



# **MARKSCHEME**

**May 1999**

**BIOLOGY**

**Higher Level**

**Paper 2**

SECTION A

1. (a) (i) *(Award 2 marks)*  
(accept answers referring to respiration, metabolic, breathing or ventilation rates)  
as temperature rises rate falls then levels off / reaches a plateau;  
plateau reached above - 10°C;
- (ii) *(Award 2 marks maximum)*  
higher (cell) respiration rate / metabolic rate to generate **heat**;  
heat needed to maintain body temperature / keep (egg) warm;  
rate from -10°C upwards is the base rate / basal metabolic rate / normal rate;
- (b) *(Award 2 marks)*  
captive birds - 16.2 kg;  
wild birds - 13.3 kg;  
negative sign not necessary  
penalize once only if units not given using U-1 notation
- (c) *(Award 2 marks maximum)*  
both groups lose most of their lipid;  
captive birds lose more of their lipids than wild ones;  
11.2 kg versus 9.6 kg / 93% lost versus 81% / other valid figures comparing **change**;
- (d) *(Award 2 marks)*  
higher (cell) respiration rate / metabolic rate / more fat oxidised in captive birds;  
water is produced in (cell) respiration / oxidation of substrates;
- (e) (i) *(Award 1 mark maximum)*  
captive birds take in more oxygen;  
Captive birds inhale / exhale more;  
higher (cell) respiration rate;
- (ii) *(Award 1 mark maximum)*  
more water loss in captive birds so they need to take in more water;  
birds in tight groups have less access to snow on ground;
- (f) *(Award 3 marks maximum)*  
emperor penguins have to maintain body temperature in very cold conditions;  
forming groups reduces surface area exposed;  
forming groups reduces heat loss;  
forming groups reduces need for heat generation;  
conservation of food reserves / food/lipids used less quickly;  
helps keep the egg warm enough;  
ref to value of lipids for insulation;

2. (a) (*Award 2 marks*)  
diphtheria / whooping cough / tetanus / other;  
measles / polio / rubella / AIDS / other;
- (b) (*Award 2 marks maximum*)  
fungi;  
protozoa;  
flatworms;  
roundworms;
- (c) (*Award 3 marks*)  
**vaccine** injected / ingested / vaccination given;  
contains weak/killed form of the bacterium/virus;  
antibody production (by white blood cells) stimulated;  
antibodies / memory cells persist;  
refer to booster shots / repeated vaccination;
3. (a) (*Award 1 mark*)  
polygenic;
- (b) (*Award 2 marks*)  
AaBb;  
blue flowered;
- (c) (*Award 5 marks maximum*)  
all gametes shown with one allele of each gene only;  
four homozygous genotypes shown AABB AA bb aaBB and aabb;  
four double heterozygous genotypes shown AaBb;  
all of the eight other genotypes correct;  
all of the phenotypes correct;
- (d) (*Award 1 mark*)  
9 blue 3 red and 4 white;
- (e) (*Award 1 mark*)  
gene A converts white to red and gene B converts red to blue;

## SECTION B

*(Remember, up to TWO 'quality of construction' marks per essay)*

4. (a) *(Award 1 mark for any of the below; up to a maximum of 8 marks)*  
condensation / super coiling;  
chromatids/identical DNA molecules linked by centromeres;  
microtubules/spindle fibres grow from the centrioles/centrosomes;  
centrioles/centrosomes move to the poles;  
nuclear membrane breaks down;  
microtubules from the two poles connect to the kinetochores / centromere;  
centromeres divide;  
microtubules pull chromosomes/identical DNA molecules to the poles;  
tubulin molecules detached by centromere/microtubule motor at centromere;  
nuclear membrane forms around chromosomes at each pole;  
chromosomes become aligned on the equator;
- (b) *(Award 1 mark for any of the below; up to a maximum of 5 marks)*  
cells in a tissue all have the same structure and function;  
cells in a tissue all differentiate in the same way;  
organs contain different tissues;  
to carry out the function of the organ more than one tissue is needed;  
organ systems consist of two or more organs;  
to carry out the same function in different parts of the body;  
to carry out different parts of a common overall process;  
tissues are made of cells;  
any named example of a tissue **plus** any named example of an organ;
- (c) *(Award 1 mark for any of the below; up to a maximum of 5 marks)*  
**Advantages of light microscope**  
colours of material from tissues/organ can be seen;  
living material can be studied / less damage to specimen;  
cell activities / movement can be studied;  
larger field of view;
- Advantages of electron microscope**  
greater resolution;  
smaller structures can be seen / greater magnification;
- (Award up to 2 marks for the following overall assessment)*  
electron microscope better for cells / small structures;  
but light microscope better for organs;

**(plus 2 quality marks)**

5. (a) *(Award 1 mark for any of the below; up to a maximum of 8 marks)*  
reactions take place in the stroma;  
carbon dioxide reacts with RuBP;  
catalysed by RuBP carboxylase;  
GP formed;  
GP converted to triose phosphate;  
reduction reaction involving use of  $\text{NADPH} + \text{H}^+$  ;  
energy from ATP also needed from this conversion;  
triose phosphate converted to glucose(phosphate)/starch;  
RuBP regenerated from triose phosphate;  
Calvin cycle;
- (b) *(Award 1 mark for any of the below; up to a maximum of 6 marks)*  
light independent reactions involve  $\text{ATP}/\text{NADPH} + \text{H}^+$  / intermediates which are made in  
light dependent reactions;  
Supply of  $\text{ATP}/\text{NADPH} + \text{H}^+$  / intermediates used up / runs out in the dark;  
**ATP and**  $\text{NADPH} + \text{H}^+$ ;  
GP therefore not reduced /converted to triose phosphate;  
RuBP therefore not regenerated;  
carbon dioxide fixation therefore stops;  
GP accumulates;  
stomata close in the dark;  
carbon dioxide is therefore not absorbed;
- (c) *(Award 1 mark for any of the below; up to a maximum of 4 marks)*  
 $\text{CO}_2$  needed for photosynthesis but not for germination;  
 $\text{O}_2$  needed for germination but not for/inhibits photosynthesis;  
light needed for photosynthesis but not for/sometimes for/also for germination;  
red and blue light best for photosynthesis but red only for germination;  
heat stimulates both photosynthesis and germination;  
excessive heat inhibits both photosynthesis and germination;

**(plus 2 quality marks)**

6. (a) *(Award 1 mark for any of the below; up to a maximum of 8 marks)*  
synthesised by ribosomes;  
free ribosomes/ribosomes not attached to ER;  
mRNA is translated;  
mRNA binds to the ribosome;  
tRNAs bring amino acids;  
anticodon on tRNA binds to codon on mRNA;  
formation of peptide linkage;  
two tRNA's can bind to the ribosome at once;  
growing polypeptide linked to amino acid on tRNA;  
ribosome moves on down mRNA;  
5' to 3';  
ref to stop/start codons;  
coenzymes added;
- (b) *(Award 1 mark for any of the below; up to a maximum of 4 marks)*  
in both models substrate binds to active site;  
substrate fits active site exactly in lock and key, but does not in induced fit;  
substrate / active site changes shape in induced fit, but does not in lock and key;  
in both models an enzyme - substrate complex is formed;  
in lock and key binding reduces activation energy but in the induced fit change to substrate reduces activation energy;  
lock and key model explains narrow specificity but induced fit allows broader specificity;  
induced fit explains competitive inhibition, but lock and key does not;
- (c) *(Award 1 mark for any of the below; up to a maximum of 6 marks)*  
competitive inhibitor has similar shape/structure to the substrate;  
therefore it fits to the active site;  
no reaction is catalysed so the inhibitor remains bound;  
substrate cannot bind as long as inhibitor remains bound;  
only one active site per enzyme molecule;  
substrate and inhibitor compete for the active site;  
therefore high substrate concentrations can overcome the inhibition;  
as substrate is used up ratio of inhibitor to substrate rises;  
named example of inhibitor plus inhibited enzyme / process / substrate;

**(plus 2 quality marks)**

7. (a) *(Award 1 mark for any of the below; up to a maximum of 8 marks)*  
mitosis;  
in the germ layer/germinal epithelium;  
spermatogonia produced;  
mitosis to allow many cells to be produced/continuous cell production;  
cell growth;  
enlarged cells are primary spermatocytes;  
meiosis;  
diploid to haploid;  
two divisions of meiosis;  
secondary spermatocytes produced by first division/carry out second division;  
spermatids formed by (second division of) meiosis;  
differentiation into spermatozoa/mature sperm cells;  
growth of tail / acrosome / other feature;  
ref to role of Sertoli cells;
- (b) *(Award 1 mark for any of the below; up to a maximum of 5 marks)*  
LH levels rise and stimulate more testosterone production;  
testosterone levels are very low before puberty;  
testosterone levels rise during puberty;  
testosterone causes puberty / secondary sexual characteristics;  
testosterone has many target organs in the body;  
example of target organs and response;  
ref to sequence of changes being related to level of testosterone needed;  
testosterone stimulates sperm production;  
FSH levels rise and cause sperm maturation;
- (c) *(Award 1 mark for any of the below; up to a maximum of 5 marks)*  
*ethical arguments against*  
intercourse should only be used for procreation / contraception is against natural law /  
against religious beliefs;  
contraception encourages promiscuity;  
reference to death of embryos  
damage to traditional family structures;
- (Award 4 points maximum)*  
*ethical argument for*  
prevent unwanted children / children who cannot be cared for;;  
helps reduce human population growth;  
reduces suffering due to STDs/prevent AIDS;  
reduces abortion rate;  
mother's right to choose;

(plus 2 quality marks)

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