GCE Advanced Level

MARK SCHEME for the June 2005 question paper

9700 BIOLOGY

9700/06

Paper 6 (Options), maximum raw mark 40

This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. This 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 June 2005 question papers for most IGCSE and GCE Advanced Level and Advanced Subsidiary Level syllabuses and some Ordinary Level syllabuses.



Grade thresholds for Syllabus 9700 (Biology) in the June 2005 examination.

| | maximum | minimum | mark required | for grade: |
|-------------|-------------------|---------|---------------|------------|
| | mark available | А | В | E |
| Component 6 | 40 | 28 | 24 | 15 |

The thresholds (minimum marks) for Grades C and D are normally set by dividing the mark range between the B and the E thresholds into three. For example, if the difference between the B and the E threshold is 24 marks, the C threshold is set 8 marks below the B threshold and the D threshold is set another 8 marks down. If dividing the interval by three results in a fraction of a mark, then the threshold is normally rounded down.



GCE A LEVEL

MARK SCHEME

MAXIMUM MARK: 40

SYLLABUS/COMPONENT: 9700/06

BIOLOGY (Options)



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| | | • | GCE A LEVEL – JUNE 2005 | 9700 | 6 | |
| | | | OPTION 1 – MAMMALIAN PHYSIOLOGY | | | |
| (a) | (i) | | duces (digestive) enzymes/enzymes held in membra Itase/lactase/sucrase/exopeptidases; | ane; | | |
| | | | sorbs, enzymes from pancreas/amylase; Jlycocalyx; | | | |
| | | ref. | enterokinase; | | | ma |
| | (ii) | pro | crovilli; vide large surface area; more, rapid/efficient, absorption; | | | |
| | | pro | ny mitochondria; vide ATP; · active transport; | | | ma |
| (b) | (i) | with with | ake is higher without phlorrhizin; nout rises steeply during first 30 seconds, with rises nout phlorrhizin peaks at, 0.5 minutes/with phlorrhizin reach peak/plateaus at 2 minutes; nout phlorrhizin highest value is 3.3 a.u. but with phlor value is 0.4 a.u; | n does not | est | ma |
| | (ii) | with | nout phlorrhizin active transport can take place/with uptake is by diffusion; nout phlorrhizin glucose can be moved up a concent gradient/with phlorrhizin can only move down a gradient; orrhizin may bind to, carrier/transport protein; ref. sh (e.g. related to high glucose conc. without phlor | ration concentratic ape of curve | | ma |
| (c) | | calo cau into | neuromuscular junction cium floods in through presynaptic membrane (of mo when action potential arrives; uses release of, transmitter substance/ACh; o synaptic cleft; owing action potential to be passed (into muscle); | otor neurone |) | |
| | | calo rele calo cau | <i>muscle/sarcomere</i> cium stored in (cisternae of) endoplasmic reticulum (eased/calcium channels open, when action potential cium binds with troponin; using tropomyosin to move; owing myosin and actin to bind; | | | ma |
| (d) | (i) | so j diffe | ntrol is 3.15 and 1.0 mg cm ⁻³ is 1.20 so difference is percentage difference is 1.95 ÷ 3.15 x 100 which is 6 erence correctly calculated; rect percentage calculated (ignore signs); A 62% | | | |

| | | Page | | Syllabus | Paper |
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| | | | GCE A LEVEL – JUNE 2005 | 9700 | 6 |
| | | (ii) | dissolves in lipid (bi)layer/disrupts/alters arrangeme (bi)layer/membrane; proteins/carriers/transporters, no longer in correct, p cannot work normally; | - | |
| _ | | | | | |
| 2 | (a) | | A cochlea B Eustachian tube C incus/anvil D eardrum/tympanic membrane | | |
| | | | half mark each, round up;; | | 2 |
| | (b) | | equalising pressure on both sides of, eardrum, tymp membrane/part D; | panic | 1 |
| | (c) | | (semicircular canals) filled with fluid; hair cells in, ampulla; cupula/gelatinous structure, moves as head moves; ref. to inertia of fluid/AW; hair cells/receptors, respond to position of cupula; three, ampullae/semicircular canals, lie in different of | | |
| | (d) | | (middle ear) normally filled with air; | | max 3 |
| | (u) | | ossicles cannot vibrate (when in viscous fluid)/less r tympanic membrane; sound/vibrations, not passed to, oval window/cochle | | max 2 |
| | | | | | Total 8 |
| 3 | (a) | | A peripheral; B autonomic; | | 2 |
| | (b) | (i) | heart rate increases; increase (in heart rate) begins to level off at higher f use of figures; (<i>need change plus frequency</i>) | requencies; | max 2 |
| | | (ii) | stimulation (of parasympathetic nerve) decreases he doubling the frequency of stimulation approx halves (<i>4Hz v 8Hz</i>) use of figures; | | max 2 |
| | | | it is valid to compare all three levels of parasympath stimulation i.e. 0, 4 Hz and 8Hz. Allow up to 2 figure correct comparisons are made | | |
| | | (iii) | the two nerves release different transmitter substan sympathetic, noradrenaline/epinephrine, and parasy acetylcholine; | | |
| | | | affect post-synaptic membrane differently; | | max 2 |
| | | | | | Total 8 |

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| | | | GCE A LEVEL – JUNE 2005 | 9700 | 6 | |
| | | | | | | |
| (a) | (i) | P – | label to large vessel on left; | | | |
| | (ii) | Q - | - label to central vein; | | | |
| | (iii) | bile | ; | | | |
| (b) | (i) | dec bel so | oumin) does not leave blood (in tissues); creases, solute potential/water potential, of blood (pla ow that of tissue fluid; <u>water</u> , does not leave blood/enters blood (from tissu vn water potential gradient; | | | ma |
| | (ii) | by fibr | iverted to fibrin; thrombin; in is insoluble; | | | |
| | | pro | duces mesh in which, red cells/platelets, are trapped | ; | | ma |
| | | | | | Т | ſot |
| | | | OPTION 2 – MICROBIOLOGY AND BIOTECHNO | DLOGY | | |
| | | | | | | |
| (a) | (i) | sing circ ref. not plas | nuclear envelope; gle/not paired; cular DNA; operons/not introns/not exons; a chromosome/not linear/no histones; smid; loops/coils/super coils/relaxed coils/topoisomerase; | | | ma |
| | (ii) | incu terr pick usin stre sele | nple grown on agar plate/nutrient broth; ubated; operature/environmental feature; < off colony/remove known volume; og sterile needle/loop/pipette; eak on agar plate; ective media; ail mark e.g. plates sealed/upside down; | | | |
| | | ste isol | rilise loop between streaks; ate colony; equipment used must be sterile; | | | ma |

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| | | GCE A LEVEL – JUNE 2005 970 | 0 6 | |
| | (ii) | bacteria natural gut inhabitants; whales ingest oil; spontaneous mutations occur; bacteria able to breakdown anthracene/naphthalene; these bacteria favoured by natural selection; these bacteria survive and reproduce/increase in numbers; | | max 3 |
| (c) | | oil spills thick/barrier to oxygen; bacteria work in anaerobic conditions; work lower in slick; work on specific hydrocarbons; different enzymes; | | |
| | | different chemical pathways used; | | max 3 |
| | | | | Total 15 |
| (a) | | phage DNA integrates into host chromosome; replicates with the host chromosome; no viral particles produced; exists as provirus/in state of dormancy; no lysis/cell not destroyed; | | max 2 |
| (b) | (i) | work near a Bunsen; ref. serial dilution; dilute stock NFLX with isotonic saline/sterile water; 1 cm ³ + 9 cm ³ saline/water (10 x dilution); repeat for each dilution; | | max 3 |
| | (ii) | cloudiness in tubes where bacteria not killed/inhibited/clear in t where bacteria killed/inhibited; as concentration of NFLX increases, more bacteria killed (mak solution less cloudy); reference to correct set of figures; not zero because of bacterial debris; | | |
| | | minimum inhibitory concentration between 100 and 1000 μ g cr | n⁻³; | max 3 |
| | | | | Total 8 |
| (a) | | A – conidiospore; Accept conidia B – conidiophore; Accept fruiting hypha/AW C – metula; Accept rami D – phialides/sterigma/conidiogerous cells; | | |
| | | half marks, rounded up | | 2 |
| (b) | (i) | fermentation with constant volume of medium; all nutrients added at the start; harvest of product at end of fermentation; organisms display a normal growth curve; process is halted when sufficient product has formed; | | |
| | | process is halted when sufficient product has formed; AVP; | | max 3 |
| | | | | |

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| | (ii) | pH; temperature; aeration; sugar concentration; nitrogen source; foaming; | max 3 |
|-----|------|--|----------|
| (c) | | Penicillium normal growth curve shape with all parts (lag phase, log phase, deceleration phase, plateau); Penicillin – produced after end of log phase/as it enters stationary phase; | 2 |
| | | | Total 10 |
| (a) | (i) | general trend is greater the alcohol content the greater the sugar content; exception being B ; with a higher sugar level than expected; correct use of figures; | max 2 |
| | (ii) | alcohol is toxic to yeast at such high levels; inhibits respiration/fermentation; ref. membrane permeability; ref. denaturation of proteins; | max 2 |
| (b) | | $\begin{array}{rcl} 0.2 \times 0.2 \times 0.1 &= 0.004; \\ 7/0.004 &= 1750; \\ 1750 \times 1000 &= 1.75 \times 10^6/1\ 750\ 000; \end{array}$ | 3 |
| | | | Total 7 |
| (0) | | OPTION 3 – GROWTH, DEVELOPMENT AND REPRODUCTION | |
| (a) | | unspecialised/undifferentiated, cells; able to undergo mitotic division; totipotent/pluripotent/AW; able to differentiate into, different tissues/named tissues; | max 3 |
| (b) | (i) | dry mass better measure of growth; shows plant/cell material present; fresh mass includes water content/water content fluctuates; varies with conditions; allows more valid comparison; | max 3 |
| | (ii) | placed in oven/other suitable drying method; at suitable temperature/70 – 100°C; cooled in desiccator; repeated to constant mass; replicates/mean; | max 3 |
| | | 1 , | |

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| | (iii) | A c B <u>r</u> no A h ref. api terr diff | causes increase in mass from 1 x 10⁻¹⁰ mol dm⁻³ v. B causes peak at 1 x 10⁻⁸ mol dm⁻³; <u>naximum</u> effect at 1 x 10⁻⁷ mol dm⁻³; difference at extreme concentrations/1 x 10⁻¹⁰ mol dr 1 x 10⁻⁷ mol dm⁻³; nas less effect at 1 x 10⁻⁷ mol dm⁻³ cf. 1 x 10⁻⁸ mol dr comparative figures; (<i>must include ref. to mean fres</i> cal dominance; minal bud source of auxin; usion; interaction of plant growth regulators/AW; | m ⁻³ and n ^{-3;} | | max 3 |
| | | ape | oism; ex source of auxin; erential distribution; | | | |
| | | ref. (<i>ora</i> | motes cell elongation; stem/shoots; a : inhibits cell elongation in roots) ail of action; [e.g. effect on cell wall or water uptak | e] | | max 3 |
| | | | | | Тс | otal 15 |
| | (1) | | for deision with each exidence. | | | |
| | (i) | (wi | fer daisies with crab-spiders; th or) without scent/scent of little significance; comparative figures; | | | max 2 |
| | (ii) | pro hor | acted by (reflected) UV; vided by spider; neybees not attracted by scent/UV more significant th a of attraction to, contrast/pattern/honeyguides; | han scent; | | max 3 |
| | (iii) | car (U∖ | <i>te : MUST be benefit to crab-spiders NOT the daisies</i> nouflage (allows them to avoid predators); / reflection) attracts more prey; uces incidence of mutation; | s | | 2 |
|) | | | f-pollination results in inbreeding (cross-pollination re | sulte in | | |
| , | | | outbreeding); f-pollination gives <u>less</u> genetic diversity (than cross-p no genetic diversity] | | [R | |
| | | sel | f-pollination, increases homozygosity/decreases hete f-pollination increases expression of deleterious rece f-pollination gives greater chance of loss of alleles; | | s; | max 3 |
| | | A r | everse arguments for cross-pollination | | | |
| | | | | | То | otal 10 |
| | | stin | uses ovulation; nulates development of corpus luteum; nulates secretion of progesterone; | | | max 2 |

| (i) | GCE A LEVEL – JUNE 2005 stimulates secretion of LH (in both); | 9700 | 6 | |
|-------|--|---|--|--|
| (i) | stimulates secretion of LH (in both): | | | |
| | more rapid secretion of En (in both), more rapid secretion in women; more in women than men; 15-30 minutes, secretion peaks/remains constant in falls after 30 minutes; falls at same rate after 60 minutes; ref. comparative figures; | women; | | max 3 |
| (ii) | correct working 15/2 = 7.5 (arbitrary units); 105 minutes; | | | 2 |
| (iii) | (of reproductive) age/not prepuberty/not after menop (at same point of) menstrual cycle; AVP; | ause; | | max 1 |
| | | | | Total 8 |
| | B fetal capillaries/capillary tuft/chorionic villusC umbilical vein | | | |
| | D umbilical cord ;; [half marks rounded up] | | | 2 |
| (i) | osmosis of water; active transport of, (some) ions/amino acids/vitamins | | | |
| | U | ge molecules; | | max 3 |
| (ii) | large surface area; ref. chorionic villi/tufts of capillaries; ref. microvilli; ref. maternal blood spaces: | | | |
| | | | | max 2 |
| | | | - | Total 7 |
| | OPTION 4 – APPLICATIONS OF GENET | rics | | |
| (i) | | juence/amoun | t of | |
| | | r, of | | 2 |
| (ii) | discontinuous; single gene; different alleles have large effect/resistant v non-resi | stant; | | max 2 |
| (iii) | chloroquine much used; chloroquine = selective agent; | tage; | | max 4 |
| | (ii) (iii) (ii) (ii) | (ii) correct working 15/2 = 7.5 (arbitrary units); 105 minutes; (iii) (of reproductive) age/not prepuberty/not after menop (at same point of) menstrual cycle; AVP; A endometrium/lining of uterus B fetal capillaries/capillary tuft/chorionic villus C umbilical vein D umbilical cord ;; [<i>half marks rounded up</i>] (i) diffusion of, oxygen/carbon dioxide/urea/(some) ions osmosis of water; active transport of, (some) ions/amino acids/vitamins facilitated diffusion of glucose; pino/phago /exo/endo, cytosis of antibodies/other lar (ii) large surface area; ref. chorionic villi/tufts of capillaries; ref. microvilli; ref. maternal blood spaces; close association of (maternal and fetal) circulations; OPTION 4 – APPLICATIONS OF GENET (i) gene mutation – change in DNA code/nucleotide sector DNA; chromosome mutation – change in, structure/numbe chromosomes; (ii) discontinuous; single gene; different alleles have large effect/resistant v non-resi (iii) natural selection; chloroquine much used; chl | (ii) correct working 15/2 = 7.5 (arbitrary units); 105 minutes; (iii) (of reproductive) age/not prepuberty/not after menopause; (at same point of) menstrual cycle; AVP; A endometrium/lining of uterus B fetal capillaries/capillary tuft/chorionic villus C umbilical vein D umbilical cord ;; [<i>half marks rounded up</i>] (i) diffusion of, oxygen/carbon dioxide/urea/(some) ions; osmosis of water; active transport of, (some) ions/amino acids/vitamins/antibodies; facilitated diffusion of glucose; pino/phago /exo/endo, cytosis of antibodies/other large molecules; (ii) large surface area; ref. chorionic villi/tufts of capillaries; ref. maternal blood spaces; close association of (maternal and fetal) circulations; OPTION 4 – APPLICATIONS OF GENETICS (i) gene mutation – change in DNA code/nucleotide sequence/amoun DNA; chromosome mutation – change in, structure/number, of chromosomes; (ii) discontinuous; single gene; different alleles have large effect/resistant v non-resistant; (iii) natural selection; chloroquine = selective agent; susceptible die/resistant survive/ref. selective advantage; resistants more likely to reproduce; | (ii) correct working 15/2 = 7.5 (arbitrary units); 105 minutes; (iii) (of reproductive) age/not prepuberty/not after menopause; (at same point of) menstrual cycle; AVP; A endometrium/lining of uterus B fetal capillaries/capillary tuft/chorionic villus C umbilical vein D umbilical cord ;; [<i>half marks rounded up</i>] (i) diffusion of, oxygen/carbon dioxide/urea/(some) ions; osmosis of water; active transport of, (some) ions/amino acids/vitamins/antibodies; facilitated diffusion of glucose; pino/phago /exo/endo, cytosis of antibodies/other large molecules; (ii) large surface area; ref. chorionic villi/lufts of capillaries; ref. maternal blood spaces; close association of (maternal and fetal) circulations; OPTION 4 – APPLICATIONS OF GENETICS (i) gene mutation – change in DNA code/nucleotide sequence/amount of DNA; chromosomes; (ii) discontinuous; single gene; different alleles have large effect/resistant v non-resistant; (iii) natural selection; chloroquine much used; chloroquine much used; (iii) natural selection; (iii) natural selection; (iii) circulation = selective agent; susceptible die/resistant survive/ref. selective advantage; resistants more likely to reproduce; |

| | | Page | age 8 Mark Scheme | | Syllabus | Pape | r | | | | |
|---|-----|------|-----------------------|-------------------------|---------------------------|-----------|--------------|-------------------|----------------|----|----------|
| | | | | G | CE A LEV | ′EL – J | UNE 2005 | | 9700 | 6 | |
| | | | | | | | | | | | |
| | (b) | (i) | <u>6 + 7 + 7</u> 4 | <u>7 + 6</u> / <u>2</u> | <u>26</u> ; | | | | | | |
| | | | 4 = 6.5; | | 4 | | | | | | 2 |
| | | | - 0.3, | | | | | | | | 2 |
| | | (ii) | | od resist | | | | | | | |
| | | | • | | selective a | | - | -1 | | | |
| | | | | | other/have appearing | | | | | | max 2 |
| | | | 00100100 | | appearing | 9 | sondonay | 3 | | | |
| | (c) | | | | es for eac | | | | | | |
| | | | | | cond base | | | | /degenerate; | | |
| | | | - | tRNA bir | | e onan | iges anni | 0 000, | | | |
| | | | | jed mRN | | | | | | | |
| | | | in transla | ation at ri | bosome; | | | | | | max 3 |
| | | | | | | | | | | | Total 15 |
| _ | | | _ | | | | | | | | |
| 2 | (a) | | | | tic) divers luction in | | | | | | |
| | | | | | ygosity/de | • | | zvaositv: | | | |
| | | | | | | | | | essive allele | s; | max 3 |
| | (h) | | oomooro | nattorn | with other | c indivi | duolo: | | | | |
| | (b) | | | | with other narkers. c | | | ferent place | s: | | |
| | | | because | different | , length/s | ize/ma | iss; | · | -) | | |
| | | | | | ndicate re | | | ; | | | |
| | | | | | umber of n each ho | | | nosome of r | pair, the same | ÷. | |
| | | | | [ora] | in each, m | | gao, en en | | | ., | |
| | | | the more | e inbred t | he more s | similari | ities; [ora |] | | | max 3 |
| | (c) | (i) | inbreedii | na increa | ses susce | entibilit | tv to infec | tion [.] | | | |
| | (0) | (.) | | - | ptibility) to | • | • | | | | |
| | | | | | eptible to | herpe | s/slightly i | nbred susc | eptible to | | - |
| | | | b | acteria; | | | | | | | max 2 |
| | | (ii) | less abili | ity to pro | duce imm | une re | sponse; | | | | |
| | | | | alleles lo | ost; | | | | | | |
| | | | less fit; | of delete | erious rec | acciva | e. | | | | |
| | | | | | eles might | | - | sistance | | | max 2 |
| | | | | | | | | | | | |
| 3 | (a) | (i) | error in r | meinsis [.] | | | | | | | Total 10 |
| U | (4) | (י) | | | e 21/triso | my 21 | • | | | | |
| | | | problem | of, spind | le/synaps | sis/cen | tromere; | | | | max 2 |
| | | (ii) | breakao | e of chro | mosome; | | | | | | |
| | | ('') | transloca | | | | | | | | |
| | | | detail e.ç | g. Robert | sonian/loi | ng arm | n 21 to an | other autos | ome/13/14/1 | 5; | max 2 |
| | (b) | (i) | ves diffe | er signific | antly/not | due to | chance. | | | | |
| | (9) | (') | | | sual bench | | | 20; | | | 2 |
| | | | | | | | | | | | |

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| (ii) | more cases than expected of second disease in both groups of |
|------|--|
| | families; |
| | p = 0.00001 (highly) significant; |
| | p = 0.001 significant; |

max 2

Total 8

3

(a) Parents: AaBb x aabb;
 Gametes: AB Ab aB ab x ab;
 Offspring: genotypes and phenotypes;

| gametes | AB | Ab | aB | ab |
|---------|-------|---------|-------|---------|
| ab | AaBb | Aabb | aaBb | aabb |
| | tall | tall | dwarf | dwarf |
| | green | mottled | green | mottled |

 (b) two genes are, linked/on the same chromosome; inherited together/alleles do not assort independently; recombinant (named) classes result from crossing over; in meiosis; prophase 1; diagram of crossing over; 12 units apart; max 4

Total 7