UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary Level and GCE Advanced Level

MARK SCHEME for the June 2004 question papers

9700 BIOLOGY

9700/01	**Paper 1 (Multiple Choice), maximum raw mark 40**
9700/02	**Paper 2 (Theory 1), maximum raw mark 60**
9700/03	**Paper 3 (Practical 1), maximum raw mark 25**
9700/04	**Paper 4 (Theory 2 (A2 Core)), maximum raw mark 60**
9700/05	**Paper 5 (Practical 2 (A2)), maximum raw mark 30**
9700/06	**Paper 6 (Options (A2)), maximum raw mark 40**

These mark schemes are published as an aid to teachers and students, to indicate the requirements of the examination. They show the basis on which Examiners were initially instructed to award marks. They do 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 2004 question papers for most IGCSE and GCE Advanced Level syllabuses.

Grade thresholds taken for Syllabus 9700 (Biology) in the June 2004 examination.

	maximum mark available	minimum mark required for grade:		
		A	B	E
Component 1	40	35	32	23
Component 2	60	48	43	31
Component 3	25	20	18	16
Component 4	60	50	44	27
Component 5	30	27	25	18
Component 6	40	27	23	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.

© University of Cambridge International Examinations 2004

June 2004

GCE A AND AS LEVEL

MARK SCHEME

MAXIMUM MARK: 40

SYLLABUS/COMPONENT: 9700/01

BIOLOGY
Paper 1 (Multiple Choice)

UNIVERSITY of CAMBRIDGE
International Examinations

Question Number	Key	*Question Number*	*Key*
1	**B**	21	**D**
2	**A**	22	**C**
3	**B**	23	**B**
4	**C**	24	**C**
5	**C**	25	**B**
6	**C**	26	**B**
7	**C**	27	**B**
8	**C**	28	**C**
9	**B**	29	**A**
10	**C**	30	**C**
11	**A**	31	**A**
12	**D**	32	**D**
13	**A**	33	**A**
14	**D**	34	**B**
15	**B**	35	**B**
16	**B**	36	**B**
17	**D**	37	**B**
18	**D**	38	**C**
19	**B**	39	**A**
20	**C**	40	**A**

TOTAL 40

© University of Cambridge International Examinations 2004

June 2004

GCE A AND AS LEVEL

MARK SCHEME

MAXIMUM MARK: 60

SYLLABUS/COMPONENT: 9700/02

BIOLOGY
Paper 2 (Theory 1)

UNIVERSITY of CAMBRIDGE
International Examinations

KEY

a semi colon ;	indicates a separation of marking points
an oblique line /	indicates alternative wording or acceptable alternative
R	means reject
A	means accept
AW	means 'alternative wording'
underlined with a straight line	accept this word only, no alternative word is acceptable
D	represents quality mark(s) awarded for diagrams, as indicated on the Mark Scheme
L	represents mark(s) awarded for labels on diagrams, as indicated on the Mark Scheme
Q	represents quality of expression and is used for marks awarded on free-response questions

Question	Expected Answers	Marks
1 (a)	P - right atrium / auricle; **R** atrial Q - aorta;	2
(b)	more muscle in wall of S; ora S / left ventricle, (pumps) blood, around whole body / further; R / left atrium, (pumps) blood to ventricle / short distance; (wall must resist) high(er) pressure in S / needs to overcome greater resistance to flow;	2 max
(c)	myogenic; SAN, is pacemaker / sends out impulses / waves of excitation / initiates, heart beat / action potential / contraction; **R** electrical, messages / waves / signals AVN delays, impulse / contraction (of ventricles); detail e.g. specific time ref (0.1 - 0.2 secs) *or* to allow ventricles to fill / atria to empty; relays impulse to Purkyne tissue / bundle of His; Purkyne tissue conducts (impulse) to base / apex of heart / septum / ventricles; ref to papillary muscles contracting; ventricle (muscle) contracts / ventricular, contraction / systole, from base upwards; (blood) into arteries / named artery;	4 max
(d)	fat / cholesterol / deposited in, plaque / atheroma formed in, wall / endothelium / epithelium / lining, of artery; **R** dead cells • (so) narrows lumen of artery; • (so) blood flow reduced / restricted (in coronary arteries); **R** constricted / stop (this) creates higher blood pressure; less oxygen / glucose, supplied to heart muscle; **R** no oxygen **A** blood sugar less wastes removed; anaerobic respiration; build up of lactic acid; fibrillation / heart muscle contracts less strongly; angina / CHD / heart attack / MI / heart failure; • (risk of), thrombosis / clot / thrombus; cardiac, cell / tissue / muscle, death;	4 max
	• *(award only if linked to deposition of fat / plaque formation not sticky platelets)*	**[Total: 12]**

© University of Cambridge International Examinations 2004

Question		Expected Answers	Marks
2 (a)	(i)	(primary) producers / autotrophs;	1
	(ii)	population;	1
	(iii)	community;	1
	(iv)	ecosystem;	1
	(v)	primary consumers; **R** first consumers	1
(b)		place / area / space where an organism lives; example of a habitat from passage (desert / woodland / coral reef); example of a physical / biotic condition in habitat given;	2 max
(c)		small leaves / needles / needle-like leaves; **R** 'spines' / thorns / narrow / fewer leaves reduce / small surface area; temporary / shed leaves; leaves dry out and then rehydrate; fleshy leaves / succulent leaves / leaves with hypodermis; curled / rolled, leaves; **R** curved / folded / coiled (very) thick / waxy / impermeable, cuticle; stomata surrounded by hairs / hairy leaves / hairs trap moisture; sunken stomata / stomata in pits / crypts / grooves; **R** inverted / few stomata stomata closed during the day / stomata open at night; ***max 2*** *for features given above* (so) reduces / slows down (rate of) transpiration / water loss / evaporation / diffusion of water vapour; **R** prevents / avoids water loss *N.B. link to one valid feature above*	3 max
			[Total: 10]

© University of Cambridge International Examinations 2004

Question **Expected Answers** **Marks**

3 (a)

roles of water	physical properties of water			
	high specific heat capacity	strong cohesive forces between water molecules	high heat of vaporisation	solvent for polar molecules and ions
transport medium in blood plasma and phloem				/
surface for small insects to walk on		/		
major component of sweat used in heat loss			/	
transpiration pull in xylem		/		
prevents wide variation in temperature	/			

5

© University of Cambridge International Examinations 2004

Question	Expected Answers	Marks
3 (b)		

- higher temperature and higher wind speed gives higher / greater / faster (rate of) uptake / transpiration / water loss / movement of, water / bubble;
- both conditions / AW increase water potential / diffusion gradient (between leaf and air);
- = *general points*

temperature

use of figs. (units required) to make a valid comparison;
e.g. expts. 1 and 3 - 12 to 24 mm h^{-1} } **A** appropriate
expts. 2 and 4 - 22 to 45 mm h^{-1} } factor increase
expts. 3 and 5 - 24 to 64 mm h^{-1} } e.g. rate doubles
A figs. once only in temperature or wind speed (see below)

ref to kinetic energy / speed of movement of molecules and rate of evaporation / transpiration / diffusion;
warm air holds more water vapour / molecules than cold air / AW; **R** water

wind speed

use of figs. (units required) to make a valid comparison;
e.g. expts. 1 and 2 - 12 to 22 mm h^{-1} } **A** appropriate
expts. 3 and 4 - 24 to 45 mm h^{-1} } factor increase
A figs. once only in wind speed or temperature (see above)

idea that air blowing over the surface of / around the leaf takes moist air / water vapour / molecules, away / reduces transpiration shells;
(so) air, around leaf / outside stomata, does not become saturated / is less humid; **4 max**

© University of Cambridge International Examinations 2004

Question	Expected Answers	Marks
3 (c)	*in intact plant*	
	limited / less water available from the soil; slower rate of water uptake / absorption by the roots; (because) there is resistance to water movement across (root) cortex / apoplast / cell walls / endodermis / Casparian strip; water has to travel further / greater distances, in xylem vessels under tension / in small vessels; other factors (e.g. light intensity / humidity) could affect width / size / opening of stomata; (compared with controlled potometer investigation) **A** reverse arguments for potometer	**2 max**
		[Total: 11]

© University of Cambridge International Examinations 2004

Question	Expected Answers	Marks
4 (a)	calculation = 40 000 / 2.5 / suitable alternative; answer = x 16 000; **A** 15 500 -> 16 500	**2**
(b)	chlorophyll C; cellulose B; DNA D; phospholipid C / F;	**4**
(c)	*assume answer is about red blood cells unless indicated otherwise* no nucleus; no cell wall; no vacuole; **R** smaller vacuoles no, organelles / named organelle visible in fig. 4.1; **A** only chloroplasts / mitochondria / ribosomes **R** refs to shape	**3 max**
(d)	partial pressure of oxygen is low; **A** low concentration / lack / less of oxygen / ora more haemoglobin (is produced); *idea of* compensating / making up for / counteracting the smaller volume of oxygen absorbed / lower saturation of haemoglobin / haemoglobin only 70% saturated / less oxygen carried around body;	**2 max**
		[Total: 11]

© University of Cambridge International Examinations 2004

Question	Expected Answers	Marks
5 (a) (i)	U - phosphate / PO_4; **R** phosphoric acid / phosphorus / P W - deoxyribose; **R** pentose X - cytosine; **R** nitrogenous base / pyrimidine / C	3
(ii)	Z - hydrogen; **R** H	1

(b) *Assume answer is about polypeptide unless indicated otherwise. A comparison is not required. Information given below is for <u>either</u> polypeptide <u>or</u> DNA features.* ***A*** *ideas from either column. Do not penalise if points are not corresponding on one line / sentence. Mark all points on line. Only* ***R*** *if biologically incorrect.*

polypeptide	*DNA*
amino acids	nucleotides ;
one / single strand / chain	two / double strand / chains ;
peptide bonds **R** between peptides / polypeptides	phosphodiester ;
20 monomers / sub units **A** > 4 monomers / sub units	only 4 monomers / sub units ; **R** 4 bases
no phosphate / PO_4	has phosphate / PO_4 ;
2^o / 3^o structure	double helix ; **3 max**

[Total: 7]

© University of Cambridge International Examinations 2004

Question	Expected Answers	Marks
6 (a)	mitosis / mitotic division; **R** cell division / cytokinesis	1
(b)	clone;	1
(c)	T cell receptor is correct / exact / perfect match / fit / complementary to antigen; **R** corresponds / identical / same ref to different / wrong shapes of receptors on J and / or L; ref to specificity;	2 max
(d)	*N.B. Mark first role given* *either* *helper cells* secrete / release / produce, cytokines / lymphokines / hormones; to stimulate B cells to, divide / develop into plasma cells; (which) produce antibodies; (and) stimulate macrophages to carry out phagocytosis / (idea of); *or* *cytotoxic / killer T cells* seek out / find / bind to (foreign) antigens on host cells / pathogens; destroy, host cells / intracellular parasites / virally infected cells / viruses; attach to surface of cells / 'punch holes' into cells; release toxic substances / interferons / hydrogen peroxide (into cells); **R** enzymes	2 max
(e) (i)	carcinogen / mutagen; **R** all other responses	1
(ii)	T cells do not recognise antigens; no immune response / weak immune response / no secondary immune response; no / few antibodies produced; no / few T killer cells produced; susceptible / vulnerable to / increased likelihood of, infection / disease / opportunistic infections; **R** refs to cancer / autoimmune disease	2 max
		[Total: 9]

Paper Total = 60

© University of Cambridge International Examinations 2004

June 2004

GCE A AND AS LEVEL

MARK SCHEME

MAXIMUM MARK: 25

SYLLABUS/COMPONENT: 9700/03

BIOLOGY
Paper 3 (Practical 1)

UNIVERSITY of CAMBRIDGE
International Examinations

Question	Expected Answers	Mark	Additional Guidance
1 (a) (i)	S1 – potassium hydroxide **and** copper sulphate – lilac/mauve/purple – protein present;	1	Accept biuret Allow 1 ecf only
	S2 – hydrochloric acid / HC*l;*	1	
	Benedict's – orange / red – non reducing / sucrose present;	1	}Accept any colour change }**after** blue through to red.
	S3 – Benedict's – orange / red – glucose present;	1	
1 (a) (ii)	Hydrolyse / add acid **and** heat; Cool; Neutralise / add sodium (hydrogen) carbonate; Volumes used / equal volumes OR > Benedicts; (Water bath) at 80°C+ / boil; for => 1 minute;	max 3	Reject less Benedicts
1 (a) (iii)	Make range of at least 3 glucose concentrations; The more the precipitate the more the glucose; Range of at least 3 colours; Green / yellow least; Orange / red most; Match colours or precipitate to the standard; May need to dilute or increase range; Use of colorimeter;	max 4	
	Total	**11**	
2 (a)	Area of chromosomes correct relative size i.e. => ½ of cell length and width; Cell wall with 1 or 2 clear continuous close lines; Width of chromosome constant and not pinched and > width of cell wall; Two correct labels, 1 mark each;;	max 4	If not anaphase or metaphase or no / wrong label then max 2 **Accept** chromosome, centromere, cytoplasm, cell wall, equator or pole. **Reject** cell or nuclear membrane, spindle, any organelle, nucleus.
2 (b) (i)	Correct stages labelled; *Interphase* Circular area of chromatin with no visible chromosomes (blank or shaded); Chromatin labelled correctly; Nuclear membrane / envelope labelled; *Telophase* Two distinct masses of chromosomes nuclei; (mass) of chromosomes labelled; **Both** labelled as nucleus / daughter nuclei / membrane; Length of cell at least twice the width;	max 6	If not labelled assume first drawing interphase and second drawing telophase
2 (b) (ii)	Length of cell > telophase drawing in **2bi;** Intact <u>circular</u> nucleus; Nucleus same size as nucleus in interphase in **2bi;** Vacuole labelled or statement of comparison; Nucleus small relative to cell of **2bi** interphase;	max 4	Allow all marks for correct annotation
	Total	**14**	

Paper Total 25

© University of Cambridge International Examinations 2004

June 2004

GCE A LEVEL

MARK SCHEME

MAXIMUM MARK: 60

SYLLABUS/COMPONENT: 9700/04

BIOLOGY
Paper 4 (Theory 2 (A2 Core))

UNIVERSITY of CAMBRIDGE
International Examinations

Question 1

(a) peptide bonds between amino acids ;
primary structure / amino acid sequence determines folding sites ;
hydrogen bonds maintain (secondary structure) ;
ref. beta pleated sheet / alpha helix ;
ref. folding to form tertiary structure / globular shape ;
sulphur bridges / ionic bonds / Van de Waals forces / hydrophobic interactions ;

3 max

(b) reverse transcriptase / synthesise DNA from mRNA ;
restriction endonuclease / enzyme ;
produces sticky ends ;
plasmid cut by restriction enzyme ;
recombinant DNA formed ;
DNA ligase (correct ref) ;
DNA inserted into host e.g. Hamster kidney / ovary cells ;
Detail of insertion e.g. electric shock / calcium ions.

4 max

(c) no contamination / ref. named infection HIV / reduced rate of infection / greater production rate ; **1**

(d) ref. to introns and exons / only mammalian cells have Golgi / enzymes (for post translational modification) ;

1

Total: 9

Question 2

(a) (i) correctly indicated on inner membrane ;
(ii) correctly indicated in matrix ;

2

(b) folded inner membrane / cristae ;
increases surface area available ;

intermembrane space ;
allows accumulation of H^+ ;

impermeability of inner membrane to H^+ ;
maintains H^+ gradient / H^+ only go through channels ;

stalked particles / ATPase ;
channel for H^+ / ATP synthesis ;

linear arrangement of ETC on inner membrane ;
greater efficiency ;

4 max

(c) (no) oxygen to combine with e^- / H^+ / H / 2H / proton ;
at the end of the ETC ;
no H^+ gradient produced ;
no ATP synthesized / oxidative phosphorylation does not occur ;
no NAD regenerated / NADH not oxidized ;
stops Krebs cycle ;

3 max

Total: 9

© University of Cambridge International Examinations 2004

Question 3

(a) **A** microvilli / brush border ;
B invagination / infolding of membrane / basal channels ;

2

(b) basal channels / microvilli / brush border – increase surface area ;
many mitochondria – provide ATP for active transport ;
carrier proteins / cation pumps in csm – active uptake / facilitated diffusion / co-transport ;
tight junctions – prevent migration of membrane proteins / separate tubule fluid ;
ref. to pincocytosis – protein uptake ;

3 max

(c) Na^+ actively transported (out of cell) into blood ;
creates concentration gradient ;
Na^+ enters cell by diffusion ;
through cotransporter / symporter proteins ;
glucose cotransported / facilitated diffusion (from lumen to cells) ;
glucose diffuses into blood capillaries ;

3 max

(d) proximal convoluted tubule cells have a low / more negative water / solute potential ;
due to high concentration of salts / ions / glucose / Na^+ ;
water enters by osmosis ;
down water potential gradient (idea) ;

2 max

Total: 10

© University of Cambridge International Examinations 2004

Question 4

(a) *Use **one** of the following schemes **1, 2 or 3.***

1 named example e.g. sickle cell anaemia / PKU
change base ;
may change amino acid ;
change folding / shape of protein ;
detail of affect of protein changes ;

2 named example e.g. PKU ; **R** sickle cell anaemia
lack of enzyme / non functioning enzyme ;
2 x phenotype changes / symptoms ;;

3 chromosome mutation ;
detail of mutation ;
named example e.g. Down's syndrome ;
2 x symptoms ;;

4 max

(b) homozygotes for sickle cell allele die from sickle cell anaemia ;
sickle cell allele frequent in malarial areas ;
heterozygotes are resistant to malaria / have selective advantage ;
therefore pass on sickle cell allele ;
homozygous normal suffer / die from malaria ;

4 max

Total : 8

© University of Cambridge International Examinations 2004

Question 5

(a)

black female X orange male

X^BX^B X^oY ;

tortoiseshell female black male

X^BX^O X^BY ; *

orange female X black male

X^OX^O X^BY ;

tortoiseshell female orange male

X^BX^O X^OY ; *

(* *must also have either gametes / construction lines / punnet square*).

(b)

tortoiseshell female

X^BX^O ;

black female

X^BX^B ;

black male

X^BY ;

orange male

X^OY ;

(*phenotypes and genotypes must be linked otherwise max 2*).
(*penalize **once** for lack of gender*).

(c) X chromosome inactivated randomly early in development / AVP ;

1

Total : 9

© University of Cambridge International Examinations 2004

Question 6

(a)

1 depolarisation/action potential ;
2 of presynaptic membran,/synaptic knob ;
3 opening calcium ion channels ;
4 calcium ions in ;
5 vesicles containing transmitter / acetylcholine ;
6 fuse with membrane ;
7 contents emptied into synaptic cleft / exocytosis ;
8 transmitter / acetylcholine diffuses across synaptic cleft ;
9 transmitter / acetylcholine binds to receptor ; **R** protein channel
10 on post synaptic membrane ;
11 Na^+ channels open / Na^+ enters ;
12 depolarises post synaptic membrane ;
13 action potential set up / impulse transmitted ;
14 breakdown / hydrolysis of transmitter / acetylcholine by enzyme / cholinesterase ;

9 max

(b)

15 when blood glucose levels low ;
16 glucagon released from alpha cells (in pancreas) ;
17 (acts on) liver (cells) ;
18 breakdown of glycogen to glucose ;
19 use of fatty acids in respiration ; **R** fats
20 production of glucose from other compounds / fats / amino acids / gluconeogenesis ;
21 liver releases glucose into blood ;
22 glucose levels rise / return to normal ;
23 switching off glucagon secretion ;
24 antagonistic to insulin ;

6 max

Total : 15

© University of Cambridge International Examinations 2004

Question 7

(a)

1 RuBP 5C ;
2 combines with carbon dioxide ;
3 rubisco ;
4 to form an unstable 6C compound ;
5 which forms 2 X GP (PGA) ;
6 ATP;
7 energy source
8 and reduced NADP ;
9 forms TP (GALP) ;
10 TP used to form glucose / carbohydrates 1 lipids / amino acids ;
11 TP used in regeneration of RuBP
12 requires ATP ;
13 as source of phosphate ;
14 light independent ;

9 max

(b)

15 coenzyme ;
16 reduced ;
17 carries protons ;
18 and (high energy) electrons ;
19 from photosystem7light stage ; R photosystem II
20 on thylakoid membrane grans ;
21 to stroma / Calvin cycl~
22 ref. regeneration of NADP ;

6 max

Total : 15

© University of Cambridge International Examinations 2004

June 2004

GCE A LEVEL

MARK SCHEME

MAXIMUM MARK: 30

SYLLABUS/COMPONENT: 9700/05

BIOLOGY
Paper 5 (Practical 2 (A2))

Question	Expected Answers	Marks	Additional Guidance
1 (a) (i)	3 from: Initially sink; Bubbles / oxygen form on (surface) of beads; Then float; No reaction in water / beads do not float;	 max 3	 Accept 'no reaction' Reject 'no change'
1 (a) (ii)	4 from: H_2O broken down; By catalase / enzyme (in yeast); Release oxygen / O_2; Correct reference to density; No hydrogen peroxide / substrate in **aii**	 max 4	
1 (b) (i) & (ii)	Spaces with six readings; Time taken to rise with units / AW in column / row heading; Means shown in table; Means correct 1.0 faster than 0.2;	1 1 1 1 1	
1 (b) (iii)	goggles / eye protection;	1	Accept mop up spills and any procedure that stops hydrogen peroxide coming in touch with the skin or any other sensible procedure relating to **safety**.
1 (b) (iv)	3 from: Ref to conc of hydrogen peroxide / substrate / amount of molecules: Means fewer molecules to collide / fewer collisions / ORA; Active sites used less often / empty more of the time / ORA; IDEA OF time taken is inverse of rate of reaction;	 max 3	
1 (c)	6 from: 1 At least 5 temperatures between 100 and O°C; 2 Means of maintaining / monitoring temperature; 3 Means of measuring volume of gas produced (e.g. gas syringe / bubbles counted etc.) OR means of measuring time. 4 In a given time interval OR time taken for bead to float; 5 constant volume / concentration of yeast; 6 constant volume / concentration of substrate; 7 Any other variable controlled and means to achieve it; 8 Repetition	 max 6	
	Total	**22**	
2 (a)	4 from: Single continuous line for epidermis / piliferous layer; Single continuous line delineating storage from non storage tissue; Two or three concentric circles for encdodermis and pericycle; Stelate conductive tissue; Labels distinguish between xylem & phloem; Proportion correct i.e. stele <1/3 of root radius; Tissue only, no cells	 max 4	
(b)	Root;	1	
(c)	cell wall of conducting cell thicker than cell wall of storage cell; conducting cell empty; storage cell has starch grains;	 1 1 1	 If labelled wrong way round then max 2.
	Total	**8**	
	Paper Total	**30**	

© University of Cambridge International Examinations 2004

June 2004

GCE A LEVEL

MARK SCHEME

MAXIMUM MARK: 50

SYLLABUS/COMPONENT: 9700/06

BIOLOGY
Paper 6 (Options (A2))

UNIVERSITY of CAMBRIDGE
International Examinations

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

© University of Cambridge International Examinations 2004

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

© University of Cambridge International Examinations 2004

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 <u>in diet</u> 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

© University of Cambridge International Examinations 2004

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

© University of Cambridge International Examinations 2004

Option 2

1. (a) (i) **A** – capsomere ;
B - nucleic acid / DNA / RNA ;
C - envelope / lipid bilayer ;
D – capsid ;

½ marks rounded up 2

(ii) $50/500 \times 10^{-6}$ / $50 \times 10^{6}/500$;
1×10^{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 <u>cell</u> ;
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 <u>per year</u> ; 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

© University of Cambridge International Examinations 2004

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

© University of Cambridge International Examinations 2004

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

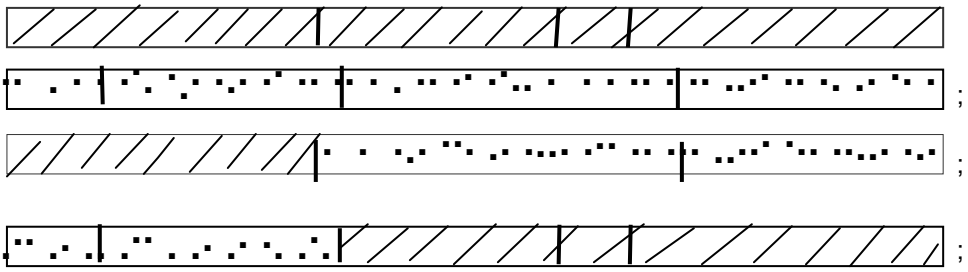
Total 10

© University of Cambridge International Examinations 2004

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

© University of Cambridge International Examinations 2004

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 (somatoclonal) 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) 156 x 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

© University of Cambridge International Examinations 2004

2 (a) (i) decreases with increased age ;
approx. same decrease from ages19 - 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 <u>peak</u> 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

© University of Cambridge International Examinations 2004

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

© University of Cambridge International Examinations 2004

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 (somatoclonal) 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) 156 x 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

© University of Cambridge International Examinations 2004

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

© University of Cambridge International Examinations 2004

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

© University of Cambridge International Examinations 2004

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

© University of Cambridge International Examinations 2004