

**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**

This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which Examiners were initially instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began. Any substantial changes to the mark scheme that arose from these discussions will be recorded in the published *Report on the Examination*.

All Examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes must be read in conjunction with the question papers and the *Report on the Examination*.

- CIE will not enter into discussion or correspondence in connection with these mark schemes.

CIE is publishing the mark schemes for the November 2004 question papers for most IGCSE and GCE Advanced Level syllabuses.



**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 + CO<sub>2</sub>
- OR (maximum) exposure to light\* (\*once only)
- (Ignore references to oxygen, but **R** O<sub>2</sub> 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 pos<sup>n</sup> 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
	O LEVEL – NOVEMBER 2004	5090	2

- 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 ( $\alpha$ -/ $\gamma$ -/X-rays)/chemicals  
/u.v./sunlight/carcinogens/smoking/viruses) ;
- (R heat/infra-red/disease)

Page 3	Mark Scheme	Syllabus	Paper
	O LEVEL – NOVEMBER 2004	5090	2

(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 $OO$	;
$A/I^A$ or $B/I^B$ 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) ( <b>A</b> references to A/B/O without I)	; 3
	<b>Total 10</b>
4 (a) ecosystem	; 1
( <b>A</b> light/sun)	
(b) energy entering producer/plant/tree/leaf ( <b>A</b> no arrow head)	;
( <b>R</b> unlabelled arrow)                      ( <b>A</b> unlabelled drawings)	
plant/tree/leaf → caterpillar → bird (arrows must be present) (and in correct direction)	; 2
( <b>R</b> tree → leaf)	
(c) (i) correct pyramidal shape ( <b>A</b> inverted pyramid)	;
all levels correctly identified with labels ( <b>A</b> tree + leaf here)	; 2
(tree will be on top if inverted but <b>R</b> 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) ( <b>A</b> e.c.f.)	; 2
(unless (c) (ii) is wrong and (d) is correct)	
	<b>Total 9</b>
5 (a) <b>G</b> oesophagus/gullet	;
<b>H</b> stomach	;
<b>I</b> colon/large intestine/large bowel	; 3
(b) <u>E/ileum</u> ( <b>R</b> small intestine)	; 1

Page 4	Mark Scheme	Syllabus	Paper
	O LEVEL – NOVEMBER 2004	5090	2

- (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
	O LEVEL – NOVEMBER 2004	5090	2

(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 ;

\*CO<sub>2</sub> out/released/produced + O<sub>2</sub> in/absorbed/used ;

(ii) light/day + photosynthesis ;

faster than respiration AW ;

\*O<sub>2</sub> out/released/produced + CO<sub>2</sub> in/absorbed/used ;

**max. 5**

(\* accept on annotated equation)

(b) (i) reference concentration gradients of CO<sub>2</sub>/O<sub>2</sub> ;

CO<sub>2</sub> is a limiting factor/the more CO<sub>2</sub> the faster the P/S ;

more or faster CO<sub>2</sub> in + more or faster O<sub>2</sub> 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
	O LEVEL – NOVEMBER 2004	5090	2

- 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
	O LEVEL – NOVEMBER 2004	5090	2

- 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**