Cambridge Pre-U

Cambridge International Examinations
Cambridge Pre-U Certificate

BIOLOGY (PRINCIPAL) **9790/01**

Paper 1 Structured **For Examination from 2016**

SPECIMEN MARK SCHEME

2 hours 30 minutes

MAXIMUM MARK: 100

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

This document consists of **9** printed pages and **1** blank page.

CAMBRIDGE International Examinations

[Turn over

The following abbreviations may be used in mark schemes:

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

Section A

Question Number	*Key*	*Question Number*	*Key*
1	**C**	11	**D**
2	**A**	12	**A**
3	**C**	13	**B**
4	**B**	14	**C**
5	**C**	15	**A**
6	**D**	16	**D**
7	**D**	17	**D2**
8	**B**	18	**C2**
9	**D**	19	**B1**
10	**D**	20	**D3**

[Turn over

Section B

21 (a) (i) *idea of* linking, energy releasing / oxidation, reactions to energy-consuming reactions ; [1]

small molecule, so readily diffusible throughout cytoplasm ;
water soluble ;
easily regenerated / ADP + Pi → ATP / AW ;
easy to transfer energy by hydrolysis of terminal bond ;
idea that ATP 'fits into' many, parts of the cell / enzymes / proteins ;
charged so that it, stays in cell / does not cross membrane ;
energy released by hydrolysis can be used in many cell processes ;
R 'high energy bonds' [max 3]

(ii) *ATP production*
substrate-linked phosphorylation / chemiosmosis / ATP synthase ;

ATP transfers energy to
anabolic reactions / example /
active transport (of molecules and / or ions) /
adding phosphate groups (phosphorylation) / example /
beating / movement of, flagella /
movement of muscle filaments /
bioluminescence
AVP ; any other type of process [2]

(b) (i) ribose (not deoxyribose) ;
ribose / pentose / sugar, has two –OH groups / deoxyribose has one ;
A ref to C2 [max 1]

(ii) phosphorylated (by ATP) ;
dATP ;
DNA, polymerase / ligase ;
pairs with, T / thymine, on template (strand / polynucleotide) ; [max 2]

(c) secondary structure, alpha helix / beta (pleated) sheet ;
areas of non-regular structure / not α or β ;
tertiary structure ;
complex folding / AW ;
idea of specificity ;
R bonding as not shown in figure [max 3]

(d) *type of T cell and outline of role of each*
helper-T cells + role e.g. activate / direct other immune system cells ;
cytotoxic-T / T-killer cells, + role e.g. destroy cells infected with virus ;
suppressor-T cells / regulatory-T cells, + role, e.g. suppress / control unwanted immune responses ;
memory-T cells + role e.g. remain after antigen exposure and quickly activate after re-exposure ;
[max 3]

(e) ref to somatic gene therapy ;
inserting genes into cells means that treatment is short-lived ;
idea of inappropriate immune response to viral vectors ;
gene inserted into the wrong place inducing a tumour ;
another problem associated with gene being inserted in, wrong place / into another gene ;
child receiving treatment for SCID developed leukaemia ;
further detail regarding treatment for SCID ;
credit a case study ;
AVP ; [max 4]

[Total: 19]

22 (a) (i) protein forms, fibres / (micro)filaments / cytoskeleton ;
ref to distribution of endoplasmic reticulum in cytoplasm ;
AVP ; [max 1]

(ii) spindle apparatus / spindle fibres ; Accept spindle / microtubules / tubulin / centrioles / microtubule organising centres / MTOCs [1]

function to max 2
attach to chromosomes / kinetochores ;
detail of, elongation / structure / shortening, of microtubules ;
for movement of chromosomes ;
during mitosis ;

Accept if centrioles given as identity
forms poles of the cell ;
organises the spindle ; [max 2]

(b) (i) antibody molecules too large to pass through membrane ; [1]

(ii) locate position of specific, proteins / structures ;
antibody molecules have complementary shape to target, proteins / structures ;

can see distribution of, proteins / structures, in <u>light microscope</u> ;
do not need to prepare sections for the electron microscope ;
easier to look at a large number of cells than in EM ;

higher degree of specificity than using other staining techniques ;
idea of variable regions of antibodies giving greater specificity ; [max 2 + max 2]

[Total: 9]

23 (a) *Oleander*

lower stomatal density / AW ;
less water vapour lost through stomatal transpiration / described ;

stomata in pits / stomata below leaf surface / sunken stomata ;
longer diffusion pathway for water vapour / ref to boundary layer / ref vapour pressure deficit (VPD) at stomatal opening ;

hairs / trichomes, in pits / around stomata ;
ref slower air movement / stagnant air / ref VPD at stomatal opening ;

thicker cuticle ;
less evaporation from leaf surface / epidermis ; **A** less water loss from leaf surface / epidermis [max 2 + max 2]

(b) increase in $[K^+]$ when stoma is open ;
comparative data quote ;
values similar for both guard cells ;

active transport of K^+ inwards ;
further details of K^+ pump ;
chloride ions diffuse in ;
lowers, solute potential / water potential ;
water enters by osmosis ;
phosphate values very similar ;
used in ATP synthesis ; [max 4]

(c) ref to symplast ;
K^+ would diffuse out of guard cells (to adjacent cells) ;
other substance, lost / shared / AW ; e.g. malate
further explanation ; e.g. higher rate of active transport would be required
AVP ; e.g. further detail [max 2]

[Total: 10]

24 (a) stroma of the chloroplast ; [1]

(b) (i) ribulose bisphosphate / RuBP ; [1]

(ii) rubisco / ribulose bisphosphate carboxylase (oxygenase) ; [1]

(c) *award two marks for the correct answer (1/6 or eq) with or without working*

RuBP = 5, glycerate 3-phosphate = 3, glucose = 6 ;
1/6 / eq ; [2]

(d) ref to carbon fixation ;
key role in carbon cycle ;
only / main, route into food chains for carbon ;
the major route out of the atmosphere for carbon dioxide ; [max 2]

(e) ATP and, $NADPH_2$ / reduced NADP ;
produced in the light-dependent stage ;
production stops after dark ;
are required for step C ;
will rapidly be used up after dark ; [max 4]

(f) ref to endosymbiosis (in correct context) ;
pre-existing prokaryotes could already photosynthesise ;
ref to cyanobacteria as putative ancestral chloroplast ;
uptake of prokaryotes into other prokaryotes ;
to give a symbiotic, union / community ;
transfer of some genes to host cell nucleus ;
retention of other genes in chloroplast ;
idea of so it became an obligate symbiosis ; [max 4]

[Total: 15]

25 (a) biotic factors affecting / abiotic factors affecting / description of, habitat ;
trophic level / what it feeds on ;
adaptations for feeding / foraging method ;
time / places, where it feeds ;
where it roosts ;
whether / when, living, individually / in small groups / in flocks ;
where / when, it reproduces ;
predator / what feeds on it ;
parasites ;
competitors ;
AVP ; ; [max 4]

(b) number of species is low when few *Littorina* ;
suggest successful competition by few species of algae ;
environment unsuitable for both / AW ;

maximum number of algal species when *Littorina* is at 150 m^{-2} ;
Littorina grazes most competitive species reducing their effect ;

smallest number of algal species at, highest *Littorina* density / 250 m^{-2} ;
ref to overgrazing ;
AVP ; [max 5]

(c) *definition of keystone species*
a species whose presence and role within an ecosystem has a disproportionate effect on other organisms within the system / AW ;

removal of the species has profound effects on the, community / ecosystem ;

removal of predatory starfish reduces numbers of seven species ;
increases numbers of three species ;

reduces, species richness / biodiversity ;
presence keeps other predators in check ;
AVP ; [max 3]

[Total: 12]

26 (a) *Accept any sensible symbols*
Accept without X and Y chromosomes but male must indicate absent allele by using a dash or by putting in a Y chromosome

I^BI^o Ch Ch / **I^BI^o Ch ch** / **I^BI^o $X^{Ch}X^{Ch}$** / **I^BI^o $X^{Ch}X^{ch}$** ;
I^oI^o Ch ch / **I^oI^o $X^{Ch}X^{ch}$**;
I^BI^o Ch – / **I^BI^o $X^{Ch}Y$** ; [3]

(b) (i) fathers pass on **X** chromosome to their daughters / fathers never pass on **X** chromosome to their sons ;
mother has (at least one) dominant allele and this has been passed on to the sons ; [2]

(ii) grandson / 12, has inherited colour blindness from, mother / 7, who is a carrier ;
she has inherited **X^{ch}** from, her father / 1 ;
other grandson / 10, cannot inherit **X^{ch}** through the male line ; [max 2]

(iii) multiple alleles / 3 alleles at this locus but each person diploid so can only have 2 ;
gives 6 different genotypes / genotypes listed ;
codominance between **I^A** and **I^B**, so gives AB ;
dominance between **I^A** / **I^B** and **I^o** , so means **I^A I^o** is same phenotype as **I^A I^A** / **I^BI^o** is same phenotype as **I^BI^B** ; [max 3]

(c) *one mark for each genotype, one mark for giving notation for linkage*

father
$\frac{I^A\ np}{I^B\ Np}$ / **(I^A np) (I^B Np)**

mother
$\frac{I^o\ np}{I^o\ np}$ / **(I^onp) (I^onp)** [3]

(d) loci are linked so $\mathbf{I^A}$ and **np** are likely to be inherited together **;**
so if blood type A, likely to be free of the disease **;**
5% / small, chance, of $\mathbf{I^A}$ and **Np ;**
as a result of crossing over between loci in father **;** [max 2]

[Total: 15]

BLANK PAGE