

**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**

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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)

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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  $OO$  ;
- $A/I^A$  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) ; 3  
(\*AW) (A references to A/B/O without I)

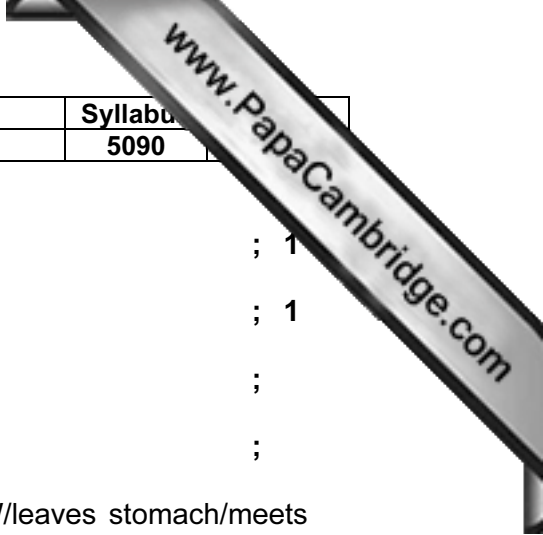
**Total 10**

- 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) ; 2  
(and in correct direction)
- (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 - ; 2  
other two blocks large then small + correctly labelled
- (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) E/ileum (R small intestine) ; 1

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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
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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) ;
- (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)

max. 8

Total 10



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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**