



Cambridge International Examinations
Cambridge Pre-U Certificate

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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.

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
<u>words</u>	underlined words must be present in answer to score a mark

Section A

<i>Question Number</i>	<i>Key</i>	<i>Question Number</i>	<i>Key</i>
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

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 / $\text{ADP} + \text{P}_i \rightarrow \text{ATP}$ / 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 light microscope ;
 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 biphosphate / RuBP ; [1]

(ii) rubisco / ribulose biphosphate 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, NADPH₂ / 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

$I^B I^O \text{ Ch Ch} / I^B I^O \text{ Ch ch} / I^B I^O X^{\text{Ch}} X^{\text{Ch}} / I^B I^O X^{\text{Ch}} X^{\text{ch}} ;$
 $I^O I^O \text{ Ch ch} / I^O I^O X^{\text{Ch}} X^{\text{ch}} ;$
 $I^B I^O \text{ Ch } - / I^B I^O X^{\text{Ch}} Y ;$

[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

$I^A I^A / I^B I^O$ is same phenotype as $I^B I^B$;

[max 3]

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

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

mother
 $I^O \text{ np}$ / $(I^O \text{ np}) (I^O \text{ np})$
 $I^O \text{ np}$

[3]

- (d) loci are linked so 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 I^A and Np ;
as a result of crossing over between loci in father ;

[max 2]

[Total: 15]

