Cambridge International Examinations
Cambridge Pre-U Certificate

BIOLOGY **9790/03**

Paper 3 Case Study and Synoptic Essay **May/June 2017**

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 will not enter into discussions about these mark schemes.

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

Notes:

The following abbreviations may be used in mark schemes:

;	separates marking points
/	alternative and acceptable answers for the same marking point
allow / accept / **A**	answers that can be accepted
not / reject / **R**	answers that are not worthy of credit
ignore / **I**	statements that are irrelevant – applies to neutral answers
AW / owtte	credit alternative wording / or words to that effect
ecf	error carried forward
(words)	bracketed words that are not essential to gain credit
<u>words</u>	underlined words must be present in answer to gain credit
max	indicates the maximum number of marks that can be given
ORA	or reverse argument
AVP	any valid point – marking points not listed on the mark scheme but which are worthy of credit

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Section A – Case Study

Question	Answer	Marks
1(a)	*Plasmodium* ; **ignore** species name *any three from:* • female *Anopheles* mosquito ; • takes <u>blood</u> from infected person ; • (feeds on uninfected person) and transfer of parasite ; • ref. to mosquito saliva / anticoagulants / anticlotting ; • ref to vector ; • AVP; shared needles with infected person / across placenta / transfusion / transplantation	**4**
1(b)	*any four from:* • parasite shows variation ; • caused by, mutation / recombination / coding different proteins ; • these parasites survive ; • pass on advantageous <u>alleles</u> ; • (natural) selection / selection pressure / selective advantage ; • ability for antigens to change / AW ; • became intracellular ; • AVP ; • AVP ; e.g. no plasmodium antigens on the surface of host cells no target for T cells / new immune response required shorter time of life cycle in blood plasma resistance to high temperatures / fever	**4**

Question	Answer	Marks
1(c)	*any four from:* • exposure to antigens (of *Plasmodium*) **;** • stimulation of B or T lymphocytes **;** • production of memory B or T cells **;** • ref. to specific, B / T cells **;** **A** complementary • ref. to secondary immune response / described **;** • production of different antibodies or T cells (against different *Plasmodium* antigens / strains) **;**	**4**
1(d)	*any three from:* • used as a control **;** **A** placebo • to compare effects of using a *Plasmodium* vaccine against any vaccine **;** • resulted in more malarial cases (than RTS,S vaccine) **;** • need to use something to stimulate the immune system **;** • ref. to factors that may influence the immune response (e.g. malnutrition) **;** • choice of vaccine may be useful as rabies is common (do not use a vaccine against a disease, uncommon / unknown in that area) / may encourage volunteers **;** • unethical / unknown effect on malaria parasite **;** • idea of it not being a true control **;**	**3**
1(e)	*any two from:* • ionising (radiation) **;** • mutates / alters / damages, DNA / genes **;** • alters proteins **;** **A** appropriate named protein • reference to cell cycle checkpoints **;** **A** prevents DNA replication	**2**

Question	Answer	Marks
1(f)	*any five from:* *for (internal max 4):* • less get malaria / saves lives ; • reduces healthcare costs ; • ref. to statistical significance / $p < 0.001$; • saving economic costs of malaria / workforce protected ; • AVP ; prevention of epidemic / disease eradication / less reliance on antimalarial drugs *against (internal max 4):* • safety concerns / side effects / allergies ; • ref to stated costs, e.g. production / storage / administering ; • length of immunity / new strains appear ; • unknown effects on people over 17 months ; • not totally effective / 8.5% still contracted malaria / only 56% effective ; • cheaper / more effective alternatives described ; • small sample size / only one trial ; • AVP ; limited ethnic mix, encourages complacency about other methods of control, possible biased / invalid trial so shouldn't be rolled out	**5**

Question	Answer	Marks
2(a)(i)	*any two from:* • fever could be non-malarial ; • incorrect home diagnosis / fever not defined ; • hospital data are not, arbitrary / subjective OR expert / professional decision ; • hospital diagnosis based on (described) tests ;	**2**

Question	Answer	Marks
2(a)(ii)	*any three from:* • malaria is spread by mosquitoes ; • description / recognition of symptoms ; • reporting of symptoms / where to get help / what to do ; • how to use medication / anti-malarial drugs ; • correct use of mosquito nets ; • screens on windows ; • wearing clothes that cover skin ; • use of insecticides (other than with nets) / insect repellents ; • information on mosquito breeding (sites) ; • dealing with mosquito breeding sites e.g. draining bodies of water / oil on water / adding fish / AW ; • AVP ;	**3**
2(b)	*any three from:* • ref, to top predator may be keystone species ; • reduced predation ; • increase / overpopulation, of next trophic level ; • ref. to competition / competitive exclusion ; • decrease / loss, in subsequent trophic level / overgrazing ; • effect on abiotic aspects ; • change / loss of habitat ; • AVP ; ; e.g. change in energy flow	**3**

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 use 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 include 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 include many major errors • given no detail expected from the relevant learning outcomes

Question	Answer	Marks
Cloning is widely used in a range of different technological applications for the production of particular molecules, cells and organisms. **Describe applications of cloning technology and discuss the need for controlling its use.**		

Question	Answer	Marks
3	• DNA cloning techniques • Uses of genetic modification • Stem cells • Animal cell cloning • Monoclonal antibodies • Plant cell cloning ***Introduction – description / definition of cloning:*** definition of cloning ***Uses*** *cells* fermenters algae fungi bacterial *animal cell cloning* include description of, somatic cell nuclear transfer / embryo splitting examples of cloning of animal tissue *plant cell cloning* include use of cuttings and cell isolation and growth in sterile culture medium examples of plant cell culture *Molecules* Gene cloning In vivo In vitro (PCR) genetic modification include examples of genetic modification DNA cloning to produce multiple genes PCR	**30**

Question	Answer	Marks
3	*organisms* wildlife / criminal, forensics research *cloning of endangered species* description of use of cloning to preserve species that are threatened in the wild *cloning of advantageous plants* to improve crop yield, disease resistance, nutritional value horticultural plants / gardening / cuttings cloning advantageous animals to improve animal productivity, health pharming *therapeutic cloning* include reference to stem cells description of isolation of cells from blastocyst use of embryos example of disease treated with cloning of stem cells *replacement tissues* reference to potential benefits of treating diseases with tissue clones advantages re. rejection *replacement body parts* reference to potential use for replacement of organs of parts of the body *monoclonal antibodies* diagnosis treatment	

Question	Answer	Marks
3	***Need for control:*** use of (human) embryos issues associated with obtaining embryos for use ethical / moral issues health risks description of risks associated with cloning of animals, including gene damage and mutation genetic contamination / gene release cloning wildlife need for legal framework / laws	

Question	Answer	Marks
Microscopes have transformed the study of biology. **Discuss the extent to which this is true.**		
4	• Microscopy • Animal and plant cell structure • Prokaryotic cell structure • Classification • Immunofluorescence • Tissue structure ***Microscope type / function:*** optical microscopes use of light limit to resolution, ability to view live cells electron microscopes use of electrons high resolution, high energy particles staining other – confocal, fluorescent, laser	**30**

Question	Answer	Marks
4	***Uses of microscopes:*** measurement discovery of animal / plant cells RBC / egg / sperm development of cell theory discovery of bacterial cells and viruses identification of bacteria / diagnosis development of germ theory cell structure and ultrastructure relate organelle discovery to resolution optical microscopy – e.g. nucleus, chromosomes, chloroplasts electron microscopy – e.g. ribosomes, cell membrane, chloroplast structure chromosome identification / analysis cell abnormality / diagnosis / smear tests / biopsy immunolabelling and fluorescence studies / GFP – biochemical pathways cell / muscle, movement cell growth and development blood cell analysis / haematology tissue structure histology tissue preparation, staining, sectioning tissue pathology / diagnosis classification / taxonomy identification historical approach	

Question	Answer	Marks
4	***Areas where microscopes have had less effect:*** ethology / behaviour / psychology ecology biochemistry DNA technology genetics fossil studies gross anatomy	

Question	Answer	Marks
How do different types of animal behaviour promote survival?		
5	• Innate / instinctive behaviour • Learned behaviour • Behaviour and survival • Adaptation ***Definition and types of behaviour:*** definition of behaviour – a response to an external stimulus *innate / instinctive:* taxes kineses withdrawal reflex *learned:* imprinting habituation classical conditioning operant conditioning reasoning	**30**

Question	Answer	Marks
5	***Behaviour and survival:*** link between behaviour as a form of adaptation adaptation to survive suckling blinking swallowing foraging e.g. *Drosophila* 'sitters' and 'rovers' link to finding food and survival rates courtship e.g. bird display – allows successful mating between same species, correct sexes / suitable partner territorial e.g. bird song protection of territory and space to breed / nest / feed hunting e.g. stalking, pack behaviour link to increased chance of successful hunt defensive e.g. 'playing dead', herding, startling of predators avoidance of predation migratory / hibernation suitable example link to food availability / seasonal changes social e.g. primate behaviour link to social cooperation and problem solving	

Question	Answer	Marks
5	thermoregulatory e.g. penguin huddling, lizard basking link to ability to survive adverse climates altruism e.g. social insects, cooperative rearing of young	