanation of why DDT was replaced – again looking for three separate aspects:</td></tr>
<tr><td></td><td>•</td><td>Some insects have natural resistance which can be inherited</td><td>1 mark</td></tr>
<tr><td></td><td>•</td><td>resistant insects survive and reproduce</td><td>0.5 marks</td></tr>
<tr><td></td><td>•</td><td>results in population of resistant insects</td><td>0.5 marks</td></tr>
</table>

In this section if students mentioned acquired resistance or described insects becoming resistant they did not score.

An example of a response scoring 5 marks is:

(i)   *DDT was sprayed on crops such as wheat and corn to prevent and control pests and insects however the excess (run off) entered the water table and waterways after rain and eventually entered the sea.*

(ii)   *DDT takes many many years to break down and once its in the human tissue it remains their and builds up as they come in contact and consume more. So if they eat fish that had DDT in it that amount will stay in them and it build up through the years as it doesn't break down quickly.*

(iii)   *Even if DDT wasn't banned and farmers continued to use it the insects and pests would have slowly developed a resistance to DDT because when the first lot of insects got sprayed most of the insects got killed however a couple had a genetic resistance and they bred and the population of their offsprings with DDT resisitance increased and every time they got sprayed only those with the gene survived and bred increasing their population thus eventually most of the insects will bare that gene that makes them resisitamt to DDT.*

This answer contains all the points required by the mark scheme.

An example of a response scoring 4 marks is:

(i)   *DDT was sprayed on crops ie wheat and corn, to control insect pests and once it rained or the crops were watered the off-run (including the water and chemical DDT) gradually made its way towards rivers which then carried DDT into the sea water killing or poisoning many animals and plants on the way.*

(ii)   *As agricultural crops (wheat and corn) were continuously sprayed with the pesticide DDT, it is no doubt that humans are going to be effected by it once they consumed vegetables which have been sprayed. Once consumed the chemical DDT does not just go away but is a persisitant chemical which remains in the body even years after it is consumed.*

(iii)   *When first sprayed some of insects would had a natural resistance towards DDT while others died. These mosquitoes with a resistant would pass on this characteristic to their offspring and gradually the population of these particular pests would turn from susceptible to resistant.*

This answer did not score the mark in (ii) for accumulation but scored all others.

An example of a response scoring 0.5 marks is:

(i)   *DDT sprayed on crops left residues in the soil which were then washed out by rain into the waterways and eventually out to sea.*

(ii)   *DDT left a large amount of residue in the soil*