

**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)**



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### 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
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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 ( $\alpha$ -/ $\gamma$ -/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><math>A/I^A</math> or <math>B/I^B</math></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) ( <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><b>E</b>/ileum</u> ( <b>R</b> 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**

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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 ;

\*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
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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**