Cambridge Assessment International Education
Cambridge Pre-U Certificate

BIOLOGY **9790/03**

Paper 3 Case Study and Synoptic Essay **May/June 2018**

MARK SCHEME

Maximum Mark: 60

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the May/June 2018 series for most Cambridge IGCSE™, Cambridge International A and AS Level and Cambridge Pre-U components, and some Cambridge O Level components.

This syllabus is approved for use in England, Wales and Northern Ireland as a Cambridge International Level 3 Pre-U Certificate.

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Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5: Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).
GENERIC MARKING PRINCIPLE 6: Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

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Section A – Case Study

Question	Answer	Marks
1(a)	*any 2 of:* 1 perform similar function; 2 bind to same receptor; 3 closely related / recent common ancestor; 4 lack of time for mutation to occur; 5 idea of, (if function very important) would be highly conserved; 6 small molecule so one change has large effect;	**2**
1(b)	1 change in active part of molecule; 2 no longer binds to receptor / target (cell);	**2**
1(c)	151aa × 3 = 453 base pairs; 2637 – 453 = 2184; correct answer = 2 marks	**2**
1(d)	*any 2 of:* 1 packaged into vesicles by Golgi / budding off from Golgi; 2 vesicles move to / fuse with, cell surface membrane;	**2**

Question	Answer	Marks
2(a)	*Isotonic buffer solution* increased blood volume (so increased blood pressure); *Endothelin* constriction of blood vessels increases blood pressure; *and any 1 of:* increases stretch of atria / leads to expansion / distension of atria; leads to, release of ANP;	**3**
2(b)	*must include at least 3 of these:* 1 lowers water potential; 2 therefore, water moves into the blood (from interstitial fluid); 3 increases blood volume; 4 increases blood pressure; 5 increase / causes, ANP release; *and up to any 2 of the following:* 6 detected by hypothalamus / osmoreceptors; 7 ADH released by pituitary; 8 increases reabsorption of water; 9 in nephron;	**5**

Question	Answer	Marks
3(a)	*increased renal flow* 1 greater blood flow in afferent arteriole; 2 increased pressure in glomerulus; 3 increased GFR / greater volume of filtrate; *ADH inhibition* 4 decreased water reabsorption; 5 from DCT / collecting ducts; 6 aquaporins removed (from walls of DCT / collecting ducts);	**5**
3(b)(i)	1 presence of atheromatous plaque in artery; 2 idea of, restricted space due to reduced lumen; 3 increased cardiac output (to compensate);	**2**
3(b)(ii)	slower clearance from blood;	**1**

Question	Answer	Marks
3(c)	1 reduces blood pressure, by; 2 (ANP causes) increasing urine production / reducing blood volume / increasing arteriole dilation;	**2**
3(d)(i)	*any 2 of:* 1 frameshift mutation; 2 idea of, stop codon being lost; 3 continues until a new stop codon;	**2**
3(d)(ii)	*any 2 of:* 1 no effect on first 28aa / original structure is unchanged / no change to binding site / no change to active part; 2 still able to bind to receptors;	**2**

Section B – Synoptic Essay

Breadth **Maximum 3 marks**

Mark	Descriptors
	Candidate has:
3	given a balanced account including most of the relevant topic areas and selected a wide range of facts, principles, concepts and / or examples pertinent to the title
2	given a fairly balanced account including some of the relevant topic areas and selected many of the appropriate facts, principles, concepts and / or examples pertinent to the title
1	given an account including a few of the relevant topic areas and selected some of the appropriate facts, principles, concepts and / or examples pertinent to the title
0	given an account that relies on one topic area alone and selected only a few of the appropriate facts, principles, concepts and / or examples pertinent to the title

Argumentation **Maximum 3 marks**

Mark	Descriptors
	Candidate has:
3	developed and sustained a coherent argument throughout the essay leading to an appropriate conclusion showing insight
2	introduced an argument and partially developed it, so that some coherence is shown in the essay
1	shown evidence of an argument, with little development
0	shown no evidence of argumentation

Communication **Maximum 2 marks**

Mark	Descriptors
	Candidate has:
2	organised and presented information clearly and used correct terminology in appropriate contexts
1	attempted to organise material and use some correct terminology, so that with re-reading the meaning becomes apparent
0	presented an unstructured answer with poor use of terminology

Spelling, punctuation and grammar **Maximum 2 marks**

Mark	Descriptors
	Candidate has:
2	used spelling, punctuation and grammar accurately, with no more than very few errors
1	generally used spelling, punctuation and grammar accurately, but has made a number of significant errors
0	not used spelling, punctuation and grammar accurately

Scientific Content **Maximum 20 marks**

Mark	Descriptors
	Candidate has:
20	• recalled and consistently used all facts and principles (relevant to the essay) • shown sound understanding of all principles and concepts • written accurately with no major errors and very few minor errors • given comprehensive detail expected from the relevant learning outcomes, with evidence of relevant reading around the subject.
16	• recalled and consistently used most facts and principles (relevant to the essay) • shown sound understanding of most principles and concepts • written accurately with no major errors and few minor errors • given full detail expected from the relevant learning outcomes.
12	• recalled and consistently used some facts and principles (relevant to the essay) • shown sound understanding of some principles and concepts • written some material accurately with not more than one major error and some minor errors • given most detail expected from the relevant learning outcomes.
8	• recalled some facts and principles (relevant to the essay) • shown some understanding of some principles and concepts • written some material accurately with more than one major error or many minor errors • given some detail expected from the relevant learning outcomes.
4	• recalled a few facts and principles (relevant to the essay) • shown limited understanding of a few principles and concepts • written material that includes many errors, some of which may be major errors • given little detail expected from the relevant learning outcomes.
0	• recalled no relevant facts and principles • shown no understanding of relevant principles and concepts • written irrelevant material or includes many major errors • given no detail expected from the relevant learning outcomes.

Question	Answer	Marks
4	**Discuss why intracellular enzymes are essential to life.** *Candidates should discuss the role on enzymes in a variety of contexts and in a variety of roles within the cell. Care will need to be taken to avoid over-emphasis of simple enzyme mechanics. Reference should be to intracellular enzymes and not to extracellular enzymes.* The following syllabus sections are most directly relevant: • 1.2, 1.3, 1.4, 1.5, 1.6 • 3.3, 3.4, 3.5 • 4.2, 4.4 ***enzyme structure and function:*** enzyme structure and mechanism of action, including reference to active site and substrate interaction brief reference to properties of enzymes and factors affecting activity end product inhibition and allosteric regulation (including phosphofructokinase and ATP) ***enzymes in prokaryotes:*** development of resistance DNA replication in prokaryotes use of prokaryotic enzymes (e.g. in PCR)	

Question	Answer	Marks
4	***enzymes in eukaryotes:*** enzymes and DNA replication – DNA helicase, polymerase transcription – RNA polymerase translation – tRNA activation, amino acid bonding cell signalling – enzyme cascades cell division, including telomeres, spindle formation and cytokinesis role of enzymes in respiration, ATP synthase and phosphorylation intracellular digestion – single celled organisms, cell death, macrophages, lysosomes cell signalling ***enzymes in eukaryotes – plant cells:*** role of enzymes in light dependent reaction – ATP synthase enzymes in light independent reaction – RuBisCo photolysis of water and enzyme complexes possible role of enzymes in context of plant growth regulators ***enzymes in eukaryotes – animal cells:*** role of enzymes in carbon dioxide and oxygen transport in red blood cells enzymes involved in immune response, lysosomes and phagocytes muscle contraction	

Question	Answer	Marks
5	**'A highly developed nervous system has been crucial for the evolutionary success of mammals'. Discuss this statement.** *The structure of the nervous system will form an important part of the essay with the relationship between structure, organisation and function forming a basis for discussion of evolutionary advantage.* *The evolutionary advantages will be considered in light of the functioning of a mammalian nervous system, with a strong underlying link to evolutionary theory and natural selection.* The following syllabus sections are most directly relevant: • 2.3, 3.3, 3.4, 5.1 ***Introduction – linking nervous systems with survival and evolution:*** description of nervous system outline of evolution evidence of mammalian evolutionary success such as niche occupancy and wide geographical range *(note this could come as part of a conclusion)* ***structure and function of mammalian nervous systems:*** organisation of PNS, including reference to receptors, effectors and nerve types role of CNS, including significance of brain and spine to nervous coordination reflex actions description of behaviour types, including levels of response description of social behaviours why mammals need a nervous system for survival	

Question	Answer	Marks
5	***role of nervous system in adaptation in mammals:*** role of nervous system in functioning and adaptation of digestive, circulatory and respiratory systems role in homeostasis importance in behavioural variation in adaptation to changing conditions, including conditioning and learning consideration of social behaviour in relation to adaptation and survival ***relationship between nervous system and evolutionary advantage:*** description of variation in nervous system function, such as differences in reaction times and behavioural differences between individuals explanation of selection pressures and possible selection mechanisms in relation to nervous system variation, and adaptive advantage possible mechanisms of selection and survival, and change to future generations distribution and radiation of mammalian species as a result of advantages due to developed nervous systems	

Question	Answer	Marks
6	**Discuss the difference between mass and background extinction and comment on the influence of human activity on both of these.** *Mass extinction and background extinction should be considered separately and then compared in terms of timescale, magnitude and effect. Candidates should then discuss the effect of human interference and human activity on both mass extinction and background extinction. Both direct effects of human activity (such as poaching) and indirect effects (such as climate change) could be considered.* The following syllabus sections are most directly relevant: • 2.3, 5.1, 5.2 ***introduction*** *– an overview of extinction and human influence:* description of what is meant by extinction or organisms what brings about extinction	

Question	Answer	Marks
6	***mass extinction events:*** definition of mass extinction evidence for mass extinction events description of theories relating to known mass extinction and possible causes ***background extinction:*** definition of background extinction relationship between extinction and adaptation evolutionary theory, niches and speciation – the ability of a species to survive ***human activity and extinction events:*** description of human activity that may be detrimental to species survival – e.g. habitat destruction, agriculture, pollution, urbanization, fishing / hunting, global warming consideration of possible effects on mass extinction – the idea of man-made mass extinction consideration of human effects on background extinction consideration of the fact that there were significant mass extinction events and background extinction before humans evolved description of human activity that may be beneficial to species survival – e.g. conservation efforts and nature reserve, environmental protection legislation, zoos, seed banks, captive breeding	