

June 2004

GCE A LEVEL

MARK SCHEME

MAXIMUM MARK: 50

SYLLABUS/COMPONENT: 9700/06

BIOLOGY
Paper 6 (Options (A2))



Page 1	Mark Scheme	Syllabus	Paper
	BIOLOGY – JUNE 2004	9700	6

Option 1

- 1 (a) A gastric, pit / gland ;
 B muscularis mucosa ;
 C circular muscle / muscularis externa ;
 D mucosa ;
- If answers to B and C are BOTH 'muscle' = ½ mark
- half marks round up* 2
- (b) (i) secreted by chief cells / peptic cells / zymogen cells ;
 detail of secretion / exocytosis ;
 as pepsinogen ;
 short length / part, of (amino acid) chain removed ;
 by, hydrochloric acid / pepsin ; 2 max
- (ii) (catalyses the) hydrolysis of proteins ;
 breaks peptide bonds (between amino acids in proteins) ;
 it is an endopeptidase / breaks bonds within the protein molecule ;
 produces, shorter lengths of amino acid chains / peptides ;
 preparation for exopeptidases ; 3 max
- (c) (i) it increases / stimulates (the secretion of hydrochloric acid) ;
 maximum effect / maximum secretion, 120 minutes (after exposure of tissue to gastrin) ;
 levels off after 160 minutes / effect still present after 180 minutes ;
 quantitative comparison with 'no hormone' values, e.g. maximum secretion is 8 times greater / 4.3 mmol H⁺ per hour greater ; 3 max
- (ii) as acidity increases secretion of somatostatin increases ;
 somatostatin inhibits secretion of hydrogen ions / HCl / acid ;
 as acidity drops somatostatin secretion also drops ;
 negative feedback ; 3 max
- (iii) control of variable / fair test idea ;
 presence of food stimulates secretion of hormones 2

Total 15

Page 2	Mark Scheme	Syllabus	Paper
	BIOLOGY – JUNE 2004	9700	6

- 2 (a) A (transverse process) muscle attachment ;
B (centrum) support / rigidity / load-bearing ; 2
- (b) (i) [21 – 5 = 16 (16 ÷ 5) x 100 = 320%]
working ;
answer ;

correct answer = 2 marks 2
- (ii) (risk of fracture) is greater in men than in women below age 49 / greater in women than men above 49 ;
both increase faster above age 50 ;
rate of increase of risk in women is faster than in men above age 50 ;
allow other comparative point ; 2 max
- (iii) initial / normal, bone mass / bone density of women is less than that of men ; ORA
so loss of bone mass / decrease in calcium content, more likely to weaken bones substantially in women than in men ;
(on average) men may be more physically active / or relevant e.g. than women below the age of 49 ;
menopause / at approx. 50, in women results in loss of protective effect of oestrogen ;
ref to increased activity of osteoclasts and decreased activity of osteoblasts ; 2 max

Total 8

Page 3	Mark Scheme	Syllabus	Paper
	BIOLOGY – JUNE 2004	9700	6

- 3 (a) (i) carbon dioxide ; 1
- (ii) hepatic vein ;
- filtered from blood in, glomerulus / Bowman's capsule (in kidney) ;
 high pressure / ultrafiltration ;
 removed from body in urine / dissolved in water ;
 detail ; 3 max
- (iii) urea formation requires ATP / ammonia excretion, more energy
 efficient / does not waste energy ;
 no ornithine cycle ;
 no need to convert ammonia to less toxic compound ; 2 max
- (b) the conversion of one amino acid to another ;
 by the transfer of an amine group from an amino acid ;
 to an organic acid ;
 amino acids in diet may not match the body's requirements ;
 can convert a type of amino acid in excess to a type in short supply ; 3 max

Total 9

Page 4	Mark Scheme	Syllabus	Paper
	BIOLOGY – JUNE 2004	9700	6

- 4 correct ref. to optic nerve (in either) ;
ref parasympathetic role (once only) ;
- (i) (bright light) detected by, cells in retina / rods / cones ;
action potentials / impulses, carried to brain in sensory neurone ;
then to iris muscles in motor neurone ;
(causes) contraction of circular muscles ; 4 max
- (ii) loss of focus on retina detected by brain ;
action potentials / impulses, carried to ciliary muscle in motor neurone ;
(causes) contraction of ciliary muscle ;
loosens tension on suspensory ligament ;
lens resumes its natural shape / becomes more convex ;
ref elasticity ; 4 max
- Total 8**

Page 5	Mark Scheme	Syllabus	Paper
	BIOLOGY – JUNE 2004	9700	6

Option 2

1. (a) (i) **A** – capsomere ;
B - nucleic acid / DNA / RNA ;
C - envelope / lipid bilayer ;
D – capsid ;
- ½ marks rounded up* 2
- (ii) $50/500 \times 10^{-6} / 50 \times 10^6/500$;
 $1 \times 10^5 / 100000$; 2
- (b) size ;
can not reproduce outside host cell ;
lack cellular organelles / structures / named example ; **A** no cell organisation
AVP. ; 2 max
- (c) viral, RNA / genetic material, enters cell ;
viral genetic material replicated ;
viral protein synthesised ;
new viruses assembled ;
cell bursts / lysis / bud ;
more virus released to *infect / invade* other cells ;
AVP ; for further detail 3 max
- (d) (i) 1400 - 700/4 / 700/4 ;
175 per year ; 2
- (ii) transfusions ;
intravenous drug use / shared needles ;
accidental contamination of blood / specific example ;
via placenta / at birth ;
breast feeding ; 2 max
- (iii) protected sex / specific example ;
better education / more aware ;
change in sexual practise / specific example ;
increased publicity ;
AVP ; 2 max
- Total 15**

Page 6	Mark Scheme	Syllabus	Paper
	BIOLOGY – JUNE 2004	9700	6

2. (a) (i) no moving parts;
continuous circulation;
maintained using difference in specific gravity;
of rising aerated culture and air-depleted culture;
heat exchange removes heat;
produced from respiration; 3 max
- (ii) C source / glucose ;
N source / ammonia;
growth factor / choline ;
minerals / ammonium sulphate / zinc sulphate / copper sulphate / iron sulphate;
3 max
- (b) coloured;
flavoured;
fibres pressed to form pieces / ref texture;
reduction of RNA; 2 max

Total 8

Page 7	Mark Scheme	Syllabus	Paper
	BIOLOGY – JUNE 2004	9700	6

3. (a) Describe the roles of barley and yeast enzymes in beer production
- amylase (from barley) ;
hydrolyses starch ;
to maltose ;
ref. α and β amylase ;
maltose converted to glucose ;
maltase ;
anaerobic breakdown / glycolysis, of sugar ;
into ethanol and carbon dioxide ;
- 4 max
- (b) (i) end product not contaminated ;
enzyme more stable / less likely to be denatured ;
AVP e.g. cost ;
enzyme recovery easier ;
idea of enzyme can be reused ;
AVP e.g. cost ;
- 4 max
- (ii) α amylase ;
more maltose produce ;
use of figures ;
- 2 max

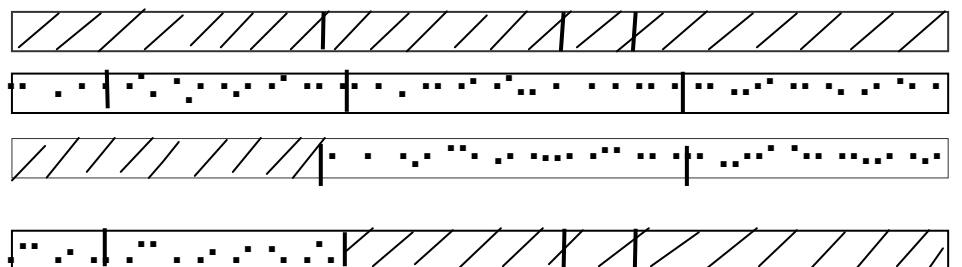
Total 10

Page 8	Mark Scheme	Syllabus	Paper
	BIOLOGY – JUNE 2004	9700	6

4 (a) (i) (a microorganism) containing recombinant DNA / DNA of another organism / foreign gene ;
integrated into genetic material ;
containing a specific gene ;
AVP ; e.g. may have DNA removed, detail of process 2 max

(ii) avoids allergic response ;
other sources of insulin are not structurally identical to human insulin ;
shortage of pigs ;
objections to the use of animals ;
prevent spread of disease ;
easier to produce in large quantities ;
AVP ; ; e.g. cost, religious objections 2 max

(b)



i.e. 1 for originals, 1 for each new one

3

Total 7

Page 9	Mark Scheme	Syllabus	Paper
	BIOLOGY – JUNE 2004	9700	6

OPTION 3 - GROWTH, DEVELOPMENT & REPRODUCTION

- 1 (a) result of asexual reproduction ;
genetically identical ;
 same, genotype / DNA, as plant from which callus derived ;
 DNA replication ;
 mitotic division ;
 ref. rare (somatic) mutation ; max 3
- (b) (i) both cytokinin and auxin needed for, cell division / growth / little or no growth
 if only one present ;
 lowest conc. of cytokinin cf. auxin gives only roots / AW ;
 highest conc. of cytokinin cf. auxin gives only shoots / AW ;
 intermediate cytokinin to auxin concentration, gives more callus/stimulates, cell
 division/growth ;
 appropriate use of figures with units ;
 ref to different concentrations i.e. auxin conc higher throughout ; max 3
- (ii) remove (from treatment D);
 give treatment B / description of treatment B ;
 justification ; max 2
- (c) (i) $\frac{156}{74} \times 100$;
 74% ; 2
- (ii) *different methods*
 stem tissue, has less contamination / better, than leaf discs ;
 average x 9 better / other appropriate comparison ;

time of year
 both treatments highest % non-contamination in January ;
 lowest for leaf discs in August, for stem tissue in April ;
 figures ; max 3
- (d) use medium with fungicide ;
 and antibiotic / AW ;
 better surface sterilisation ;
 A.V.P. ; max 2

Total: 15

Page 10	Mark Scheme	Syllabus	Paper
	BIOLOGY – JUNE 2004	9700	6

- 2 (a) (i)** decreases with increased age ;
approx. same decrease from ages 19 - 26 to 27 - 34 as from 27 - 34 to 35 -39 ;
comparative figures ;
peak same day for all ages ; max 3
- (ii)** older partners reduce probability of pregnancy in women aged 35 – 39 ;
not those aged 27 – 34 ;
reduce peak of women aged 19 – 26 ; max 2
- (iii)** greater probability if intercourse is before ovulation ;
peak fertility on same day in all groups ;
2 days before ovulation ;
fertile period same length in all groups ;
ref. figures *re* length ; *allow max – 6 to +1, min – 5 to 0* max 2
- (b)** sperm need time (in female tract) ;
for capacitation ;
detail capacitation ;
to reach, oviduct/oocyte ; [*A ovum*]
AVP (e.g. ref. cervical mucus/prostaglandins) ; max 3

Total: 10

- 3 (a)** **A** connective / vascular tissue / vascular bundle ;
B stomium ; [*A line of dehiscence/AW*]
C pollen sac ;
D tapetum ; [*A nutritive layer*] *half marks rounded up* 2
- (b)** meiosis of, pollen/microspore, mother cell ;
haploid cells ;
tetrad/4 cells ;
each, secretes / separated by, wall / intine and exine ;
mitosis ;
gives pollen tube nucleus and generative nucleus ;
mitosis of generative nucleus gives two male, nuclei/gametes ; max 4
- (c)** open pollen sacs ;
correct detail ; [*single opening + reflexed walls*] 2

Total: 8

Page 11	Mark Scheme	Syllabus	Paper
	BIOLOGY – JUNE 2004	9700	6

- 4 (a) (i)** large sample of, boys and girls/children ; [*A 100 or more*]
height measured, annually / on a regular basis ;
detail measurement ;
at age 18/when mature height reached ;
% reached each year calculated ;
means ; max 3
- (ii)** girls reach given % of final height earlier / girls' curve steeper than boys'
between 2 and 12 ;
figures ;
girls reach final height earlier ;
growth spurt for girls c. 11/12 - 13 y v. boys 13/14 – 15/16 y ;
greatest change between 1 and 2 y for both ; max 2
- (iii)** used to estimate a child's final height / monitor growth ;
so that anomaly can be treated ;
- A.V.P. ;
detail of A.V.P. ; max 2
- Total: 7**

Page 12	Mark Scheme	Syllabus	Paper
	BIOLOGY – JUNE 2004	9700	6

OPTION 4 - APPLICATIONS OF GENETICS

- 1 (a) result of asexual reproduction ;
genetically identical ;
 same, genotype / DNA, as plant from which callus derived ;
 DNA replication ;
 mitotic division ;
 ref. rare (somatic) mutation ; max 3
- (b) (i) both cytokinin and auxin needed for, cell division / growth / little or no growth
 if only one present ;
 lowest conc. of cytokinin cf. auxin gives only roots / AW ;
 highest conc. of cytokinin cf. auxin gives only shoots / AW ;
 intermediate cytokinin to auxin concentration, gives more callus/stimulates, cell
 division/growth ;
 appropriate use of figures with units ;
 ref to different concentrations i.e. auxin conc higher throughout ; max 3
- (ii) remove (from treatment D);
 give treatment B / description of treatment B ;
 justification ; max 2
- (c) (i) $\frac{156}{100} \times 100$;
 74% ; 2
- (iii) *different methods*
 stem tissue, has less contamination / better, than leaf discs ;
 average x 9 better / other appropriate comparison ;

time of year
 both treatments highest % non-contamination in January ;
 lowest for leaf discs in August, for stem tissue in April ;
 figures ; max 3
- (d) use medium with fungicide ;
 and antibiotic / AW ;
 better surface sterilisation ;
 A.V.P. ; max 2
- Total: 15**

Page 13	Mark Scheme	Syllabus	Paper
	BIOLOGY – JUNE 2004	9700	6

2 (a) to prevent extinction ;
to maintain, genetic diversity / gene pool ;
to counteract inbreeding depression ;
store of alleles ;
for use in future / when needed ;
for changed environment ; [A e.g. of change - abiotic or biotic]
for, selective breeding/genetic engineering ;

max 4

(b) artificial selection ;
(often) faster than evolution ;
man selective agent ;
(dependent on) variation in, IR59655/parent variety ;
plants chosen for desired traits and interbred ;
offspring selected for desired traits and interbred ;
ref. to traits in table ;

max 4

Total: 8

Page 14	Mark Scheme	Syllabus	Paper
	BIOLOGY – JUNE 2004	9700	6

- 3 (a) **AAbb** sugarsnap with (thin) layer of cells lining pod / thin layer present, not lignified ;
aaBB (sugarsnap) with no (thin) layer of cells lining pod ; 2

[A 'sugarsnap' x 2]

- (b) Ab x aB ; (gametes)

AaBb ; (F1 genotype)

tough pods/AW ; (F1 phenotype)

AaBb x AaBb ;

AB Ab aB ab x same ; [A from sides of Punnett square]

genotypes in Punnett square;; [minus 1 for each of first two mistakes]

phenotypes identified ; [tough and sugarsnap / tough, thin layer and no layer]

ratio 9 tough : 7 sugarsnap / 9 tough: 3 thin layer: 4 no layer ;

NB for tough **A** 'inedible' , for sugarsnap **A** 'edible'

max 8

gametes	AB	Ab	aB	ab
AB	AABB tough	AABb tough	AaBB tough	AaBb tough
Ab	AABb tough	AAbb sugarsnap/ thin layer	AaBb tough	Aabb sugarsnap/ thin layer
aB	AaBB tough	AaBb tough	aaBB sugarsnap/ no layer	aaBb sugarsnap/ no layer
ab	AaBb tough	Aabb sugarsnap/ thin layer	aaBb sugarsnap/ no layer	aabbsugarsnap/ no layer

Total: 10

Page 15	Mark Scheme	Syllabus	Paper
	BIOLOGY – JUNE 2004	9700	6

- 4 (a)** dominant allele can mask (defective) recessive allele ;
added to genome ;
recessive allele does not have to be, removed/inactivated/switched off ;
dominant disease allele would have to be, inactivated/AW ;
very difficult to do ; max 3
- (b)** liver site of production of, blood clotting proteins/plasma proteins / factor 1X ;
liver (large) active organ ;
A.V.P. ; [*relatively insensitive to 'handling'*] max 2
- (c)** *2 sensible potential hazards*
allele may be inserted within another needed gene altering product ;
allele may be inserted into tissue other than target with unknown consequences ;
allele may be inserted into germ line and passed via gamete ;
virus may damage tissue ;
A.V.P. ; [*e.g. inserted in promoter/gene switching*] max 2

Total: 7