

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

General Certificate of Education O Level

MARK SCHEME for the November 2004 question paper

5090 BIOLOGY

5090/02

Paper 2 (Theory), maximum mark 80

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NOVEMBER 2004

GCE O Level

MARK SCHEME

MAXIMUM MARK: 80

SYLLABUS/COMPONENT: 5090/02

**BIOLOGY
Paper 2 (Theory)**



Page 1	Mark Scheme	Syllabus	Paper
	O LEVEL – NOVEMBER 2004	5090	2

Section A

- 1 (a) **A** - guard cell ;
- B** - epidermis/al cell (**R** lower epidermis) ;
- C** - phloem/sieve tube (**A** companion) ; **3**
- (b) (i) allows leaf to float AW/(maximum) exposure to light* ;
- (R support unqualified)
- (ii) diffusion/movement/collection/source/provides/gives AW + CO₂
- OR (maximum) exposure to light* (*once only)
- (Ignore references to oxygen, but **R** O₂ references if they refer to respiration) ; **2**
- (**R** absorbs/takes in/references gas exchange)
- (c) (Ignore references to leaf stalks and to spaces not interconnected)
- stomata/guard cells (mainly) on upper surface AW ;
- (or v.v.)
- air spaces/chambers + palisade cells (or posⁿ described) ;
- chloroplasts/chlorophyll in epidermis (**R** upper epidermis) ;
- reference cells in clumps v. cells loosely packed AW/
air chambers v. intercellular spaces/
large spaces v. small spaces (**R** more/fewer spaces) ;
- no cuticle on lower surface ;
- reference quantity of chloroplasts/chlorophyll in spongy cells ;
- max. 3**
- (d) less/no + thickening/lignin/xylem/woody (or v.v.) ;
- (**R unqualified references to hard/rigid**)
- no need for support/support from water (or v.v.) ; **2**
- (**A** floats on)

Total 10

Page 2	Mark Scheme	Syllabus	Paper
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- 2 (a) large(r) diameter at low light intensity/or v.v. ;
 (A bigger/inversely proportional or description) (R proportional unqualified)
 fastest rate of change around 2 - 4 a.u./
 slowest rate of change/levels off at 7 - 10 a.u. ; 2
- (b) reflex/autonomic/automatic/involuntary ; 1
 (R spinal/conditioned)
- (c) light sensitive/receptor (cells) or named/retina ;
 neurones/nerve cells or fibres (A optic nerve) ;
impulses ;
contraction + circular muscles (R if reference ciliary) ;
relaxation + radial muscles (R if reference ciliary) ;
 correct reference iris ;
max. 5
- (d) no colour/pigment in iris/choroid (R eye) ;
 permits internal reflection AW of light/too much light enters
 eye/received by retina (A no shading/shielding/protection for retina) ;
 damage to retina/receptors/light-sensitive + cells/visual impairment AW
 (R damage to eyes) ; 3
Total 11
- 3 (a) one chromosome shown - in a string (mark the first) ;
 genes matching in shape and sequence (A reversed) ;
 (the appropriate 4 may be selected from a string of more than 4)
 gene 3 not shaded (all others must be uniform black or white) ; 3
 (gene 2 if the chromosome has been reversed)
- (b) (i) mutation (ignore reference chromosome) ; 1
 (ii) mutagen (or named)/reference change in DNA structure ; 1
 (A any plausible e.g. - radiation or named (α -/ γ -/X-rays)/chemicals
 /u.v./sunlight/carcinogens/smoking/viruses) ;
 (R heat/infra-red/disease)

Page 3	Mark Scheme	Syllabus	Paper
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(c) (i) I^A	;
I^o (allow in either order)	; 2
(ii) O/I^o from partner/offspring must be $I^o I^o$ or OO	;
<u>A/I^A or B/I^B</u> from the person/person cannot supply I^o/O (must have reference to both alleles)	;
I^A and I^B are dominant* (to I^o) / I^o recessive* (to both) (*AW) (A references to $A/B/O$ without I)	; 3
	Total 10
4 (a) ecosystem	; 1
(A light/sun)	
(b) energy entering producer/plant/tree/leaf (A no arrow head)	;
(R unlabelled arrow) (A unlabelled drawings)	
plant/tree/leaf → caterpillar → bird (arrows must be present) (and in correct direction)	; 2
(R tree → leaf)	
(c) (i) correct pyramidal shape (A inverted pyramid)	;
all levels correctly identified with labels (A tree + leaf here)	; 2
(tree will be on top if inverted but R producers/consumers as labels)	
(ii) bottom or top block smallest and labelled tree AW or largest and labelled leaf	;
working away from the tree/leaf - other two blocks large then small + correctly labelled	; 2
(d) block of fleas/parasites larger than and next to birds	;
rest of pyramid a reasonable copy of that in (c) (ii) (A e.c.f.)	; 2
(unless (c) (ii) is wrong and (d) is correct)	
	Total 9
5 (a) G oesophagus/gullet	;
H stomach	;
I colon/large intestine/large bowel	; 3
(b) <u>E/ileum</u> (R small intestine)	; 1

Page 4	Mark Scheme	Syllabus	Paper
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- (c) (i) 2 h(ours)/120 minutes (units required) ; 1
- (ii) stomach/H ; 1
- (d) acid resistant coat (R in BI context) ;
- not affected by HCl/acid in stomach ;
- drug not released until duodenum/small intestine AW/leaves stomach/meets alkaline environment (A letters) ;
- takes longer for water to enter/drug to dissolve ;
- membrane slows down speed of drug release ;
- max. 3**
- (e) reference sticks to mucus + in intestine AW (R oesophagus/stomach) ; 1

Total 10

Total mark for Section A = 50

Section B

- 6 (a) correct reference atria(um)/auricle(s) ;
- correct reference ventricle(s) ;
- muscles/muscular + contract(ion) (R pushing/forcing pumping - in Q.) ;
- reference thickness of ventricular compared with atrial walls ;
- atrio-ventricular/identified valve(s) (open) + blood passes ;
- close + to prevent return of blood ;
- tendons/cords/(R heartstrings) + action/function of ;
- reference aortic valves + their action (A close prevent backflow) ;
- cycle repeated/idea of co-ordinated action; ;
- max. 7**

Page 5	Mark Scheme	Syllabus	Paper
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(b) right (ventricle) wall thinner/left (ventricle) wall thicker OR reference less/
more muscle OR weaker/stronger contractions ;

(A smaller—Larger)

(pulmonary) shorter distance to travel (A only to the lungs) (or v.v.) ;

little work to do against gravity (the idea of) (or v.v.) ;

avoidance of damage to lung capillaries/low pressure required in lungs ;

(body) high pressure for kidney filtration ;

oxygen/glucose to brain ;

max. 3

Total 10

7 (a) anywhere – one correct reference stomatal movement + effect ;

– (ignore references to water vapour)

(i) dark/no light + no photosynthesis ;

(R night)

respiration occurring ;

*CO₂ out/released/produced + O₂ in/absorbed/used ;

(ii) light/day + photosynthesis ;

faster than respiration AW ;

*O₂ out/released/produced + CO₂ in/absorbed/used ;

max. 5

(* accept on annotated equation)

(b) (i) reference concentration gradients of CO₂/O₂ ;

CO₂ is a limiting factor/the more CO₂ the faster the P/S ;

more or faster CO₂ in + more or faster O₂ out ;

(ii) wilting/cells flaccid AW (R plasmolysis) ;

stomata close ;

slower exchange of gases (R no exchange) ;

slower rate of P/S (R no P/S) ;

max. 5

Total 10

Page 6	Mark Scheme	Syllabus	Paper
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- 8 Either (a) (i)** sperms + ova/eggs [anywhere in (a)] ;
- smaller/larger/correct size reference of either
- (ova – 120 to 150µm, sperm 60µm with head diameter 2.5µm x 3µm) ;
- many can be released/sperm is only nucleus + tail
- OR ovum carries some nutrition/cytoplasm/yolk (or v.v.) ;
- sperm small enough to enter egg ;
- (ii)** ratio – large numbers : one/few (A lifetime numbers) ;
- (A 1 000 minimum)
- greater wastage/chance of fertilisation/sperms
- (A more die) reaching ovum ;
- limited space for embryo/fetus/baby/room only for a few embryos/fetuses/babies ;
- fixed number of eggs (ova)/ova present from birth/sperms produced continuously ;
- (iii)** sperms have tail/flagellum/swim/motile (R move) ;
- to reach egg/ovum/reference fertilisation + in oviduct ;
- (A Fallopian tube)
- ova experience only passive movement (or described) ;
- max. 8**
- (b) (i)** copulation AW + when no ovum in system/at infertile time/stated time in cycle (A any time outside 5 days before ovulation to 7 days after)/#withdrawal method explained/*abstinence1 ; 1
- (R rhythm method unqualified)
- (ii)** (linked to (i) above, but can score if (i) is left blank)
- cycle variable or irregular/description of irregularity/miscalculation/misinterpretation of raised temperature/
- #some sperms released before ejaculation/
- *lack of control – (BUT A this IS the safest method) ; 1
- (if they say it)

Total 10

Page 7	Mark Scheme	Syllabus	Paper
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- 8 OR (a) (i) (female) one per ovule ;
 comparatively few ovules/gametes (per plant or flower) ;
 parent must supply space/food for developing seed ;
 (male) millions/lots of male gametes/pollen (grains) ;
 (A 1 000 minimum)
 great wastage/many may die/pollination is very chancy ;
 (ii) female gamete does not move/is attached to ovule/ovary ;
 already positioned where it will develop AW ;
 male gamete/pollen is moved by named agent ;
 gamete is inside pollen grain ;
 described adaptation of pollen grain for dispersal ;
 to carpel/stigma ;
 then moves within/by growth of the pollen tube ;
max. 7
- (b) same (properties) as parent/genetically identical AW ;
 only one parent needed/no need for gametes/no agents needed/
 faster ;
 less wastage/more certain ;
 offspring bound to be in suitable environment AW ;
 well-developed before separation from parent/allows (rapid)
 colonisation ;
max. 3
- Total 10**
- Total mark for Section B = 30**