

MARK SCHEME for the May/June 2007 question paper

9700 BIOLOGY

9700/04

Paper 4 (A2 Structured Questions), maximum raw mark 100

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Mark schemes must be read in conjunction with the question papers and the report on the examination.

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Section A

- 1 (a) 1. killed / hunted, qualified ; e.g. for meat / for fur / blood sport / takes human food / thought to be dangerous A poaching (unqualified)
 2. war ;
 3. sale of live young ;
 4. habitat destruction / AW ;
 5. loss of / competition for food ;
 6. AVP ; e.g. disease

[3 max]

- (b) (i) 1. fewer animals need to be caught (for zoos) ;
 2. ref. becoming pregnant ; e.g. IVF / finding a mate
 3. reintroduction into the wild ;
 4. research easier with captive animals / AW ;
 5. ref. increase in numbers ;
 6. ante or postnatal care ;

[3 max]

- (ii) 1. inbreeding / AW ;
 2. gene pool too small ;
 3. no fear of humans / difficulty in socialising with other gorillas ;
 4. difficulty in, finding food / reproducing ;
 5. ref. transfer of pathogens ;
 6. ref. effects of captivity ; e.g. stress

[2 max]

[Total: 8]

2

process	major products
glycolysis	ATP ; pyruvate ; reduced NAD ;
Krebs cycle	ATP ; reduced NAD / reduced FAD ; CO ₂ ;
oxidative phosphorylation	ATP ; water ; NAD / FAD ;

[8 max]

R NADP throughout

[Total: 8]

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3 (a) (i)

bacterial strain	A	B	
diameter (d) / mm	24	16 ;	
area / mm ²	452 - 453	201 – 201.2 ;	A ecf
ratio of area A : area B	2.25 : 1	A 9:4	A ecf

[3]

- (ii)
1. penicillin kills more of strain A than strain B or C / AW ;
 2. ref. different active or binding sites ;
 3. A produces less penicillinase than B or C ;
 4. C is resistant (to penicillin) ;
 5. C has mutation ;
 6. penicillin cannot bind to enzymes ;
 7. penicillin inactivated by C / C produces much penicillinase ;
 8. AVP ; e.g. B is evolving into a more resistant strain / variation in carriers across membrane [4 max]

- (iii)
1. antibiotic, is selective agent / provides selective pressure ;
 2. resistant survive / susceptible die ;
 3. ref. reproduction ;
 4. resistants pass on, mutation / allele ; R gene
 5. ref. vertical transmission ;
 6. increases frequency of allele in population ;
 7. may pass advantageous mutation to other species / ref. plasmid transfer ;
 8. ref. horizontal transmission ; [4 max]

accept reference to strains A, B and C in correct context for points 2, 3 and 4

- (b)
1. competitive inhibitors (of transpeptidase) ;
 2. binds to enzyme ;
 3. blocks active site ;
 4. crosslinks in peptidoglycan wall cannot form ;
 5. weakens cell wall ;
 6. lysis / cell bursts ;
 7. ref. high internal pressure of bacterial cell ; [4 max]

[Total: 15]

- 4 (a)
1. norm concentration of blood glucose is 80 - 120 mg 100cm⁻³ ; (A within range)
 2. β cells of, Islets of Langerhans / pancreas, detect increase ;
 3. ref. K⁺ channels close / role of Ca²⁺ ;
 4. secrete insulin ;
 5. ref. glycogenesis ;
 6. increased uptake of glucose (by cells) ;
 7. increased use of glucose in respiration / glucose converted to fat ;
 8. ref. negative feedback / described ; [4 max]

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- (b) *reverse transcriptase*
 makes, cDNA / single strand of DNA ;
 from (human) mRNA ;
DNA polymerase
 produces, second strand of DNA / double stranded DNA ;
 ref. links nucleotides (in context of backbone formation) ;
 ref. semiconservative replication / ref. complementary base pairing ; [max 2]
restriction enzymes
 cut DNA / cut plasmid ; **R** cuts gene **A** cuts out gene
 at specific sites / at palindromic sites ;
 to give sticky ends ; **A** blunt ends [max 2]
DNA ligase
 seals nicks in sugar-phosphate backbone ;
 forms rDNA ;
 by adding phosphate group ; [max 2] [6 max]

[Total: 10]

- 5 (a) (i) air spaces (between cells) / aerenchyma ;
 in mesophyll / cortex ;
 formed by cell death ; [2 max]
- (ii) provides oxygen ;
 for aerobic respiration / because conditions are anaerobic ;
 ref. diffusion ;
 AVP ; e.g. allows escape of ethene / buoyancy / active transport [2 max]
- (b) (i) internode length increases as water depth increases ;
 use of figures ; (2 days) 2 depths + 2 lengths ignore units [2]
- (ii) part of plant is (always) above water ;
 access to light ;
 access to, air / oxygen / carbon dioxide ;
 ref. pollination / flowering ; [2 max]
- (iii) ethene concentration increases up to 30 or 40 cm water depth ;
 fluctuation / plateau between 30 or 40 cm to 60 cm water depth ;
 comparison between when water level is constant and when water level increases ; [2]
- (c) (i) substance that affects growth / development ; [1]
- (ii) 1. gibberellin causes increase in stem length ;
 2. detail of mechanism ; e.g. cell elongation
 3. gibberellin has greater effect with ethene present ;
 4. more gibberellin could be secreted as water depth increases ;
 5. gibberellin could remain constant but have greater effect because more ethene
 secreted ;
 6. more gibberellin could be transported through plant as water depth increases ;
 7. AVP ; [3 max]

[Total: 14]

Page 5	Mark Scheme	Syllabus	Paper
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- 6 (a) A – germinal epithelium ;
B – Graafian follicle ; [2]
- (b) (i) primary oocyte ; [1]
- (ii) label to primary oocyte on Fig. 6.2 ; [1]
- (iii) P - mitosis
Q - meiosis ; both required for mark [1]

- (c) *either*
independent assortment ;
homologous / maternal and paternal, chromosomes position themselves either way up / AW ;
on equator (of spindle) ;
so segregate randomly / any combination of maternal and paternal chromosomes can end up
in daughter cells ;
AVP ; e.g. occurs during metaphase 1
or
crossing over / chiasmata ;
between, chromatids of homologous chromosomes / non-sister chromatids ;
genetic material on maternal and paternal chromosomes swap places / AW ;
leads to new combination of alleles ; **R** genes
AVP ; e.g. breaking established linkage groups / occurs during prophase 1 [3 max]

[Total: 8]

- 7 (a) both alleles, influence phenotype / are expressed ;
ref. more than 2 phenotypes possible ;
phenotype of heterozygote different from either homozygote ; [3]
- (b) son receives Y chromosome from father ;
Y chromosome does not carry haemophilia allele ;
father will pass haemophilia allele to daughter(s) ;
daughter will be, a carrier / heterozygous / $X^H X^h$;
daughter may pass allele to, her son / his grandson ; *accept on diagram* [3 max]

- (c) (i) (male) $C^B C^B X^a X^a$; x (female) $C^W C^W X^A Y$;
(gametes) $C^B X^a$ $C^W X^A$ or $C^W Y$;
 $C^B C^W X^A X^a$; $C^B C^W X^a Y$;
(male, blue, barred) (female, blue, non-barred)

accept other symbols but only with key

if male XY and female XX then mark gametes and offspring genotypes to max 2

if other symbols used but no key then mark to max 2

[5]

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- (ii) blue colour is heterozygous / $C^B C^W$;
test cross ;
with non-barred female ;
if all offspring barred, must be $X^A X^A$ / homozygous ;
if some offspring non-barred, must be $X^A X^a$ / heterozygous ;

[3 max]

[Total: 14]

- 8 (a) 1. human ;
2. applies selection pressure ;
3. for benefit of human ;
4. choose / breed, parents with suitable trait ;
5. named example (species and characteristic) ;
6. select offspring ;
7. repeat over several generations ;
8. increased allele frequency ;

[4 max]

- (b) (i) 140 (%) ;
2 marks for correct answer
(14/10 x 100 = 1 mark)

[2]

- (ii) genetic variation ;
ref. polygenes ;
environmental variation ;
AVP ; e.g. sampling / experimental, error

[2 max]

[Total: 8]

Section B

- 9 (a) 1. action potential / depolarisation, reaches presynaptic membrane ;
2. calcium (ion) channels open / presynaptic membrane becomes more permeable to Ca^{2+} ;
3. Ca^{2+} flood into presynaptic neurone ; **R** membrane
4. this causes vesicles of (neuro)transmitter to move towards presynaptic membrane ;
5. ref. acetylcholine / ACh ;
6. vesicle fuses with presynaptic membrane / exocytosis ;
7. ACh released into synaptic cleft ;
8. ACh diffuses across (cleft) ;
9. ACh binds to receptor (proteins) / AW ;
10. on postsynaptic membrane ; **R** neurone
11. proteins change shape / channels open ;
12. sodium ions rush into postsynaptic neurone ; **R** membrane
13. postsynaptic membrane depolarised ;
14. action potential / nerve impulse ;
15. AVP ; e.g. action of acetylcholinesterase

[9 max]

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- (b) 16. ensure one-way transmission ;
 17. receptor (proteins) only in postsynaptic, membrane / neurone ; *ora*
 18. vesicles only in presynaptic neurone ; *ora*
 19. ref. adaptation ;
 20. increased range of actions ;
 21. due to interconnection of many nerve pathways ;
 22. ref. inhibitory synapses ;
 23. involved in memory / learning ;
 24. due to new synapses being formed ;
 25. AVP; e.g. summation / discrimination

[6 max]

[Total:15]

- 10 (a) 1. biconvex disc ;
 2. 3-10 μm diameter ;
 3. double, membrane / envelope ;
 4. internal membrane system ;
 5. flattened or fluid-filled sacs / thylakoids ;
 6. arranged in stacks / grana ;
 7. hold pigments / named pigment ;
 8. ref. clusters of pigments / AW ;
 9. (membrane of grana) hold ATP synthase ;
 10. intergranal lamellae ;
 11. stroma / ground substance ;
 12. lipids / starch grains ;
 13. contains enzymes of Calvin cycle ;
 14. stroma contains ribosomes / DNA etc ;
 15. AVP ; e.g. variation in shape between species

[9 max]

accept on labelled diagram

- (b) 16. closely packed -- to absorb more incident light / AW ;
 17. palisade mesophyll near upper surface of leaf -- to maximize light interception ;
 18. arranged at right angles to leaf surface -- to reduce number of light absorbing walls ;
 19. cylindrical cells -- producing air spaces between cells ;
 20. air spaces -- act as reservoir of carbon dioxide ;
 21. large surface area -- for gas exchange ;
 22. cell walls thin -- so short diffusion pathway ;
 23. large vacuole -- pushes chloroplasts to edge of cell ;
 24. chloroplasts on periphery -- to absorb light more efficiently ;
 25. large number of chloroplasts -- to maximise light absorption ;
 26. chloroplasts can move within cells -- towards light ;
 27. chloroplasts can move away from high light intensity -- to avoid damage ;
 28. AVP ;

[6 max]

accept chlorophyll for chloroplast for 23, 24 and 25 only

[Total: 15]