GCE

Biology

Advanced GCE **A2 7881**

Advanced Subsidiary GCE **AS 3881**

Mark Schemes for the Units

June 2007

3881/7881/MS/R/07

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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 should be read in conjunction with the published question papers and the Report on the Examination.

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Advanced Subsidiary GCE Biology (3881)

MARK SCHEMES FOR THE UNITS

Mark Scheme 2801
June 2007

ADVICE TO EXAMINERS ON THE ANNOTATION OF SCRIPTS

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	ora	= or reverse argument

Question	Expected Answers	Marks
1 (a) (i)	*Each of the following to be labelled with a clear label line.* *Allow **P** and **E** as letters inside the appropriate cell.* **P** / palisade mesophyll cell **;** **E** / lower epidermal cell **;** **C** / cuticle **;**	**3**
(ii)	*award two marks if correct answer (150) is given* *incorrect answer (or no answer) but correct working = 1 mark* (x) 150 **;;** **R** units **A** in the range 147 – 153 ***answer should not exceed 1 d.p.*** *if answer incorrect or to too many d.p., then allow 1 working mark for* *÷ 0.7 (mm) or equivalent*	**2**
(b)	*if describing organ, max 1* made up of **,** more than one / two / a few **,** types of cell **;** **A** named cell types (vessel / fibre / parenchyma) working together / AW **;** with a **,** specific / particular / same **,** function / role / purpose / job **;** **A** named function **A** transport minerals **R** transport nutrients	**2 max**
		[Total: 7]

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

2 (a) **one mark for each correct row**

if only ticks, assume that spaces are crosses; if only crosses, assume that spaces are ticks

R **hybrid ticks**

	statement					
substance	***use heat***	*use biuret reagent*	*use Benedict's reagent*	*boil with a dilute acid*	*a positive result is a blue-black colour*	*a positive result is an emulsion*
lipid	×	×	×	×	×	✓
protein	×	✓	×	×	×	× ;
starch	×	×	×	×	✓	× ;
reducing sugar	✓	×	✓	×	×	× ;
non-reducing sugar	✓	×	✓	✓	×	× ;

4

(b) (i) glycosidic **;** **A** covalent / C-O-C / oxygen bridge
R oxygen bond / 'glucosidic' **1**

(ii) hydrolysis / hydrolytic **;** *if qualified, needs to be correct* **1**

(c)

1 no (suitable) enzyme (in gut) to digest sucralose / sucrase will not act on sucralose / AW **;**

2 enzymes **,** are specific / only act on one substrate **;**
3 complementary shape **;**

4 idea that (C*l* on sucralose instead of OH) gives different **,** shape / structure **;**
5 no ESC (enzyme substrate complex) / substrate will not fit into active site **;**

6 AVP **;** e.g. further detail of enzyme-substrate interaction **4 max**

[Total: 10]

Question	Expected Answers	Marks
3 (a) (i)	U A C C G G A U U C A C ; ; *1 error = 1, 2 errors = 0* *allow 1 mark for giving T throughout instead of U* *(i.e. T A C C G G A T T C A C = 1 mark)*	**2**
(ii)	transcription / transcribed ; **R** transcriptase	**1**
(b) (i)	**J** anticodon ; **R** anticodons **K** transfer RNA / tRNA ; **L** ribosome / rRNA ; **M** codon ; **R** codons	**4**
(ii)	**1** DNA triplet / codon / **M** / mRNA triplet , codes for specific amino acid ; **2** order of , triplets / bases , determines the order of amino acids ; **3** tRNA / K , has , corresponding / complementary , triplet / anticodon ; **4** (tRNA / K) attached to specific amino acid ; **5** activation of amino acid ; **6** 2 (tRNA) binding sites on the ribosome ; **7** codon and anticodon bind ; **A** match **8** A to U <u>and</u> C to G ; **9** adjacent amino acids join ; **10** peptide bond ;	**4 max**
(c)	**1** attaches to ribosome ; **2** removes , base / portion , of ribosome ; **A** stops ribosome assembling / changes shape of ribosome **3** prevents ribosome , attaching to / reading , mRNA ; **4** prevents codons being exposed ; **5** prevents , tRNA / anticodon , attaching to , mRNA / codon ; **6** prevents / inhibits enzyme responsible for , formation of peptide linkages ; **7** AVP ; e.g. further detail of any of the above points	**2 max**
		[Total: 13]

Question	Expected Answers	Marks

4 (a) *credit comparative statements on the same line ~ must refer to both*

do not credit ref to size of cell
ignore vacuoles / slime layer

prokaryotic	***eukaryotic***	
no **,** nucleus / nucleolus / nuclear membrane / nuclear envelope **A** free DNA	nucleus / nucleolus / nuclear membrane / nuclear envelope **A** DNA enclosed	;
circular DNA **A** loop	linear DNA	;
no **,** histones / (true) chromosome **A** naked DNA	histones / chromosome **A** DNA + protein	;
no membrane-bound organelles	membrane-bound organelles/ named e.g. (*Allow up to 2 marks*)	;
cell wall	may have cell wall	;
peptidoglycan / murein **,** cell wall	cellulose cell wall (if present)	;
ribosomes **,** 18 nm / 70S / smaller	ribosomes **,** 22 nm / 80S / larger	;
plasmids	no plasmids (except inside organelles)	;
AVP e.g. no cytoskeleton flagellum not 9+2 pili fimbrae capsule mesosome	AVP e.g. cytoskeleton flagellum 9+2 no pili no fimbrae no capsule no mesosome	; **3 max**

4 (b) ***max 7 for the process of genetic engineering***
max 2 for the advantages

1 identify / find **,** gene (for insulin) / length of DNA coding for insulin **;**

2 obtain / isolate / extract **,**
gene / length of DNA (for insulin) **;** obtain / isolate / extract **,**
mRNA (for insulin) **;**

3 restriction enzyme / named e.g. ;reverse transcriptase ;

4 cut plasmid **;** cut plasmid **;**
5 use same restriction enzyme **;** use restriction enzyme /
named e.g. **;**

6 ref to , complementary ends / sticky ends / described **;**

7 insert **,** gene / AW **,** into plasmid **;**
8 recombinant DNA **;**

9 plasmid uptake by bacteria **;**
10 identify those bacteria that have taken up the plasmid **;**

11 provide with **,** raw materials / nutrients **;**
12 fermenter / bioreactor **;**
13 bacteria produce insulin **;**
14 extract and purify / downstream processing **;**

15 AVP **; e.g.**. detail of uptake by bacteria
method of identifying those that took up plasmid
PCR
ligase *7 max*

16 advantage 1 **;** e.g. more reliable supply
17 advantage 2 **;** greater / faster , production
overcomes ethical problem described
less risk of disease
less risk of , rejection / side effects
human insulin so more effective **8 max**

QWC – clear, well organised using specialist terms ; **1**
award QWC mark if four of the following are used

gene	plasmid
restriction enzyme	complementary
named e.g. of a restriction enzyme	sticky end
reverse transcriptase	recombinant DNA
fermenter / bioreactor	

[Total: 12]

Question		Expected Answers	Marks
5	(a)	***R*** *"I" and "II" throughout*	
	(i)	prophase **;**	**1**
	(ii)	interphase / S phase **;**	**1**
	(iii)	telophase **;** *ignore cytokinesis*	**1**
	(b)	**1** attach to spindle **;** **2** by centromere **;** **3** centromere **,** divides / splits **;** **R** breaks **4** spindle fibres shorten / AW **;** **5** chromosomes / chromatids **,** pulled to **,** poles / centrioles / different ends of cell / different ends of spindle **;** nucleus / 1 of each pair **6** centromere leading **;** **7** detachment from spindle fibres **;** **8** (start to) unravel / uncoil / decondense / lengthen / AW **;**	**4 max**
	(c) (i)	asexual **;** **A** binary fission / cloning **ignore** mitosis	**1**
	(ii)	**1** restore diploid number when gametes fuse / AW **;** **2** prevents doubling of chromosome number (in each successive generation) **;** **3** without use of gametes there is less variation **;** **4** no input of genetic material from more than one individual **;** **5** triploid / 5n / etc **,** would be infertile **;** **6** AVP **;** e.g. polyploid would result in loss of variation	**2 max**

[Total: 10]

Question	Expected Answers	Marks
6 (a) (i)	denitrification;	1
(ii)	*Rhizobium* ;	1
(iii)	active transport / diffusion ;	1
(iv)	nitrification ;	1
(b)	*max 3 for each method*	
	ploughing-in	
1	legumes / named e.g. , possess , (root) nodules / nitrogen fixing bacteria ;	
2	*Rhizobium* , performs nitrogen fixation / described ;	
3	nitrogenous compounds are present in , roots / nodules / legumes / plants ;	
4	made available to soil if , ploughed in / not removed ;	
5	roots / AW , decomposed / acted on by decomposers / rot / decay	
6	;	
7	nitrogenous compounds released (by decomposers) ; formation of nitrate ; *3 max*	
8	***crop rotation***	
	different , crops / plants , have different (nutrient / nitrate)	
9	requirements ;	
	each year , different demands made on the soil / nutrients not	
10	being removed at the same rate ;	
	in , 4th / fallow , year , no (little) nutrients removed / used for	
11	grazing animals ;	
12	nutrient levels allowed to build up ;	
13	use legume in rotation ;	
	tuber / root , crop to improve soil structure ; *3 max*	4 max
	[Total : 8]	

Mark Scheme 2802
June 2007

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Question	Expected Answers	Marks
1 (a)	*read whole statement and decide* inherited ; **A** hereditary *treat "genetic" as neutral* result in a, gradual / progressive, decline of bodily, tissues / functions / AW ; **R** ref to chronic TB / AIDS / cholera / cold / influenza / measles / mumps / malaria / chicken pox / cervical cancer / leukaemia / AVP ; **A** HIV/AIDS *treat "HIV" as neutral* mental / psychiatric / psychotic / neurotic ; *treat "psychological" as neutral* permanent or temporary damage to part of the body / any disease that is not mental ; **A** harm *treat "wear and tear" as neutral*	**5**
(b)	*accept alternative wording that gives idea of each point* **1** identify location where disease is spreading *or* predict, where / when, epidemic may arise ; **2** identify those at risk / contact tracing ; **3** find a way to prevent spread / isolate / quarantine ; **4** ref to targeting vaccination ; **5** give (individuals) advice on, lifestyle / diet / other named risk factor ; **6** qualified ref to targeting funding ; **7** ensure sufficient, medicines / antibiotics / vaccines / facilities, are **8** available ; ensure enough medical personnel are available ; **9** qualified ref to education of population ; **10** prioritising diseases; **11** target screening ; **12** assess effectiveness of treatment programme ;	**max 3**
		[Total: 8]

Question	Expected Answers	Marks
2 (a) (i)	produce / secrete / release, mucus ; prevent collapse of / hold open / support, airways ; **A** provide shape of bronchus **R** gives wall, structure / strength	2
(ii)	cilia, destroyed / damaged ; **R** cilia not working (epithelium replaced by) scar tissue / scarring ; (smooth) muscle becomes thicker ; mucous glands enlarge / larger goblet cells / more goblet cells ; **R** more mucus secreted inflammation of connective tissue ; AVP ; idea of tumour if it describes a structural change	**max 2**
(b)	stretch, as air is inhaled / allow alveoli to expand during inhalation ; to increase lung volume / surface area ; prevents alveoli bursting ; (elastic fibres) recoil, as exhale ; **R** contract more, complete / rapid, expulsion (from the alveoli) ; **A** expel more air	**max 2**
(c)	tidal volume is reduced / less air inhaled and exhaled / residual volume is larger / air trapped in alveoli / vital capacity smaller ; more difficult to exhale ; (as) alveoli cannot, stretch / recoil ; rapid / shallow, breathing / breathlessness / wheezing ; alveoli may burst ; leaves gaps in tissue / larger air spaces / AW ; less surface area (for gaseous exchange) ; blood / haemoglobin, less well oxygenated / less carbon dioxide removed ; ***R** less able to do exercise / need to use oxygen*	**max 4**

[Total: 10]

Question			Expected Answers	Marks
3	(a)	(i)	coronary ;	1
		(ii)	high concentration of, cholesterol / LDL, in blood ; endothelium / lining damaged ; deposition (fat / cholesterol) in wall of artery ; **R** "on artery" ref to plaque / atherosclerosis / atheroma ;	max 2
	(b)	(i)	***R** if refer to body muscles* less, oxygen / nutrients / sugars / fatty acids, supplied (to heart muscle) ; slower removal of carbon dioxide ; less, respiration / ATP made ; muscle contraction is weaker / cannot pump as forcefully / contraction stops ; death of heart muscle ; makes (remaining) heart muscle work harder / hypertrophy ;	max 3
		(ii)	angina / chest pain when, exercising / exertion ; reduced ability to perform exercise ; breathlessness ; myocardial infarction / heart attack / cardiac arrest ;	max 2
	(c)	(i)	ref to suitable drug ; e.g. anticlotting, blood pressure reducing, diuretic bypass operation ; stents fitted ; angioplasty / balloon on catheter ; AVP ; e.g. name of drug extra detail about a named drug or one of above procedures	max 2
		(ii)	avoid, saturated / animal, fats ; **A** cholesterol eat, unsaturated fats / polyunsaturated fats / plant oils / fish oils ; qualified ref to, more / regular, exercise ; avoid smoking ; avoid stress ; eat more, fruit / vegetables / antioxidants ; **A** moderate intake of red wine reduce weight ; reduce alcohol intake ; eat more soluble fibre ; ref to vitamin D production / exposure to sunlight ;	max 2

[Total: 12]

Question			Expected Answers	Marks
4	(a)		*treat fibre / water as neutral* carbohydrates / sugars / polysaccharides ; vitamins ;	2
	(b)	(i)	those that must be ingested ; those that cannot be synthesised (by the human body) ;	max 1
		(ii)	to make, protein / polypeptide / named protein ; to make, other / non essential, amino acids ; **R** use in deamination and respiration *treat growth / repair as neutral*	max 2
	(c)	(i)	muscle wasting ; oedema / described ; moon face ; swollen, abdomen / liver (**R** stomach) / extremities / hands / feet / other named part ; dry / brittle / red / sparse, hair ; skin dry / flaky ; low body weight ; irritability ; apathy ; diarrhoea ; fatty liver ; loss of appetite ; tooth decay ; AVP ; e.g. increase in infections, poor immune system, loss of muscle strength xerophthalmia / poor night vision	max 3
		(ii)	age they are weaned *or* younger (than 6-18 months), fed on milk / breast-fed ; milk contains proteins ; food eaten, cereal / starchy / may have less protein / poor quality protein ; AVP ; e.g. weaned early as second child on way / AW growing quickly so need lots of protein	max 2

[Total: 10]

Question	Expected Answers	Marks
5 (a)	low % infected in, Western Europe / North America ; high % infected in Sub-Saharan Africa ; highest % increase in Eastern Europe and Central Asia ; high % increase in, North Africa / Sub-Saharan Africa / East Asia ; low % increase in, Western Europe / North America ; figures to illustrate a comparison ;	**max 2**
(b)	*HIV/AIDS difficult to prevent because…* **1** no cure ; **2** no vaccine ; **3** high mutation rate / antigenic, shift / drift / change ; **4** cannot be treated with antibiotics ; **5** symptomless carriers / long incubation period ; **6** HIV is transmitted by, unprotected sexual contact / unscreened blood products / across placenta / in breast feeding / blood to blood contact / mixing of blood / reusing needles ; **7** people reluctant to be tested for HIV ; *Higher rate increase in LEDC because…* *marking points below refer to LEDCs* *Accept reverse argument in each case* **8** poverty ; **9** less education about, means of transmission / disease ; **10** sexual attitudes / promiscuity / more partners / ref to sex industry ; **11** lower availability of condoms ; **12** religious / cultural, reasons ; **13** denial / superstitious beliefs ; **14** fewer, medical personnel / clinics / facilities / hospitals / (effective) drugs, (to treat infected people) ; **15** less, screening of blood products / testing of people ; **16** ref to government financial constraints ; **17** (enforced) migration / refugee camps ; **18** more infected mothers breast feed ; **19** more cases of rape ; **20** more intravenous drug abuse ; **21** more use of, shared / unsterilised, needles ; **22** AVP ; e.g. lack of contact tracing **23** AVP ; HIV inside cell so hidden from immune system / antigens concealed	**max 7**
	QWC – legible text with accurate spelling, punctuation and grammar ;	**1**
		[Total: 10]

Question			Expected Answers	Marks
6	(a)		*Plasmodium* ; antigens ; cytotoxic / killer / T killer / T_k / T_c ; helper / T helper / T_h ; cytokine / lymphokine ; memory ;	6
	(b)		antibodies / immunoglobulins ;	1
	(c)	1	several, strains / species, of malarial parasite ; **A** *P. falciparum* is not the only malarial parasite **R** disease	
		2	parasite is a, protist / protoctist / eukaryote ;	
		3	many surface, proteins / antigens ; **A** more than one stage in human	
		4	mutation ;	
		5	ref to antigenic drift / antigens may change ;	
		6	ref to antigenic shift ;	
		7	much of life cycle inside, host cells / red blood cells / hepatocytes ;	
		8	hidden / protected, from immune system ; **A** ref to antigen concealment	
		9	AVP ; e.g. qualified ref to economic argument low antigenicity	max 3

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Mark Scheme 2803/01
June 2007

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1 (a)	the heart / ventricle / cardiac muscle (involved) **;** peaks coincides, with, systole / contraction **;** **R** pump troughs coincide, with, diastole / relaxation / AW **;** stretch-recoil effect / AW **;** ***must*** *link to rise / fall not just a general statement*	**2 max**
(b)	distance (from heart) qualified, e.g. further / around the body / AW **;** friction / resistance to flow / AW **;** less / no, stretch-recoil effect / AW **;** increasing volume of, arterioles / capillaries **;** **A** surface area of capillaries / large capillary bed / many capillaries / branching **R** large SA:V ratio	**3 max**
(c)	stop damage (to capillaries) **;** **A** stop bursting **R** 'can't cope' **A** 'can't withstand' lack of (much) elasticity / thin / delicate / fine / one cell thick / no collagen / no muscle **;** *ora* for artery wall slows flow rate **;** allows time (for) **;** exchange / AW **;** **A** one named substance moved, but **R** "food" oedema risk reduced / high pressure might force out more tissue fluid **;**	**2 max**
(d)	valves prevent backflow / AW **;** action of (skeletal) muscle **;** **R** if muscle in vein wall implied residual pressure / AW **;** large lumen provides little resistance / AW **;** negative pressure in, chest / thorax / heart **;** **A** respiratory pump gravity effect (from areas above heart) **;**	**2 max**
		[Total: 9]

Question		Expected Answers	Marks
2	(a)	**C ;** **E ;**	**2**
	(b)	large surface area (to volume) / many **;** low water potential **;** **A** ref to low solute potential **R** refs to water concentration **A** refs to (high) solute concentration thin <u>wall</u> / short diffusion path **;** uncutinised / permeable / unlignified / AW **;** rapid, growth / replacement **;**	**2 max**
	(c) **1**	osmosis in correct context **;** *look for across membrane, or, into / out of, cell / root*	
	2	moves down a <u>water potential</u> gradient / from high to low <u>water potential</u> **;** **R** along / across **R** concentration / diffusion gradients	
	3	most negative / lowest, in the xylem **;**	
	4	(uptake of) ions / minerals / solutes, into xylem / root hair**;** *in context of WP gradient*	
	5	tension in xylem / transpiration pull / cohesion-tension **;** *relate to pathway in root*	
	6	(moves) via the cell walls **;**	
	7	(moves) via, cytoplasm / vacuoles **;**	
	8	passage via the plasmodesmata **;** *look for linking cytoplasm / through wall*	
	9	Casparian strip / suberin / waxy / fatty / AW, blocks, cell wall route / apoplast **;** **A** waterproof	
	10	water, crosses membrane / enters, cytoplasm / vacuole / symplast **;**	
	11	AVP **;** e.g. pits in xylem / passage cells /aquaporins / protein channels / capillarity in cell wall (spaces)	**max**
		credit points from diagram	**6**
		QWC – legible text with accurate spelling, punctuation and grammar ;	**1**

(d) *1 for feature and 1 for role in each section* ***except lignin*** *but max 2 for features and max 2 for functions*
apply AW throughout

lignin / AW **;**
(allows) adhesion / waterproof / stops collapse (under tension) **;**
A two functions

rings / spirals / thickening / AW **;** **A** thick wall / rigid sides
prevents collapse (under tension) **;** **R** strong / support / stops bursting

no cytoplasm / lack of contents / hollow / (empty) lumen / AW **;**
R "dead" unqualified
less resistance to flow / ease of flow / AW / more space (linked to lack of contents) **;**

lack of end walls / continuous tube **;** **A** long tube idea
less resistance to flow / ease of flow **;** **A** continuous columns idea

pits / pores, inside walls **;** **A** holes **R** gaps
lateral movement / get round air bubbles / supplies(water) to cells or tissues / water in or out **;** **R** "just let things in and out" unqualified

develop as a continuous water-filled column / AW **;**
allows tension to pull water up / AW **;**

narrow lumen / AW **;**
idea of more capillary rise **;** **4**

[Total: 15]

Question	Expected Answers	Marks
3 (a)	**F** = sinoatrial node / SAN / pacemaker **;** **G** = pulmonary vein **;**	**2**
(b) (i)	atrium / **X**, (only) has to pump, to ventricles / short distance **;** *ora for ventricles* **A** ref to gravity effect / negative ventricle pressure left ventricle / **Y**, has to pump to, body / systemic circulation, and, right ventricle / **Z**, has to pump, to, lungs / pulmonary system **;** *comparison of Y and Z* left ventricle / **Y**, pumps, further / great(er) pressure **;** ora right ventricle / **Z** **A** to all / whole body *idea* as distance left ventricle / **Y**, pumps against great(er) resistance **;** ora right ventricle / **Z**	**3 max**
(ii)	(Purkyne fibres) conduct wave of excitation / AW **;** **R** *impulse, signal, pulse* to the, base / apex, of heart **;** so contraction occurs upwards / AW **;** both ventricles contract together **;** *ora for answers written in terms of what does not happen*	**2 max**
(c)	blood passes to left atrium / deoxygenated and oxygenated blood mixes in atria **;** **R** 'between atria' – must imply direction in first alternative not the reverse (due to flap) **;** (so) blood, in left ventricle / aorta, not fully oxygenated / AW **;** deoxygenated blood / less oxygen, delivered to brain **;** **A** carbon dioxide build up in brain reduced (aerobic) respiration in brain / anaerobic respiration **;** **R** *no respiration* (possible link with), lactic acid / lactate, build up **;** **R** *waste* oxygen shortage in brain (might) lead to raised blood pressure (causing migraines) / AW **;** AVP **;** e.g. ref to oxygen debt	**3 max**
		[Total: 10]

Question			Expected Answers	Marks
4	(a)		78% ; **A** 79%	1
	(b)	(i)	**1** fetus gains oxygen, from mother / across placenta ;	
			2 partial pressure of oxygen in placenta low ;	
			3 2-5 kPa ; **A** any figure within range	
			4 maternal (oxy)<u>haemoglobin</u> releases oxygen ; **R** if stealing / taking oxygen from mother is given	
			5 fetal <u>haemoglobin</u> has a high(er) affinity for oxygen ; **A** binds more strongly	
			6 maintains a diffusion gradient / AW ;	
			max 4	
		(ii)	*accept answers written in terms of adult haemoglobin*	
			7 oxygen would not be released readily enough / AW ;	
			8 (because) affinity of fetal haemoglobin would be, too / very / so, high ; ***only accept*** *higher/high if linked to oxygen release*	
			9 ref to idea that adult (females) will need difference with their fetuses in due course ;	**5 max**
				[Total: 6]
5	(a)		carbonic anhydrase ; carbonic acid / H_2CO_3 ; hydrogencarbonate / HCO_3 ; **A** bicarbonate haemoglobinic acid ; **A** HHb oxygen / O_2 ;	5
				[Total: 5]

Mark Scheme 2803/03
June 2007

ADVICE TO EXAMINERS ON THE ANNOTATION OF SCRIPTS

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   You are advised to destroy all draft versions.

2. Please mark all post-standardisation scripts in red ink. A tick (✓) should be used for each answer judged worthy of a mark. Ticks should be placed as close as possible to the point in the answer where the mark has been awarded. The number of ticks should be the same as the number of marks awarded. If two (or more) responses are required for one mark, use only one tick. Half marks (½) should never be used.

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   x = incorrect response (errors may also be underlined)
   ^ = omission mark
   bod = benefit of the doubt (where professional judgement has been used)
   ecf = error carried forward (in consequential marking)
   con = contradiction (in cases where candidates contradict themselves in the same response)
   sf = error in the number of significant figures

4. The marks awarded for each part question should be indicated in the margin provided on the right hand side of the page. The mark total for each question should be ringed at the end of the question, on the right hand side. These totals should be added up to give the final total on the front of the paper.

5. In cases where candidates are required to give a specific number of answers, (e.g. 'give three reasons'), mark the first answer(s) given up to the total number required. Examiners will be expected to use their professional judgment in marking answers that contain more than the number required. Advice about specific cases will be given at the standardisation meeting.

6. Correct answers to calculations should gain full credit even if no working is shown, unless otherwise indicated in the mark scheme. (An instruction on the paper to 'Show your working' is to help candidates, who may then gain partial credit even if their final answer is not correct.)

7. Strike through all blank spaces and/or pages in order to give a clear indication that the whole of the script has been considered.

8. An element of professional judgement is required in the marking of any written paper, and candidates may not use the exact words that appear in the mark scheme. If the science is correct and answers the question, then the mark(s) should normally be credited. If you are in doubt about the validity of any answer, contact your Team Leader/Principal Examiner for guidance.

Abbreviations, annotations and conventions used in the Mark Scheme	/	=	alternative and acceptable answers for the same
	;	=	marking point
	NOT	=	separates marking points
	R	=	answers which are not worthy of credit
	( )	=	reject
	___	=	words which are not essential to gain credit
	ecf	=	(underlining) key words which **must** be used to gain
	AW	=	credit
	A	=	error carried forward
	ora	=	alternative wording accept or reverse argument

Planning Exercise

The mark scheme for the planning exercise is set out on page 4. The marking points **A** to **T** follow the coursework descriptors for Skill P.

Indicate on the plans where the marking points are met by using a tick and an appropriate letter. There are 14 marking points for aspects of the plan and two marks for quality of written communication (QWC).

Practical Test

Pages 5 to 10 have the mark scheme for Questions 1 and 2 for the Practical Test.

AS Biology. Planning Exercise

Checking Point	Descriptor	The candidate
A	P.1a	Plans a procedure that involves exposing yeast suspensions to different temperatures and **then** checking for signs of activity by using methylene blue / other acceptable method **;**
B	P.1a	Gives a prediction that at a certain temperature (or in a given range) all the yeast cells will be killed (may be on a graph) **;** **R** 'yeast cells are denatured'
C	P.1b	Selects suitable equipment and materials, to include apparatus for heating, measuring volumes, detecting activity of yeast cells (microscope / colorimeter / colour standard) **;**
D	P.3a	Describes an effect of temperature on cells that is likely to kill them, e.g. on membranes, enzymes, proteins **;**
E	P.3a	Identifies at least 2 key factors to control e.g. volumes of yeast suspension, volumes of sugar solutions, duration of heat treatment, concentration of sugar, concentration of yeast, volume / concentration of methylene blue, pH, magnification **;**
F	P.3b	Decides on appropriate number of measurements to take: minimum of **five** different temperatures for heat treatment **;** **A** from preliminary work
G	P.3b	Decides on a (wide or narrow) range of temperatures (min range = 10^{o}C) **;**
H	P.3b	Describes a way of obtaining reliable results by using a minimum of **three** readings per temperature **;**
I	P.5a	Uses appropriate scientific knowledge and understanding in developing a plan, e.g. breaking bonds, disruption of 3^{o} structure, membrane structure **;**
J	P.5a	**Uses** preliminary work or previous practical work in developing a plan **;**
K	P.5a	Refers to a hazard and an appropriate precaution, e.g. methylene blue, use of hot water, electricity and water **;**
*L**	*P.5b*	*Gives a clear account, logically presented with accurate use of scientific vocabulary (QWC)* **;**
M	P.5b	**Describes** way(s) of obtaining precise results e.g. uses haemocytometer, percentage live/dead cells in a cell count, use of colorimeter, use of photos, dilution before count, timing to reach colour of colour standard **;**
N	P.7a	Uses relevant information from any **two written sources**, e.g. class notes / text book / web site etc **;** *must be cited in plan*
O	P.7a	Shows how results are to be presented in table including correct use of units **;**
*P**	*P.7a*	*Uses spelling, punctuation and grammar accurately (QWC)* **;**
Q	P.7b	Explains how data would be interpreted to find an answer to the investigation, e.g. plots percentages of live/dead cells against temperature**;** **A** in prediction
R	P.7b	Comments on precision, e.g. difficult to count cells accurately, use of a haemocytometer, difficulty with indirect/qualitative methods, taking temperature of yeast suspension not water bath, ref to intermediate temperatures, yeast reproduction **;**

S	P.7b	Comments on reliability, e.g. difficulty in taking samples in the same way each time, take account of anomalies, use >1 tube per temperature explained **;**
T	P.7b	Comments on validity, e.g. if method involves indirect measurements of cell activity use temperatures at which known to be active, use boiled yeast as control, effect of temperature on methylene blue, effect of methylene blue on cells, reason for using sugar solution, ref to heat shock, put oil on top of mixture **;**

Point mark up to **14** by placing letters A to T **excluding L and P** in the margin at appropriate points.

Then award **1** mark for each of **L** and **P** (QWC). **Total: 16**

"Expected" results for Q.1 (c)

tube	ethanol concentration / %	pH at 1 minute	pH at 7 minutes
1	0	6	6/5/4
2	10	6	6/5/4
3	20	7	6/7
4	40	7	7
5	50	7	7
6	100	7	7

Question	Expected Answers	Marks
1 (a) (i)	*look for these ideas* *if ethanol added first* yeast in all tubes would be exposed to, 100% / pure, ethanol ; **A** AW / ora the yeast in all the tubes would be treated in the same way ; kills all the yeast / AW ; **A** 'denatures enzymes' **R** 'denatures yeast'	1 max
(ii)	*idea of* colour comparison (with samples from tubes 1 to 6) ; shows starting pH / AW ; shows that pH of glucose solution not responsible for decrease / AW ; **R** 'as a control' alone	1 max
(b) (i)	difficult to read position of plunger on the scale / AW ; marks too far apart / insufficient gradations (on the barrel) / AW ; air bubbles ; cannot read a meniscus (as is possible in a graduated pipette) ; *idea that* wide barrel reduces accuracy (compared with narrow tube of pipette) ; ref to friction between plunger and barrel / AW ; AVP ;	2 max
(ii)	remove / no, air bubbles ; filled and refilled syringe / 'pumped' the plunger several times / AW ; inverted and flicked syringe ; nozzle held below liquid level ; held syringe in front of eyes to read the scale / AW ; used smaller syringe for smaller volume ; wet the syringe plunger ; AVP ;	2 max
(iii)	burette / graduated pipette / description / drawing ; **A** volumetric / bulb pipette **R** 'biuret'	1
(c)	table format ; **R** split tables pH at one minute and at seven minutes (**A** other times) given in table headings ; concentration of ethanol in first column ; *ignore tube numbers* ethanol concentrations adjusted for dilution effect (i.e. half those given) ; two sets of results recorded (for one minute and seven minutes) ; pH values recorded ; pH in tube 1 lower than pH in tube 5 at 7 minutes ;	7
(d)	*for any of tubes 1 to 4* **1** bubbles / effervescence ; **2** froth / foam / scum / 'head' ; **3** cloudy / turbid / opaque / AW ; *for tubes 5 or 6* **4** yeast at bottom of tube / sediment ; **5** no, bubbles / froth / turbidity ; **A** clear / not cloudy **6** measurement of froth / relative heights of froth / comparative colour comment ;	4 max

(e) *accept other colours for blue, such as turquoise / purple / mauve*

source of yeast cells	colour of yeast cells
boiled yeast	(all) blue **;**
suspension from boiling tube **1**	(most) colourless / yellow **;** **A** <u>some</u> are blue **A** clear / white
suspension from boiling tube **6**	(all) blue **;**

3

(f) dissolves / acts as a solvent **;** **R** 'makes smaller molecules' **1**

(g) *results from **(c)***

1 (yeast cells) respire (if alive) / ora **;** ref to tubes 1 to 4/5 **A** ferments
2 produce carbon dioxide **;**
3 ref to coming out of solution **;**
4 carbon dioxide, dissolves in water / reacts with water **;**
5 forms carbonic acid **;**
6 (carbonic acid) dissociates to form, H^+ / AW **;**
7 lowers pH / increases $[H^+]$ / makes solution more acidic **;**

8 ref to observations in **(d)** **;** e.g. forms bubbles

9 yeast cells in tube 6 (**A** tube 5) are dead **;**
10 pH has not decreased **;**
11 no carbon dioxide produced **;**

12 ref to concentration of ethanol that yeast can tolerate / ora **;**

*results from **(e)***

13 all cells are dead in 'boiled yeast' sample / boiling kills yeast **;**
A not respiring / enzymes denatured **R** 'yeast cells are denatured'
14 blue = dead / white (AW) = alive **;** **A** not respiring / respiring
15 living cells, pump out / decolourise, methylene blue **;** *ora*
16 many alive / some dead, in suspension from tube 1 **;**

17 boiling destroys / ethanol dissolves, (cell) membranes **;**
18 mitochondria do not function **;**

19 AVP **;** e.g. end-product inhibition **8 max**

(h) *Question asks for steps 1 to 8* ***only***
improvement must match limitation – label ticks with appropriate numbers
if in doubt about limitation, read the improvement and if OK it is likely that a mark can be awarded for the limitation

	limitation	*improvement*
1	no control **;**	use, water / dead *or* boiled yeast **;**
2	temperature not kept constant / ref to temperatures recorded in steps 4 and 9 **;**	keep suspensions in a thermostatically-controlled water bath **;** **A** monitor temperature and add hot water **R** electronic water bath
3	results not taken at exactly, one min / seven min for each tube **;**	make up each mixture separately / use a staggered start / AW **;**
4	not reliable / no repeats / no replicates / not sure whether any single result is anomalous **;** **A** 'not enough repeats'	repeat at least **twice** / do minimum of three replicates **;**
5	limited number of concentrations within range **;**	do, more intermediates / any one named intermediate **;**
6	no idea which is the highest concentration that yeast can tolerate **;**	use more concentrations between 50 (25)% and 100 (50)% **;**
7	yeast only exposed to ethanol solutions for seven minutes **;**	expose yeast to solutions for, > 7 minutes / different lengths of time **;**
8	difficult to, estimate / determine, pH with universal indicator **;** **A** ref to colour chart	use, pH meter / pH probe (and data logger) **;** **A** use standards
9	yeast sediments during the experiment (so less glucose available) **;** **A** inadequate mixing	stir at intervals / use a magnetic stirrer **;**
10	yeast exposed to ethanol / glucose for different lengths of time (due to setting up) **;**	set up each tube individually / use staggered start **;**
11	temperature of the water bath is not temperature of the yeast **;**	take temperature of yeast suspensions **;**
12	AVP **;** e.g. contamination with glass rod / pipettes	AVP **;** *must be linked to limitation*

8 max

[Total: 30]

Question		Expected Answers	Marks
2	(a)	cilia, beat / move / waft / sweep / AW ; in coordinated fashion / described ; **A** metachronal rhythm / wave-like manner ref to (sliding) microtubules ; use, energy / ATP ; **A** ref to mitochondria AVP ;	**3 max**
	(b)	*max 2 if cell wall* (cell membrane) engulfs / indents / invaginates / AW ; **A** 'folds in' / 'forms cup' (cell) membrane fuses ; **A** 'pinches' to form, (food) vacuole / vesicle ; endocytosis / bulk transport ;	**3 max**
	(c) (i)	lysosomes ; *treat vesicles as neutral* **R** lysozyme	**1**
		produced in the Golgi (body / apparatus) ; 'pinch off' from the Golgi ; AVP ; **A** any reference to manufacture of enzymes on, RER / ribosomes **A** transcription **A** translation **A** protein synthesis *ecf* *if ribosome*: nucleolus ; rRNA + protein ; moves to (R)ER ; *if enzyme*: ribosome ; in cytosol / on ER ; translation / described ; *if chloroplast / mitochondria*: self-replication / described ;	**2 max**
	(ii)	contain enzymes ; hydrolytic ; e.g. protease / carbohydrase / nuclease / lipase ; breaks named bond ; e.g. glycosidic, peptide, ester, phosphodiester **R** covalent named chemical change ; e.g. protein → peptides / amino acids ; breaks down cell wall ; AVP ;	**4 max**
	(d)	*either* remove / transport / distribute / AW (through cell / organism / cytoplasm) ; digested materials / named digested material(s) ; **A** nutrients for diffusion (of products of digestion into cytosol / cytoplasm) ; large surface area (in context of absorption) ; AVP ; e.g. <u>before</u> removal of waste (by exocytosis) storage **R** exocytosis of small vacuoles *or* vacuoles move towards surface ; exocytosis ; removal of waste ;	**2max**

(e) can use, time lapse / video **;**
continuous record / can see all stages **;**
observer does not need to be looking at, cells / tissue, constantly **;**
not dependent on ability of observer to describe, colours / changes **;**
permanent image(s) **;**
easier to see detailed / can enlarge image **;**
can identify cell structures involved **;**
ref to image being still and not moving **;**
AVP **;** e.g. more people can view image / easily transferred (e-mail, etc)
for future reference **max 3**

[Total: 14]

Mark Scheme 2804
June 2007

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   con = contradiction (in cases where candidates contradict themselves in the same response)
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5. In cases where candidates are required to give a specific number of answers, (e.g. 'give three reasons'), mark the first answer(s) given up to the total number required. Strike through the remainder. In specific cases where this rule cannot be applied, the exact procedure to be used is given in the mark scheme.

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Abbreviations, annotations and conventions used in the Mark Scheme	/ = alternative and acceptable answers for the same marking point ; = separates marking points NOT = answers which are not worthy of credit ( ) = words which are not essential to gain credit ____ = (underlining) key words which **must** be used to gain credit ecf = error carried forward AW = alternative wording ora = or reverse argument

Question	Expected Answers	Marks
1 (a)	idea of soil development ; **A** ref to depth or fertility of soil (increase), organic material / humus ; (increase) in availability of water ; minerals available ; **A** nutrients (some pioneer species) carry out nitrogen fixation ; photosynthesis (fixing carbon) ; create habitats / provide shelter ; AVP ; e.g. increase weathering, stabilise sand / soil	**2 max**
(b) (i)	producers / plants / organisms / species, become larger ; increased number of, plants / organisms / species ; more, humus / organic material ; more / deeper, soil ; more, moisture / mineral ions ; ref to plateau being the climax (community) ;	**2 max**
(ii)	less bare soil / more plants ; **A** plants larger more, photosynthesis / light absorption ; (plateau) ref to maximum, photosynthesis / light absorption ;	**2 max**
(iii)	more, habitats / niches ; (dip) reference to competition ; (plateau) climax (community) reached ;	**2 max**
(c) (i)	final stage in succession / AW ; (community) in equilibrium with environment ;	**1 max**
(ii)	eat / trample, seedlings (of shrubs / trees) / AW ; **R** eat grass prevents, succession / establishment of next sere ;	**1 max**
(d)	*award two marks if correct answer (18.4) is given* *incorrect answer (or no answer) but correct working = 1 mark* 44 / 239 (x 100) 18.4% ; ; *ecf applied for minor addition errors +/- 2*	**2**

(e) **1** lay, tape / string, <u>across</u> path **;** **R** along the path
2 include trampled and non trampled areas in same transect **;**
3 use of quadrat **;**
4 ref to how quadrat is placed **;** **R** random
5 count number of plants / percentage cover of plants **;**
6 plot a graph **;**
7 repeat the transect **;**
8 carry out statistical test (Mann-Whitney / Spearman's rank) **;**
9 AVP **;** e.g. detail of sampling technique **5 max**

[Total: 17]

Question			Expected Answers	Marks
2	(a)	(i)	light intensity ;	1
		(ii)	some other factor becomes limiting ; carbon dioxide or temperature (linked to point 1) ;	2
	(b)	(i)	(experiment) 1 ;	1
		(ii)	if increase temp (from 15°C to 25°C) rate increases ; if increase carbon dioxide concentration (from 0.04% to 0.4%) rate increases ;	2
	(c)	1	denaturing of enzyme ;	
		2	change in shape of active site ;	
		3	named photosynthetic enzyme ;	
		4	less photolysis ;	
		5	less ATP produced ;	
		6	named step in Calvin cycle which is affected ; **A** step described	
		7	increase in rate of respiration ;	
		8	respiration occurring at faster rate than photosynthesis ;	
		9	temperature compensation point ;	
		10	increased rate of transpiration ;	
		11	stomatal closure ;	
		12	less carbon dioxide uptake ;	
		13	AVP ; e.g. ref to photorespiration	4 max
	(d)	1	less reflection of light ;	
		2	less transmission of light ;	
		3	more light absorbed ;	
		4	more, wavelengths absorbed ; **A** colours of light	
		5	more, ATP / red NADP, formed ;	
		6	increases temperature of leaf ;	
		7	enzymes work more efficiently ;	
		8	light intensity / temperature, being limiting ;	3 max

[Total: 13]

Question		Expected Answers	Marks
3	(a)	*accept labelled sketch diagram for marking points below*	
		nitrogenous base / purine **;** adenine **;** pentose / 5 carbon, sugar **;** ribose **;** three, phosphate groups / Pi **;** **R** phosphate molecule phosphorylated nucleotide **;**	
		A adenosine as an alternative to adenine **plus** ribose	**4 max**
	(b)	biosynthesis / anabolism **;** protein synthesis **;** DNA replication **;** glycolysis (initial step) **;** muscle contraction **;** cell division **;** cilia beating **;** active transport **;** electrical conduction **;** movement within cells **;** e.g. of synaptic vesicles exocytosis / secretion **;**	**3 max**
	(c) (i)	ATP synthase / ATP synthetase **;** **A** ATP ase	**1**
	(ii)	*mark first three answers only* cyclic photophosphorylation **;** non-cyclic photophosphorylation **;** **A** cyclic and non cyclic for one mark *penalise lack of photo once only* chemiosmosis **;** oxidative (phosphorylation) **;** substrate level (phosphorylation) / named reaction **;** *photophosphorylation - one mark*	**3 max**

(d) **1** NAD / FAD, involved in <u>respiration</u> **;**
2 associated with, dehydrogenase enzymes / dehydrogenation **;**
3 2 molecules of NAD (reduced) in glycolysis **;**
4 link reaction producing 1 molecule of NAD (reduced) **;**
5 Krebs cycle produces 3 NAD (reduced) (per turn of cycle) **;**
6 detail of any one step in respiration where NAD (reduced) is produced **;**
7 Krebs cycle produces 1 FAD (reduced) (per turn of cycle) **;**
8 carriers / transfers, hydrogen to, inner mitochondrial membrane / cristae / cytochromes / ETC **;**
9 mitochondrial shuttle (bringing NAD reduced from glycolysis into matrix) **;**

10 NADP involved in <u>photosynthesis</u> **;**
11 produced in non-cyclic (photo)phosphorylation **;**
12 hydrogen comes from, water / photolysis **;**
13 (used in) Calvin cycle / light independent stage **;**
14 GP to TP step **;**
15 AVP **;** e.g. NADP involved in transporting hydrogen from grana to stroma
16 AVP **;** e.g. hydrogen split into electrons and protons at ETC

credit annotated diagrams **7 max**

QWC – clear, well organised using specialist terms ; **1**
award QWC mark if three of the following are used

photophosphorylation	cristae
glycolysis	photolysis
Calvin cycle	link reaction
Krebs cycle	dehydrogenase / dehydrogenation

[Total: 19]

Question			Expected Answers	Marks
4	(a)		*chinchilla* – $C^{Ch}C^{Ch}$ $C^{Ch}C^{H}$ $C^{Ch}C^{a}$;	
			agouti – $C^{A}C^{A}$ $C^{A}C^{Ch}$ $C^{A}C^{H}$ $C^{A}C^{a}$;	**2**
	(b)	**(i)**	test cross ; **A** back cross	**1**
		(ii)	Himalayan rabbit either $C^{H}C^{H}$ or $C^{H}C^{a}$; **A** *correctly derived gametes in genetic diagram*	
			albino rabbit must be $C^{a}C^{a}$; albino offspring produced if Himalayan rabbit is heterozygous / ora ;	
			if genetic diagrams given with no annotations max 2	**3**
	(c)		*max 3 from points 1 to 5*	
		1	limited, food supply / space ;	
		2	competition ;	
		3	predation ;	
		4	disease ;	
		5	reached carrying capacity / death rate = birth rate ;	
			marking points 1 – 5 linked to keeping population stable	
		6	individuals show variation ;	
		7	variation due to, combination of alleles / mutations ;	
		8	best adapted survive / ora ; **A** *survival of fittest idea*	
		9	reproduce ;	
		10	pass alleles to offspring ;	
		11	frequency of favourable alleles will, increase / be maintained ; **A** ora	**5 max**
				[Total: 11]

Question	Expected Answers	Marks
5 (a)	light / daylength ; gravity ; water / humidity ; touch ; chemicals ; **R** carbon dioxide temperature ; **A** heat	**3 max**
(b)	in solution ; **A** symplast / apoplast diffusion ; active transport ; (mass flow) in, xylem / phloem ;	**2 max**
(c)	*max 5 from marking points 1 to 7* **1** gibberellins promote germination ; **2** produced by embryo ; **3** stimulates production of enzymes ; **4** by aleurone layer ; **5** ref to amylase ; **6** breakdown of starch to, maltose / glucose ; **7** occurs in endosperm ; **8** GA added have larger (clear) areas than control ; **A** two comparative figures **9** ref to anomalous result from GA or control plate ; **10** ABA plate has smaller (clear) areas than control ; **A** two comparative figures **11** when both present ABA reduces effect of GA / AW ; **12** ABA inhibits germination ; **13** reduces, enzyme / amylase, production ; **14** calculation of an average (1.7, 2.0, 1.1, 1.2) ; **15** ABA prevents germination at wrong time of year ; **16** AVP ; e.g. maltose to glucose / protein synthesis.	**8 max**
	QWC – legible text with accurate spelling, punctuation and grammar ;	**1**
		[Total: 14]

Question			Expected Answers	Marks
6	(a)	(i)	wide / large, afferent arteriole ; narrow / small, efferent arteriole ; *afferent arteriole, wider / larger, than efferent arteriole – 2 marks* ref to 'bottleneck' effect / AW ; **R** *build up pressure on own* to achieve filtration ; must be greater than 6.7 kPa for filtration ;	**2 max**
		(ii)	*award two marks if correct answer (1.3) is given* *incorrect answer (or no answer) but correct working = 1 mark* 8 – (4 + 2.7) **A** *8 – 6.7* 1.3 ; ;	**2**
	(b)	(i)	(too) large / RMM greater than 69000 *or* 70000 ; to pass through <u>basement membrane</u> ;	**2**
		(ii)	<u>glomerular</u> blood pressure is greater ; proteins <u>forced</u> through ; damage to capillaries / AW ; damage to basement membrane ;	**2 max**
	(c)	**1**	<u>endothelium</u> of capillaries ;	
		2	large / many, fenestrations / gaps / holes ;	
		3	modified epithelial cells of capsule / podocytes ;	
		4	slit pores / foot-like processes ; **A** finger like	
		5	basement membrane ;	
		6	made up of, collagen / glycoproteins / molecular mesh ; *accept annotated diagrams*	**4 max**
	(d)	**1**	volume will increase ;	
		2	concentration decrease ;	
		3	(wall of), collecting duct / DCT, (relatively) impermeable to water ;	
		4	fewer water channels ; **A** aquaporins	
		5	in membrane of epithelial cells ;	
		6	less water reabsorbed (from the urine) ;	
		7	by osmosis (linked to marking point 6) ;	
		8	drinking increases liquid intake and therefore liquid loss ;	**4 max**
				[Total: 16]

Mark Scheme 2805/01
June 2007

ADVICE TO EXAMINERS ON THE ANNOTATION OF SCRIPTS

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ecf	=	error carried forward (in consequential marking)
con	=	contradiction (in cases where candidates contradict themselves in the same response)
sf	=	error in the number of significant figures

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5. In cases where candidates are required to give a specific number of answers, (e.g. 'give three reasons'), mark the first answer(s) given up to the total number required. Examiners will be expected to use their professional judgment in marking answers that contain more than the number required. Advice about specific cases will be given at the standardisation meeting.

6. Correct answers to calculations should gain full credit even if no working is shown, unless otherwise indicated in the mark scheme. (An instruction on the paper to 'Show your working' is to help candidates, who may then gain partial credit even if their final answer is not correct.)

7. Strike through all blank spaces and/or pages in order to give a clear indication that the whole of the script has been considered.

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Abbreviations, annotations and conventions used in the Mark Scheme	/	=	alternative and acceptable answers for the same marking
	;	=	point
	NOT	=	separates marking points
	R	=	answers which are not worthy of credit
	( )	=	reject
	___	=	words which are not essential to gain credit
	ecf	=	(underlining) key words which **must** be used to gain credit
	AW	=	error carried forward
	A	=	alternative wording
	ora	=	accept or reverse argument

Question			Expected Answers	Marks
1	(a)	(i)	interstitial cell / Leydig cell / spermatogonium / germinal epithelial cell / primary spermatocyte / Sertoli cell ; spermatid ; spermatogonium ; Sertoli cell ; spermatid ;	5
		(ii)	allows / controls / stimulates, spermatogenesis / maturation of sperm / AW ; in seminiferous tubules ; stimulates Sertoli cells ; inhibits, GnRH / LH ; negative feedback ; AVP ; e.g. stimulates cell, growth / division e.g. Leydig cells / interstitial cells, stimulated to secrete testosterone, by LH	3 max
	(b)		into, epididymis / vas deferens ; for storage ; up to one month ; activated / become motile ; (moved) to / through, vas deferens ; by muscular activity ; **R** urethra fluid / liquid, added ; from, seminal vesicles / prostate gland / Cowper's gland ; AVP ; e.g. further detail on motility fluid from, Sertoli cells / epithelium of epididymis	5 max
	(c)	(i)	larger sample ; longer time period ; identify / control, other variables / example of variable ; compare similar groups by, age / occupation / environment / other named variable ; measure other radiation sources ; AVP ; e.g. measure quality of sperm	2 max
		(ii)	mutation / change / damage to DNA ; (reduce) motility ; (slow down / reduce) cell division (in spermatogenesis) ; AVP ; e.g. effect on named hormone	1 max
				[Total: 16]

Question	Expected Answers	Marks
2 (a)	*tissue*	
	1 meristematic **;**	
	2 undifferentiated / totipotent / able to develop into any cell type / unspecialised **;**	
	3 (cells) can still divide / undergo mitosis **;**	
	4 virus free **;**	
	max 2	
	sterilising agent	
	5 aseptic technique **;**	
	6 prevent, growth of / contamination by, bacteria / fungi **;**	
	7 could overwhelm / grow faster than / compete with, plant tissue **;** **A** AW	
	max 2	
	cytokinins, auxins	
	8 plant growth, **regulator** / **promoter** / **hormone ;**	
	9 cytokinins stimulate, shoot / stem, growth / many branches **;**	
	10 auxins stimulate growth of, root / root hairs **;**	
	max 2	
	magnesium, nitrate ions, sucrose	
	11 magnesium for, chlorophyll / photosynthesis **;**	
	12 nitrate (ions) needed for, protein / enzyme / chlorophyll / named chemical **;**	
	13 sucrose converted to, glucose / fructose / monosaccharide **;**	
	14 used in, **respiration** / release energy **;**	
	max 3	
	15 AVP **;** e.g. further detail e.g. cytokinins stimulate cell division no vascular tissue therefore disease free	**6 max**
	QWC – clear well organised using specialist terms ;	**1**
	award QWC mark if three of the following terms are given in correct context meristematic undifferentiated totipotent mitosis aseptic contamination regulator promoter hormone chlorophyll photosynthesis respiration	

(b) (i) *assume grafting described unless told otherwise*
grows faster / AW **;**
crop / fruit, obtained sooner **;**
avoids, juvenile phase / vulnerable seedlings **;**
breeds true **;** **2 max**

(ii) *scion*
desirable / uniform, size of fruit **;**
high yield **;**
ref to (desirable) colour / taste / texture / appearance / AW **;**
R nice / good quality
disease resistance **;**
unless qualified
AVP **;** *2 max*

stock
strong / vigorous / sturdy **;**
extensive / large / good, root system **;**
suitable / uniform, size of trees **;** **A** AW
suit local soil conditions **;**
AVP **;** e.g. dwarfing effect on scion
disease resistant *2 max* **4 max**

(iii) cambium / vascular tissue, in close contact **;**
(allows) growth / joining, of vascular tissue **;**
transport of, water / solutes / named solute / PGR **;** **R** nutrients
prevent water loss **;**
prevent, infection / disease / entry of pathogens **;** **2 max**

(iv) genetically different from, scion / fruiting part **;**
idea of do not have same characteristics / named characteristic / AW **;**
idea of compete with / reduce number of, branches from / AW, scion **;**
AVP **;** e.g. stock more vigorous than scion **2 max**

[Total: 17]

Question			Expected Answers	Marks
3	(a)	(i)	chorion / chorionic villi / placenta / trophoblast / blastocyst ; **R** embryo	1
		(ii)	targets / travels to, ovary ; similar role to / takes over role of, LH ; **A** AW maintains corpus luteum ; progesterone, secreted / remains high / maintained ; prevents loss of / maintains, endometrium ; **R** thickening AVP ; e.g. inhibits / stops FSH	3 max
	(b)		small enough, to pass into filtrate / to be filtered into urine ; **A** ref to ultrafiltration relative molecular mass less than 69 000 ;	1 max
	(c)		vena cava ; pulmonary vein ; aorta ;	3
	(d)		CG acts as antigen ; move, attached to, free antibodies; attach to, immobilised antibody ; coloured particles, form line ; ref to complementary shapes ; ref to antigen, antibody complex ; AVP ; e.g. further detail of antibody structure monoclonal CG-antibody complex	4 max
				[Total: 12]

Question	Expected Answers	Marks
4 (a) (i)	*award two marks if correct answer (44) is given* *incorrect answer (or no answer) but correct working = 1 mark* 88 x 50 100 answer = 44 ; ;	2
(ii)	*temperature* increase in temperature , increases germination rate / ora / AW ; increase in temperature, increases % germination / ora / AW ; increase in temperature, increases enzyme activity ; enzymes not denatured at low temperature, so germination eventually occurs ; ref to data in support ; *two comparative data points* *max 3* *light* level of light / presence or absence of light, has no / little effect ; light not required for germination ; no photosynthesis / no chlorophyll / uses nutrient stores ; ref to data in support ; *two comparative data points* *max 3*	4 max
(iii)	water ; oxygen ;	2
(b) 1	etiolation ;	
2	chlorosis / chlorophyll / chloroplasts, not produced (without light) ;	
3	photosynthesis cannot occur ;	
4	energy reserves / food stores, used up / AW ;	
5	no / little, energy for, metabolic reactions / cell division / active transport ;	
6	gibberellins cause stem elongation ;	
7	no, xylem / supporting tissue ;	
8	AVP ; e.g. no inhibition of stem growth by light / extends to reach light less leaf expansion, ref to phytochromes, no glucose for respiration	2 max
		[Total: 10]

Question			Expected Answers	Marks
5	(a)		irreversible / AW ; increase in dry mass ; **R** change increase in cell number ;	**2 max**
	(b)		shows efficiency of growth ; compare growth of different, individuals ; compare growth at different, times during growth ; compare growth of different, species ;	**2 max**
	(c)	(i)	length / diameter / size of head / length of limb / crown to rump length ; (measured on) ultrasound (scan) ; height of fundus / height relative to position in mother / AW ; AVP ; e.g. use of electronic calipers compare with standards / repeat measurements	**2 max**
		(ii)	malnutrition / poor diet / named deficiency, in mother ; mother smoking / smoking in home / AW ; mother drinking alcohol / FAS ; disease / named disease, in mother ; poor antenatal, care / advice / education ; AVP ; e.g. genetic disease thyroxine deficiency in mother drug use any further detail	**2 max**

(d) *reject references to thyroxine*

growth hormone

G1 stimulates protein synthesis **;** **A** causes / speeds up
G2 stimulates, bone growth **;**
G3 (skeletal) muscle **;**
G4 increases cell division **;**
G5 ref. to use of fat for energy **;**
G6 AVP **;** e.g. no feedback
ref to, growth spurt / different growth rates in males and females does not affect IQ / brain development *max 3*

FSH / LH

F8 (increase in concentrations) stimulate puberty **;**
F9 secondary sexual characteristics **;**
F10 e.g. of characteristic in, male / female **;**
F11 testes / ovaries, develop **;**
F12 start of menstruation **;**
F13 FSH, promotes growth / development of, (primary) follicle **;**
F14 LH, promotes, ovulation / corpus luteum **;**
F15 ref to production of oestogen / progesterone **;** *in correct context*
F16 LH stimulates testosterone production **;** **max**
F17 (LH / FSH) stimulate spermatogenesis / AW **;** *max 5* **7**

QWC – legible text with accurate spelling, punctuation and grammar ; **1**

[Total: 16]

Question	Expected Answers	Marks
6 (a) (i)	dirty, (milking) equipment / storage tanks / human hands / washing water / faeces**;** *allow 2* bacterial infection / disease in, cow / udder **;** milk is a good medium for bacterial growth **;** AVP **;** e.g. exposure to air	**3 max**
(ii)	binary fission **;** DNA replicates **;** infolding of membrane **;** **A** mesosome each cell divides into <u>genetically</u> identical cells **;** **R** clone / same DNA / same genes new cell wall / proteins produced **;** ref to doubling time / exponential growth **;**	**3 max**
(b) (i)	*data must be relevant to practice* store, <u>at / below</u>, 4^{o}C / AW **;** figs*. comparing rates at a specific time, 4^{o}C and 15*^{o}C **;** store for, short time / process quickly / AW **;** figs. *comparing numbers at two different times* **;** measure number of bacteria during storage **;** use techniques / given technique, to limit initial number of bacteria **;**	**4 max**
(ii)	<u>viable count</u> **;** known / measured, volume **;** serial dilution **;** add to agar (in petri dish) **;** replicates / repeats **;** control without bacteria **;** <u>incubate</u> **;** count number of colonies **;** multiplication factor **;** AVP **;** e.g. use of stain, measure release of carbon dioxide, aseptic technique	**5 max**

(c) *similarities*
secreted by epithelial cells **;**
(stored) in / into lumen **;**
(production) stimulated / controlled by hormones from anterior pituitary **;**
protein synthesis involved **;**
precursors supplied by, blood / capillaries / AW **;**
AVP **;** e.g. detail of pituitary hormones (*must give both*) *max 2*

differences
thyroxine into blood /endocrine / ora **;**
milk, into milk ducts / outside body / exocrine / ora **;**
thyroxine single chemical / milk mixture of chemicals / AW **;**
thyroxine secreted through life / milk secreted only, during lactation / periodically **;**
milk only in females **;**
AVP **;**
AVP **;** e.g. thyroxine negative feedback
lactation positive feedback
lactation nervous reflex involved
thyroxine stored as precursor / thyroglobulin *max 3* **4 max**

[Total: 19]

Mark Scheme 2805/02
June 2007

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	ora	= or reverse argument

Question	Expected Answers	Marks
1 (a)	*linkage* (two or more) genes / loci, on same chromosome **;** **R** alleles do not assort independently (in meiosis) / inherited together **;** *crossing over* reciprocal exchange of portions of, chromatids / DNA **;** **A** swapping alleles between (paternal and maternal) homologous chromosomes **;** **A** bivalent in prophase I (of meiosis) **;** *max 2*	**max 3**
(b)	anthers removed (before maturity) (to produce male sterility) **;** male sterilisation **;** *genetic or, PGS / hormone* pollen transferred by hand **;** plants isolated **;** flowers bagged (before and after pollination) **;**	**max 3**
(c) (i)	**R** 'chance' alone chance fertilisation **;** chance re picking 50 offspring **;** chance re other traits affecting survival **;** AVP **;** e.g. position effect, different gene interactions affecting expression, effect of crossing over on numbers of other classes	**max 1**
(ii)	*award two marks if correct answer (16%) is given without working* recognition of recombinant classes **;** $\frac{32}{200}$ x 100 **;** =16% **;**	**max 2**

(iii)

1,2 $\frac{A\ B}{a\ b}$ x $\frac{a\ b}{a\ b}$; ; **A** (AB)(ab) x (ab)(ab)

3 both chromatids per chromosome shown ;
4 crossover shown ;

5 result of crossover shown ;

6 most / 84%, gametes $\frac{A\ B}{}$ and $\frac{a\ b}{}$ [x $\frac{a\ b}{}$] ; **A** AB and ab
7 = parental ;

8 few / 16%, gametes $\frac{A\ b}{}$ and $\frac{a\ B}{}$ [x $\frac{a\ b}{}$] ; **A** Ab and aB
9 = recombinant ;

10 ref 16 map units apart / close together ; **max 6**

[Total: 15]

Question	Expected Answers	Marks
2 (a) (i)	production of desired changes in phenotype of an organism ; selection of appropriate <u>alleles</u> / AW ; by <u>artificial selection</u> ; use as parents / mate, those showing desired phenotype (to larger degree) ;	max 2
(ii)	measure of value of individual's genotype (for breeding) ; mate with number of proven individuals ; assess phenotypes of offspring ; **R** genotypes average value ; especially useful for sex-limited traits ; **R** sex-linked e.g. sex-limited trait ;	max 4
(b)	*description* **D1** chosen male and female mated ; **D2** ref to desired characteristic / named desired characteristic ; **D3** ref to AI ; **D4** advantage of using AI ; **D5** offspring inspected and best mated ; **D6** several / many, generations ; **D7** ref to problem inbreeding ; **D8** ref to way of minimising inbreeding ; **D9** ref to heritability ; **D10** easier to select for traits with high heritability / ora ; **D11** easier to select for discontinuous variation / ora continuous variation ; **D12** ref to polygenes / additive effect ; *max 6 'describe' D marks* *explanation* **E13** selective breeding involves whole genomes ; **E14** hence other traits follow selected trait(s) ; **E15** ref to linkage ; **E16** <u>artificial selection</u> ; **E17** selection, different from natural selection / for benefit of humans ; **E18** starter population, small / not representative ; **A** founder principle *max 4 'explain' E marks* AVP either D or E mark ; e.g. ref to use of, IVF / surrogate, with reason ref to loss of alleles / genetic erosion	max 8
	QWC - legible text with accurate spelling, punctuation and grammar ;	1
		[Total: 15]

Question	Expected Answers	Marks
3 (a) (i)	cow superovulated ; treated with, hormone / FSH / named proprietary brand ; washed out of oviduct (**A** uterus) / collected from ovary ; detail washing ; detail collection ;	max 3
(ii)	ref to mitochondrial DNA ; detail ; e.g. circular / self-replicating mitochondria in cytoplasts fused with darted buffalo cell ; **A** organelle embryo has mixture of buffalo and cow mitochondria ; nuclear / chromosomal, DNA is buffalo ; ref to bacterial contamination ;	max 2
(iii)	for correct phase of cycle ; ref to synchronisation ; to prepare uterus for (implantation of) embryo ; ref to increased thickness of uterine lining ; ref to increased vascularisation of uterine lining ;	max 3
(b)	increases rate of reproduction ; does not require species' eggs ; so does not require fertile female ; does not require female for pregnancy / uses surrogate ; female not put at risk in, travel / mating / pregnancy ; successfully formed embryo can be, subdivided / cloned ; can use adult cells from all existing animals to maintain diversity ;	max 4
(c)	sperm bank ; oocytes / eggs ; *"gametes"* = 1 mark only embryos ; tissue ; zoo / reserve / game park ;	max 3
		[Total: 15]

Question	Expected Answers	Marks
4 (a) (i)	4 - 6 base pairs ; palindromic / AW ; specific sequence ;	max 2
(ii)	yes, same sticky ends / sticky ends shown ; GATC / CTAG complementary (bases) ; hydrogen bond ; A with T ; C with G ;	max 3
(iii)	two correct cuts ; G| A T T C A G A A T T T C G| A A T C C T A A |G T C T T A A A G C T T A |G	1
(b) 1	restriction enzyme to cut gene from genome ;	
2	and, plasmid / artificial chromosome / DNA of vector ;	
3	same restriction enzyme ;	
4	if cut with sticky ends then join ;	
5	if cut with blunt ends then, sticky ends / nucleotides, added ; **R** bases	
6	with C bases one end and G bases other ;	
7	requires terminal transferase ;	
8	(DNA) ligase needed to seal nicks in DNA backbone ;	
9	ref to join phosphate - sugar / adds phosphate ;	
10	DNA may be produced by reverse transcriptase ;	
11	from mRNA ;	
12	single strand made double stranded by DNA polymerase ;	
13	wanted DNA replicated by polymerase chain reaction (PCR) ;	
14	using, DNA polymerase with high optimum temperature /*Taq* polymerase ;	
15	AVP ;	max 8
	QWC - clear, well-organised answer using specialist terms ; *award QWC mark if three of the following are used* endonuclease terminal transferase reverse transcriptase (DNA) ligase DNA polymerase PCR correct use of nucleotide and base sticky ends blunt ends	1
		[Total: 15]

Question	Expected Answers	Marks
5 (a) (i)	**1** mutation **;** **2** random / spontaneous / chance / pre-existing **;** **3** natural selection **;** **4** drug / insecticide, is, selective agent / selective pressure **;** **5** resistants have selective advantage **;** **6** resistants survive / susceptibles die **;** **7** pass, allele / mutation, to offspring **;** **R** gene / resistance **8** allele frequency increases **;** **9** rapid because, multiplicative phase / short generation time / large **10** numbers offspring / many breeding sites **;**	**max 5**
(ii)	*Plasmodium* inside, liver cell / red blood cell **;** antibodies cannot reach target / cannot be detected by immune system **;** large genome **;** antigenic variation / AW **;** variation from meiosis **;** detail **;** e.g. independent assortment / crossing over parasite switches between different versions of proteins **;** ref *var* gene **;**	**max 3**
(b) (i)	*marks in pairs - one pair only* mutation **;** with lack of production **;** *examples* *in, promoter / 'on' switch **;** so not transcribed **;*** *to give premature stop codon **;** so, no useful / shortened, product **;*** *deletion **;** with loss of allele / different product **;*** *frameshift **;** so, different / no useful, mRNA / product **;*** *in initiation codon **;** so mRNA not translated **;*** *AVP mutation **;** AVP lack of production* **;**	**max 2**
(ii)	*marks in pairs - one pair only* no, membrane receptor / AW **;** so no, binding / internalisation **;** no, channel / carrier / pump **;** so lack of essential, nutrient / ion **;** do not multiply in liver **;** so not available to infect red blood cells **;** AVP protein **;** problem **;**	**max 2**
(c)	100% protection with 2 boosters **;** irrespective of dosage **;** 70% with 1 booster **;** no evidence with 50 000 whether works with one booster **;** ref to memory cells **;** needs large numbers of parasite / ref 10 000 x 3 **;** safe / will not cause disease / does not kill mice **;** might mutate back to wild type **;** can infect liver cells even if no further development **;** may need drug to remove from liver **;** data relates only to mice / may not be applicable to humans **;** AVP **;** e.g. no data comparing results with standard antigenic (AW) vaccine	**max 3**
		[Total: 15]

Question	Expected Answers	Marks
6 (a) (i)	match prevents rejection / ora ; mismatch results in immune response ; detail immune response ; e.g. antibody / cells HLA alleles code for cell surface (glyco)proteins ; = antigens ; some antigens / B / DR, cause stronger reaction than others ;	max 4
(ii)	6 (4) loci (genes) / A, B, C, DP, DQ, DR (A, B, C, D) ; each with many alleles / multiallelic series ; very large number of different combinations ; loci, linked / on chromosome 6 / inherited as haplotype (linkage group) ; match outside family rare ; needs dead donor / transplants from live donors rare / few potential donors ;	max 4
(b)	insulin is, polypeptide / protein ; (promoter), switches on transcription *or* makes gene produce, mRNA / insulin ; as blood glucose rises insulin production increases ; ref to figures with units ; only produced when needed ; ref to, homeostasis / negative feedback ;	max 3
(c)	*benefits* avoids injections / pain of injections / children's fear of injections ; mimics normal pancreatic behaviour ; more stable homeostasis / reduced highs and lows in blood sugar ; less chance, hypoglycaemia / hyperglycaemia ; less restriction on lifestyle ; no need to measure blood sugar ; AVP ; *max 3* *problems* rejection ; cells could lodge elsewhere ; may take longer to act ; AVP ; e.g. rat data may not be applicable to humans, transgene may have unforeseen effect *max 3*	max 4
		[Total: 15]

Mark Scheme 2805/03
June 2007

ADVICE TO EXAMINERS ON THE ANNOTATION OF SCRIPTS

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sf	=	error in the number of significant figures

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Abbreviations, annotations and conventions used in the Mark Scheme	/	=	alternative and acceptable answers for the same marking
	;	=	point
	NOT	=	separates marking points
	R	=	answers which are not worthy of credit
	( )	=	reject
	___	=	words which are not essential to gain credit
	ecf	=	(underlining) key words which **must** be used to gain credit
	AW	=	error carried forward
	A	=	alternative wording
	ora	=	accept or reverse argument

Question	Expected Answers	Marks
1 (a)	*accept one method*	
	pH meter ; repeated reading ; calibrated electrodes in solutions of known pH ; soil suspension / solution tested ; use of barium sulphate or calcium chloride solution ;	
	pH probe ; repeated readings ; soil depth tested the same ; calibrated electrodes in solutions of known pH ; use of barium sulphate or calcium chloride solution ;	
	use of universal indicator, solution / paper ; soil, suspension / solution, tested ; repeated readings ; use of colour chart / AW ; use of barium sulphate or calcium chloride solution ;	**max 3**
(b)	*assume answer refers to Malaysian soil unless otherwise stated*	
	soil has, higher % clay / lower % silt and sand ; more clay in soil decreases permeability AW / ora ; use of <u>comparative</u> data ; ref to, percolation / infiltration rates ; ref to, air spaces / packing of soil particles ; ref to particle size ;	**max 3**
(c)	water logged soils have less available oxygen ; (more) anaerobic respiration / less aerobic respiration ; less ATP synthesis ; less available energy for active uptake in roots ; death / lack of root hairs ; AVP ; e.g. promotion of denitrifying bacteria / AW, less available nitrate ions turned to nitrogen gas by bacteria	**max 3**

(d) *common points*
pH below 4.5 allows aluminium ions (Al^{3+}) to become more soluble **;**
reduced uptake of calcium **;**
AVP **;** e.g. effect on enzymes

plants
crown dieback / AW **;**
increased susceptibility to pests and disease **;**
prevention of nutrient uptake **;**
AVP **;** e.g. ref to effect on conifers *max 2*

interference with fish gills / mucus / respiratory stress / AW **;**
effect on homing (in salmon / fish) **;**
poor bone structure / egg thinning **;**
AVP **;** e.g. effect on reproduction rate *max 2* **max 3**

(e) differences in mineral content **;**
iron content **;**
humus content differences **;**
AVP **;** e.g. ref to origin of soil **max 1**

[Total: 13]

Question	Expected Answers	Marks
2 (a)	a species threatened with extinction / AW ; man-made or natural changes in their environment /AW ; **A** hunting and poaching numbers, reduced to a critical level / so low that reproduction affected / AW ; **A** only small numbers left	**max 2**
(b)	monitor and controls trade ; export licenses ; promotes cooperation between countries ; population monitoring /AW ; education / public awareness ; AVP ; e.g. use of scientific information to inform legal practice / AW	**max 2**
(c)	genetically isolated populations ; allopatric speciation / AW ; ref to genetic drift ; ref to, founder effect / founder population ; loss of alleles / genetic erosion / reduced gene pool / loss of genetic diversity / AW ; ref to, disease / population crash ; AVP ; e.g. ref to exposure to different selection pressures	**max 4**

(d) *captive breeding*

1 rescued / collected, animals / AW **;**
2 problems of capture e.g. stress **;**
3 exchange of animals between zoos **;**
4 exchange of, genetic resource / alleles **;**
5 gene (sperm / egg) banks **;**
6 artificial insemination / AW **;**
7 (international) database **;**
8 many animals to avoid inbreeding **;**
9 inbreeding depression **;**
10 requires biological knowledge and skills **;**
11 expensive **;**
12 AVP **;** e.g. use of other named example or conditions of captive breeding

max 5

reintroduction

13 habitats might have suffered destruction **;**
14 threat of, hunting / poaching, remains **;**
15 not able to find food / AW **;**
16 change in animal behaviour e.g. stress *or* no fear of, humans / predators **;**
17 failure to breed out of captivity **;**
18 ref to immunity to disease **;**
19 AVP **;** e.g. use of other named example **max**

max 5 **7**

QWC – clear, well organised using specialist terms ; **1**
award the QWC mark if three of the following are used in correct context and explained

gene (sperm / egg) bank
gene
inbreeding / inbreeding depression
genetic resource
alleles
stress
immunity

[Total: 16]

Question	Expected Answers	Marks
3 (a)	plot size ; soil type ; soil pH ; plant cover ; aspect / locality ; ref to temperature linked to aspect ; slope ; ref to rainfall or irrigation ; time period ; AVP ; e.g. tillage, method of cultivation, degree of compaction AVP ; e.g. previous use of land	**max 3**
(b) (i)	control plot to, compare / determine, effects of treatment ; calculate background level of nitrous oxide (N_2O) release / AW ; calculate natural level of bacterial decomposition / denitrification / AW ; *reject fair test*	**max 2**
(ii)	<u>decomposers</u> ; urine / faeces / rotting vegetation ; nitrogen fixing bacteria / nitrifying bacteria / *Rhizobium* ; ref to legumes ; existing nitrogenous compounds in the soil ; AVP ; e.g. acid rain	**max 2**
(c)	combustion of fossil fuels ; vehicle emissions / AW ; power stations / generation of electricity ; metal smelting plants / domestic waste ; lightning / electrical discharges ; natural sources e.g. forest fires / volcanoes / acid rain ;	**max 2**
(d)	(increased) global climate change ; **A** global warming e.g. named effect e.g. climatic fluctuations ; increased acid rain ; e.g. named effect e.g. effect on photosynthesis on plants ; nitrous oxide reduces ozone layer ; e.g. ref to UV light and skin cancer ; AVP ;	**max 2**
		[Total: 11]

Question			Expected Answers	Marks
4	(a)		*award two marks if correct answer (10 800) is given* *incorrect answer (or no answer) but correct working = 1 mark* 10 800 **; ;** *if answer wrong look for 30 000 x 0.36 for 1 mark*	**max 2**
	(b)	**1**	recycling of, glass / paper / metal / plastics **;**	
		2	composting / garden waste **;**	
		3	reuse of materials e.g. MDF **;**	
		4	increased kerb side collections **;**	
		5	recycling schemes / bin schemes / use of bottle banks **;**	
		6	regulations on non-recyclable rubbish collection e.g. 2 week collections **;**	
		7	ref to money for recycling / fines / rewards **;**	
		8	AVP **;** e.g. education *reject materials burnt for fuel and electricity generation*	**max 4**
	(c)		*method 1 mark* *problem 1 mark* incineration **;** release of dioxins / toxins /atmospheric pollution described / greenhouse effect / acid rain / heavy metal pollution **;** sea dumping **;** effects on food chain / effects upon fisheries / ref to PCBs / ref to plastic waste **;** fly / illegal tipping **;** pollution of water courses or soil / unsightly / expensive to remove / ref to plastic waste **;**	**max 2**

(d) *common points*

1 survey the site **;**
2 stabilise site / AW **;** e.g. ref to, mine shafts / pits
3 clearance of industrial site / AW **;**
4 ref to contaminants e.g. heavy metals / toxins **;**
5 ref to costings and timescale **;**

specific points

6 ref to landscaping / AW **;**
7 ref to, removal of steep slopes / polluted soil / reduced run off and slippage **;**
8 physical / chemical, soil improvement **;** e.g. adding top soil
9 liming for neutralising acidity **;**
10 spray, seed mix / wet wood / peat / mulch **;**
11 soils are nutrient deficient in, nitrogen / phosphate **;**
12 ref to, legumes / metal tolerant plant species **;**
13 planting of trees and shrubs / stabilise soil **;**
14 suggested final use of land e.g. recreational site / housing development / nature reserve **;**
15 AVP **;** e.g. detailed example of industrial site
16 AVP **;** e.g. extension of specific points **max 8**

QWC – legible text with accurate spelling, punctuation and grammar ; 1

[Total: 17]

Question			Expected Answers	Marks
5	(a)		total value incalculable / AW ; difficult to value tourism / services / AW ; AVP ; e.g. things we cannot account for / ecosystem changes	max 2
	(b)		open oceans make up the largest area / all others are smaller ; largest area of ecosystem will have greatest % contribution ; area so large hence less discovered / AW ; low value in each hectare but large area (many hectares) ; ref to low, productivity / biodiversity ;	max 2
	(c)		more valuable tropical hardwoods ; potential, drug / health / food, benefits ; greater species diversity ; tourist income ; ref to, oil palm / importance for agriculture ;	max 2
	(d)		fisheries / agriculture ; highly, fertile areas / productive areas ; named example of land use e.g. shellfish / oyster farming ; ref to energy transfer / food chains / upwelling ; AVP ; e.g. example of renewable energy	max 2
	(e)	1	population monitoring / AW ;	
		2	quotas ;	
		3	ref to fishing policies of, UK government / European Union ;	
		4	policing / licensing ;	
		5	fishing, restrictions / bans ;	
		6	ref to, net mesh sizes / net size ;	
		7	ref to, time at sea / seasonal fishing / breeding times ;	
		8	ref to aquaculture ;	
		9	enforcement e.g. fisheries protection vessels / fines ;	
		10	AVP ; e.g. decommissioning fishing fleets	max 5

[Total: 13]

Question			Expected Answers	Marks
6	(a)	1	establish study area either with strips and with no strips ;	
		2	(line or belt) / transect / random sampling / field walk ;	
		3	use quadrats ;	
		4	at regular intervals / random coordinates ;	
		5	appropriate size of quadrat ;	
		6	identification of plant species / ref to use of keys ;	
		7	record presence / absence ;	
		8	% frequency / % cover ;	
		9	biodiversity index e.g. Simpson's diversity index ;	
		10	Braun-Blanquet scale / ACFOR / DOMIN ;	
		11	AVP ; e.g. seed and pollen traps	max 5
	(b)		competition ; lack of water / lack of nutrients ; increased shade / reduced light intensity ; pesticide spray might not reach the crop near field edges ; fertiliser might not reach the crop near field edges ; hedgerows might house, crop pests / plant pathogens / AW ; AVP ; e.g. machinery cannot reach crop	max 3
	(c)		(loss of) beneficial organisms ; ref to, pest predators / biological control ; removal of pollinators ; (loss of) food sources / damage to food chains ; ref to named example e.g. less berries therefore less birds ; AVP ; e.g. example of predator or pollinator AVP ; e.g. loss of genetic resource	max 3
	(d)	(i)	decreased (invertebrate) food / AW ; seeds coated with pesticide eaten by birds / AW ; food chain accumulation ; concentrated in fatty tissue / fat soluble / slow to degrade ; ref to, egg shell thinning / decreased reproductive rates ; AVP ; e.g. fungicides on seed coats / food for young nestlings	max 3
		(ii)	predators might eat other food ; disease ; habitat change ; farming changes likely to affect all bird species ; accept general reference to predator prey relationship ; AVP ; e.g. detail on any of the above	max 2
	(e)		ref to competition ; e.g. more intraspecific competition for food ref to named resource ; many niches / reduced niche overlap ; (structural) adaptations e.g. beak adaptations ; ref to competitive exclusion / AW ; Gause's principle ; AVP ; e.g. any further development of one of the points above	max 4

[Total: 20]

Mark Scheme 2805/04
June 2007

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1 (a) (i)	*correct drawing on each cell, labelled = 1 mark* cell wall ; ribosome(s) ; *treat reference to size as neutral e.g. 70S / 80S* plasma / cell (surface), membrane ; **A** plasmalemma	**1 max**
(ii)	*drawings and labels should be on S. cerevisiae* nucleus / nuclear envelope ; **A** nuclear membrane nucleolus / nucleoli ; RER ; SER ; Golgi, body / apparatus / complex ; lysosome / Golgi vesicle / secretory vesicle ; mitochondrion ; vacuole ; cytoskeleton / microtubules / microfilaments ; 80S ribosomes ; **A** large(r) ribosomes	**3 max**
(iii)	*two marks for correct answer* 3 µm ; ; *one mark if image length ÷ magnification correct e.g.* (8.9 – 9.1 x 10^{-2} m) ÷ 30 000 *or if not to nearest whole number*	**2**

(b) *accept ora for all relevant points*

increased, magnification / enlargement possible **;**
idea of smaller structures seen outside of range of light microscope **;**
more detail / better clarity **;**
improved / higher, resolution / resolving power **;**
greater ability to distinguish between two close points / AW **;**
any two examples of ultrastructure seen **; ;** e.g. Golgi body

e.g. *S. cerevisiae*
nuclear envelope not nuclear membrane
nuclear pores visible
mitochondrial envelope / inner membrane / cristae
ER visible
ribosomes visible
cytoskeletal structures visible

E. coli
ribosomes visible

AVP **;** e.g. SEM shows (external) surface detail
resolution approx 1000 x greater
points closer than 0.5nm can be distinguished **5 max**

(c) **(i)** *glycogen* *any one from*
supplies C (for biosynthesis) **;**
ref energy store **;** **R** food store
ref conversion to glucose for respiration **;**

polyphosphate *any one from*
for membrane structure **;**
phospholipids **;**
nucleic acid / nucleotide / RNA / DNA structure **;**
ATP (synthesis) **;** **2 max**

(ii) *any one from*
not easily dissolved in cytoplasm **;**
makes, (more) insoluble / less soluble **;**
avoids osmotic problems **;**
easier storage / less space required **;**
AVP **;** **1 max**

(d) *synthesis / production of*
human growth hormone **;**
insulin / humulin **;**

accept other valid non-specification examples
e.g. cytokines / interleukins / interferon, epidermal growth factor, tumour necrosis factor, taxol, macrophage colony stimulating factor, relaxin, prourokinase **2 max**

[Total: 16]

Question		Expected Answers	Marks
2	(a)	1 impossible to prove that the technology is entirely safe / unforeseen consequences ;	
		2 may not always practise strict safety standards / accidental release (of genetically modified organisms) into the environment ;	
		3 genetically modified organisms may also carry dangerous genes ;	
		4 genetically modified organisms may mutate and then become harmful ;	
		5 ref possibility of exposing humans to risk of, disease / infection ;	
		6 insertion of a gene may activate harmful genes in host ;	
		7 ref to immune responses occurring (from GMOs / their products) ;	
		8 use of antibiotic resistance markers ;	
		9 may increase spread of antibiotic resistance ;	
		10 ref to, ethical / moral, objections ;	
		11 ref to one undesirable consequence of human genome project ;	
		12 disruption of ecosystems / AW ;	
		13 example of disruption ; e.g. competition with natural organisms, removal of weeds	
		14 upsets balance, new plants themselves become weeds, reduced biodiversity ;	
		15 ref to, cross pollination / gene transfer, from GM to, non-GM crops / wild relatives ;	
		16 ref to, lack of, labelling of GM foods / choice ;	
		17 ref to, changing gene pool / disrupting genetic diversity ;	
		18 AVP ;	
		19 AVP ;	
		20 AVP ; e.g. ref to decreased quality of product example of safety standard that could be compromised e.g. *should use laboratories with, filters / air flow hoods / air locks / AW* *should use weakened organisms unable to survive in natural environment* *should remove potentially harmful genes* *should kill microorganisms at end of fermentation process / use suicide genes* *accidental release from badly packed parcel sent in post* *accidental mixing of GM crops / products with non-GM* example of ethical / moral objections e.g. *use of transgenic pig (for organs, blood substitute)* *use of therapy to correct defects / cure disease may create social divide* *widening gap between those able and not able to afford GM, seeds / plants* example of unforeseen consequences that, have occurred / could occur e.g. *genetically engineered organisms destroying more than intended target* *allergies to Bt toxin* *death of non-pest insects from feeding on Bt-protected, plants / pollen* *pollination of related weed-species from, herbicide / virus / pest, resistant plants* *adenovirus used in gene therapy and fatal immune response* *monoclonal antibodies used in drug trials and near-fatal immune response*	**7 max**
		QWC – legible text with accurate spelling, punctuation and grammar ;	**1**

Question	Expected Answers	Marks
2 (b) (i)	*mixing* air / gas, bubbles / stream, mix contents / allows suspension to rise ; exhaust gases / AW, leave at the top ; suspension / culture, falls (by gravity) / more dense ; past inlet of nutrients (to mix) ; *max 2* *no stirrer* fungal mycelium / hyphae delicate / AW ; idea that quality of product may be affected ; stirrer / paddles, cause, disruption / damage ; *max 2*	**3 max**
(ii)	**X** glucose / starch / hydrolysed starch ; respiratory substrate / energy source / carbon source ; **Y** ammonia ; nitrogen source *or* for amino acid / protein / nucleic acid, production ;	**4**
(iii)	*accept relevant ora for batch* (continuous) maintains in, rapid / log / exponential / main, growth phase ; greater yield as, microorganism / fungus, is the product ; (continuous allows for) primary metabolite ; ref to maximum rate of, protein synthesis / production ; **A** idea of continuous input of nutrients and removal of, products / waste no need to sterilise in between batches / AW ;	**2 max**
(iv)	make more palatable / improve taste / improve texture ; easier to digest ; high nitrogen content / increases amount of nitrogenous waste ; **A** named e.g. (people) unable to, metabolise / break down RNA ; ref to effect on health e.g. cause gout / potentially toxic / AW ;	**1 max**
(v)	high(er) in fibre / roughage ; prevents constipation / protects against gut cancer ; low(er) in fat / no cholesterol ; low(er) calorific value ; lowers risk factor for CHD / contributes less to obesity / AW ; high(er) mineral content / biotin / vitamin B ; AVP ; e.g. low salt content **R** higher protein content	**2 max**
		[Total: 20]

Question	Expected Answers	Marks
3 (a) (i)	replicates ; improves reliability ; allows greater confidence in, experimental method / results / conclusion drawn ; gives an indication of precision (of method) ; **R** control / fair test	**2 max**
(ii)	lactose ;	**1**
(iii)	ref to need to have further confirmation / greater confidence in conclusions / AW ; other, (non-coliform) bacteria / microorganisms, may also produce gas ; (possible) lack of oxygen present in tubes / AW ; (so) *E. coli* may be respiring, as a facultative anaerobe / anaerobically ; (hence) producing acid only / not producing a gas ;	**2 max**
(iv)	*max 4 if not streak plate* ref to aseptic technique for work area ; e.g. disinfecting / sterilising, work surface use of, Bunsen / spirit burner, for updraft ref to use of inoculating loop / AW ; ref to aseptic technique with equipment ; e.g. method to sterilise loop / flame neck of tube / lift lid of Petri dish slightly inoculate / add to, edge of, dish / plate ; AW description / diagram of streaking ; ref to (partially), sealing / taping, plate ; ref to use of, synthetic / narrow spectrum, medium ; ref to incubation for suitable time and temperature ;	**5 max**
(v)	red / pink, colour ; Gram negative cells ; rod shaped ; no (endo)spores visible ;	**2**
(b)	*allow 1 mark max if another technique given with valid reason* dilution plating ; viable / living (and growing), cell count ; only living cells pathogenic ; gives indication of risk ;	**2 max**
(c)	*E. coli* / coliforms, indicator organisms / from gut ; AW indicates (drinking) water contaminated by, sewage / faeces ; so pathogens may be present *or* ref high risk of (transmissible), disease / infections ; example of disease e.g. cholera, typhoid, cryptosporidiosis, giardiasis ;	**2 max**
		[Total: 16]

Question	Expected Answers	Marks

4 (a) (i) *two marks if all correct, one mark if C and A correct*

C	A	D	B

C movement through partially permeable membrane
A binding to the recognition layer
D products pass to a transducer
B electrical signal amplified **2**

(ii) separates glucose from other blood components **;**
allows diffusion of glucose through membrane **;**
smaller molecules pass through **;** **2 max**

(iii) *if no comparison assume answer ref to biosensor*
any two valid e.g.
specific to glucose **;**
no problem with red colour of blood **;**
some can give recommended insulin doses / reminders to test **;**
portable / can test anywhere **;**
smaller sample required to test **;**
ref to, accuracy / precision **;**
rapid (results) **;**
immediately quantitative **;**
ref to safer **;** **2 max**

(b) able to attach to biological recognition layer / can be immobilised **;**
idea of, complementary to (tertiary) structure of test molecule / specific to one antigen / specific antigen binding site **;**
idea that binding can be detected **;**
idea of accuracy, as amount of binding proportional to quantity of test material **;** **2 max**

[Total: 8]

Question	Expected Answers	Marks
5 (a)	*similarities:*	
	s1 requiring host cell to replicate **;**	
	s2 recognition of / binding to / attachment to, receptors / host cell **;** AW	
	s3 ref to, integration / incorporation, into host genome **;** AW	
	s4 lysogenic / temperate / latent phases **;**	
	s5 (where) virus replicates as cell replicates **;**	
	s6 production of viral nucleic acid **;**	
	s7 production of, viral proteins / named proteins **;**	
	s8 assembly of (progeny), viruses / viral particles **;**	
	s9 release of viruses causes destruction of host cell **;**	
	s10 AVP **;** e.g. induction event causes onset of lytic cycle / AW, both use host cell components to synthesise viral products	
	max 5	
	differences – must have both to score except d5 – could score if in table allow combinations for d2 and 3	

	HIV	lambda
d1	named host cell e.g. T helper	bacterium / *E. coli* **;**
d2	ref attachment, by (glyco) protein spikes / by gp 120 / to receptors	attachment by tail, plate / pins **;** **A** fibres
d3	fusion of envelope to host membrane / endocytosis	contraction of sheath / injection **;**
d4	nucleocapsid (AW) in / uncoating	no uncoating *or* only, DNA / nucleic acid, in **;**
d5	RNA to DNA / DNA synthesized (by reverse transcriptase)	(*viral DNA already present*)
d6	no circularisation / linear DNA integrates	circularises and integrates **;**
d7	provirus	prophage **;**
d8	viral <u>RNA (copies produced)</u>	viral <u>DNA</u> (copies produced)
d9	leaves host by budding / AW	leaves by lysis / production of lysozyme **;**
d10	enveloped	not enveloped **;**
d11	AVP	AVP **;**

max 5 **8 max**

QWC – clear, well organised, using specialist terms **1**

award QWC mark if three of the following are used
receptors, integrates(ion), lysogenic / latent / temperate, lytic / lysis, glycoprotein, tail, plate / pins / fibres, endocytosis, nucleocapsid, core, capsid, sheath, uncoating, reverse transcriptase, provirus / prophage, circularises(ation), lysozyme, envelope, budding

(b) mutation (of tumour suppressor gene / proto-oncogene) **;**
any ref to mode of action that leads to mutation **;** e.g. addition of viral DNA, action by cell to destroy virus
tumour suppressor gene, no longer expressed / inactivated **;** AW
proto-oncogene, unregulated / uncontrolled / becomes an oncogene / leads to potentially cancerous cell **;** AW
(virus may then) act as an environmental stimulant **;**
to convert dormant cell into transformed **;** AW

interferes with normal cell processes **;**

virus has oncogene (that enters with it) **;**
growth proteins / enzymes synthesised **;**

weakens immune system / T cell reduction / AW **;**
(so) cancer cells not destroyed **;**

uncontrolled growth / division / mitosis, leads to cancer **;**
AVP **;** e.g. other consequence of weakened immune system, viral oncogene inserts into cell's genome **3 max**

(c) bacteria, destroyed / damaged / numbers reduce **;**
ref to named bacterium infected, e.g. *Lactobacillus* / *Streptococcus* **;**
alteration to, taste / flavour **;**
pH does not decrease sufficiently *or* no, lactic acid / methanoic acid, produced **;**
thickening does not occur **;**
invasion / contamination, by other, microorganisms / bacteria **;**
ref to, stopping production / discarding batch **;**
ref to increased costs involved in dealing with problem **;** **3 max**

(d) *HIV*
reverse transcriptase enzyme **;**
to produce (c)DNA / gene, from mRNA **;**
ref reason for obtaining gene in this way e.g. cDNA lacks introns, host bacteria do not recognise introns **;**

or

lambda
packages (desired) gene during assembly **;**
injects host cell with (desired) gene **;**
acts as a vector **;** **2 max**

[Total: 17]

Question	Expected Answers	Marks
6 (a) (i)	proteins / polypeptides ; polysaccharides / oligosaccharides ; **A** named examples lipids / fats / oils / triglycerides ; nucleic acids / DNA / RNA ;	**2**
(ii)	hydrolysis ;	**1**
(iii)	*Acetobacter / Methanobacterium / Methanobacillus / Methanococcus / Methanothrix* **/** any other valid example ;	**1 max**
(b)	burning may contribute less to, greenhouse effect / global warming / AW ; can use waste (organic) matter / helps to overcome problems with waste ; cheaper, qualified e.g. less labour intensive ; ref to faster process ; can be liquefied and used to power e.g. farm machinery ; AVP ;	**2 max**
(c)	*accept ora* *digester 1 (stainless steel)* non-corrosive / long lasting / AW ; strong to resist pressure build-up / AW ; (water jacket, so) able to maintain a constant temperature / prevent overheating / insulate ; easy to add waste ; easy to move to new locations ; easy to, repair / modify ; AVP ; *digester 2 (plastic)* cheaper material ; (thick plastic) may resist pressure build-up ; (underground, so) less likely to undergo external temperature fluctuations ; (underground, so) better protection from explosions ; (underground, so) better protection from smells ; inlet pipe maintains anaerobic conditions ; AVP ;	**3 max**

(d) *any acceptable reason with any relevant explanation – examples below*

amount of organic matter **;**
example, e.g. insufficient and rate of gas production low / sufficient so rate of production at optimum / each stage occurs at high rate / too much and acid production causes pH to become too low **;**

length of time the mixture remains in the digester **;**
e.g. insufficient so anaerobic digestion incomplete **;**

composition of digester mixture **;**
example, e.g. different quantities / proportions will give different rates of products / different proportions of products for next stages / different rates of growth of bacteria **;**

temperature **;**
example, e.g. too low and rate of metabolism low/ too high destroys organisms / denatures enzymes / optimum / 35^{o}C maximum rate of production **;**

when / how often mixture added to digester **;**
example, e.g. operated as a batch digester finite gas production / added at intervals may increase quality of production **;**

difference in amount of anaerobic digestion occurring / oxygen introduced into digester **;**
example, e.g. digester design may have introduced too much air when mixture added **;**

pH too acidic **;**
methane-forming bacteria less productive **;** **4 max**

[Total: 13]

Mark Scheme 2805/05
June 2007

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	ecf	=	(underlining) key words which **must** be used to gain credit
	AW	=	error carried forward
	A	=	alternative wording
	ora	=	accept or reverse argument

Question	Expected Answers	Marks
1 (a) (i)	**A** cartilage **;**	
	B synovial fluid **;**	**2**
(ii)	reduces friction / stops bones rubbing together **;** **R** no friction shock absorber / cushions bone **;** keeps (joint) lubricated / AW **;** (fluid) provides nutrients to, chondrocytes / cartilage **;** **A** cells	**3 max**
(b)	*if no country given, mark to max 2* *(UK/Germany/Sweden)* higher percentage of women, women at greater risk **;** less, calcium in diet / uptake **;** less vitamin D in diet **;** less sunlight (on skin) **;** less vitamin C in diet **;** more slimming diets **;** less load bearing exercise **;** more likely to fall (qualified) **;** too much vitamin A **;** genetic predisposition to weak bones **;** AVP **;** e.g. less HRT offered, less screening, ref to age of population *accept ora for France / Spain*	**3 max**

(c) **(i)** reduce risk of infection **;** **R** no infection
do not need donor **;**
no rejection / no need for anti-rejection drugs / no immune response **;**
AVP **;** e.g. no need to tissue type, **2**
abundant source of fresh bone tissue **max**

(ii) **1** detail of interphase **;** e.g. protein synthesis / organelles replicated / DNA replicated / semi-conservative replication
2 mitosis **;**
3 named (bone) cells **;**
4 idea of cytokinesis **;** **3**
5 genetically identical (daughter cells produced) **;** **A** same DNA **max**

[Total: 13]

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

2 (a)

feature	*human*	*dog*
sensitivity in dim light	rods in periphery / no rods in fovea / few rods in fovea ;	many rod cells ;
acuity	many cones / has fovea ;	fewer cones / no fovea ;

for acuity only accept cones once and fovea once **4 max**

(b) hunting in packs ;
locating prey ;
avoiding predation ;
AVP ; e.g. large territory,
able to see competitors **2 max**

(c) ciliary muscle contracts ;
reduces diameter (of muscle ring) / AW ;
tension drops in suspensory ligaments / AW ; **R** relaxes **A** slackens
lens allowed to form more spherical shape / AW ;
ref to greater converging power / AW ; **3 max**

(d) **1** cone cells absorbs light ;
2 iodopsin changes form / AW ;
3 ref to three different types of cone ;
4 hyperpolarisation / –40mV to –70mV ;
5 stops releasing transmitter ;
6 bipolar / ganglion, cells ;
7 action potentials / impulses, along optic nerve ; *max 4*

8 to, visual sensory area / sensory cortex ;
9 then visual association area ;
10 ref to occipital lobe ;
11 then temporal lobe ;
12 where word is identified from memory / AW ;
13 AVP ; e.g. glutamate,
optic chiasma,
inhibitory action of transmitter **6 max**

QWC – legible text with accurate spelling, punctuation and grammar ; **1**

[Total:16]

Question			Expected Answers	Marks
3	(a)		correct labels **;** **;**	**2**
	(b)		*(HCl)* provides optimum pH for, pepsin / lipase **;** kills, bacteria / viruses / microbes, (in food) **;** **R** germs / pathogens converts pepsinogen to pepsin / activates pepsinogen **;** *max 1* *(lipase)* breaks down / digests / hydrolyses, lipids / triglycerides / fats (to fatty acids and glycerol) **;**	**2**
	(c)		secretion of mucus **;** by goblet cells **;** acts as barrier (to enzymes / acid) **;** secretion of hydrogen carbonate ions (in mucus) **;** neutralises acid **;** (therefore) pH next to stomach wall too high for enzymes to work / pepsinogen not activated / pepsin secreted in inactive form **;** acids / enzymes, only released when food is present **;**	**4 max**
	(d)	**1**	gastric juice digests, beef / protein **;**	
		2	gastric juice contains, protease / named protease **;**	
		3	no effect on cabbage **;**	
		4	cabbage mainly, cellulose / carbohydrate **;**	
		5	gastric juice does not contain <u>cellulase</u> **;**	
		6	works better at 37^{o}C than at 20^{o}C / ora **;**	
		7	comparative figs **;**	
		8	ref to optimum (temperature) / ref to kinetic energy **;**	
		9	faster (beef / protein) digestion in the stomach **;**	
		10	due to, mechanical digestion / physical digestion **;**	
		11	AVP **;** e.g. stomach provides constant supply of acids or enzymes, correct ref to gastrin	**5 max**
	(e)		*(ileum has)*	
		1	villi **;**	
		2	microvilli / brush border **;**	
		3	large surface area **;**	
		4	epithelial cells have many mitochondria **;**	
		5	(provides) energy / ATP, for, active transport / co transport **;**	
		6	network of blood capillaries (inside villi) **;**	
		7	carrier proteins / transport protein **;**	
		8	AVP **;** e.g.adsorbed enzymes, detail of lacteal, movement of villi, (good blood supply) maintains concentration gradient in villus	**4 max**

[Total: 17]

Question		Expected Answers		Marks
4	(a)	**Q** – glucagon **;** **A** adrenaline **R** – insulin **;**		**2**
	(b)	*when glucose level falls*		
	1	**Q** / glucagon, binds to receptors (on hepatocytes) **;**		
	2	ref to adrenaline **;**		
	3	ref to glycogenolysis / AW **;**		
	4	ref to gluconeogenesis / AW **;**		
	5	use of fatty acids as respiratory substrate **;**	*max 4*	
		when glucose level rises		
	6	**R** / insulin, binds to receptors (on hepatocytes) **;**		
	7	ref to glycogenesis / AW **;**		
	8	increased absorption of glucose **;**		
	9	increased use of glucose in respiration **;**		
		allow one mark for idea of hormones binding to receptors if points 1 ***and*** *6 are not already given*		**5 max**
	(c)	conversion of one amino acid to another / AW **;** (free) amino acids in body may not match body's requirements / AW **;** can only occur with non-essential amino acids **;**		**2 max**
	(d)	*ammonia*		
	1	combines with carbon dioxide **;**		
	2	to form urea **;**		
	3	using ATP **;**		
	4	ref to ornithine cycle **;**		
	5	excreted, by kidneys / in urine **;**	*3 max*	
		pyruvate		
	6	converted to triose phosphate **;**		
	7	then glucose **;** *allow point 7 only if linked to point 6*		
	8	and / or, fat **;**		
	9	converted to acetyl CoA / enters link reaction **;**		
	10	enters Krebs cycle **;**		
	11	aerobic respiration **;**	*3 max*	**5 max**
			[Total: 14]	

Question			Expected Answers	Marks
5	(a)		*chimpanzees* arboreal / AW **;** co-ordination of movement more complex / chimps perform more complicated tasks / AW **;** ora more neurones required / AW **;** ora AVP **;** e.g. hand-eye co-ordination	**2 max**
	(b)	**1**	increase in, HCO_3^- / H^+ **;**	
		2	carotid / aortic / medulla, receptors **;**	
		3	increase of frequency of impulses **;**	
		4	along, accelerator / sympathetic / phrenic, nerve **;**	
		5	to diaphragm and intercostal muscles **;**	
		6	faster breathing **;**	
		7	deeper breathing / increased tidal volume **;**	
		8	to sino-atrial node **;**	
		9	causes heart to beat faster **;**	
		10	increased stroke volume / stronger contraction **;**	
		11	more / faster, removal of carbon dioxide **;**	
		12	(blood carbon dioxide falls to) norm / set point **;**	
		13	negative feedback / homeostasis **;**	
		14	AVP **;** e.g. buffering effect of haemoglobin, ref chemoreceptors	**7 max**
			QWC – clear well organised using specialist terms ;	**1**
			award the QWC mark if three of the following are used in the correct context carotid aortic sympathetic diaphragm intercostal tidal volume sino-atrial node stroke volume negative feedback homeostasis	
	(c)	**(i)**	*award two marks if correct answer (7.6) is given* *incorrect answer (or no answer) but correct working = 1 mark* 7.6 **; ;** *ignore + / -* *accept one mark for working* e.g. $\frac{33.0 - 30.5}{33.0}$ or $\frac{30.5}{33.0}$ or $\frac{2.5}{33.0}$	**2**

continued on next page

(ii) **1** greater decline in memory when not treated with drug / ora **;**
2 greater decline in functional capacity when not treated with drug / ora **;**
3 more nursing time needed when not treated with drug / ora **;**
4 paired figs **;** *(supporting marking points 1, 2 or 3)* **3**
5 both groups continue to decline **;** **max**

[Total: 15]

Question			Expected Answers	Marks
6	(a)	(i)	red light ;	1
		(ii)	arm withdrawn (without a shock) ;	1
	(b)		**1** rat, investigates cage / tries to escape ; **2** presses lever by chance ; **3** food / reward, appears ; **4** ref to (positive) reinforcement ; **5** ref to repetition ; **6** associative learning ; **7** AVP ; e.g. trial and error	3 max
	(c)	(i)	**S** dorsal root ganglion ; **T** relay / intermediate / bipolar / internuncial, neurone ;	2
		(ii)	**1** rapid / fast acting ; **2** short lived ; **3** automatic / involuntary / no conscious thought / brain not involved ; **4** not learned / innate / genetic / inborn / instinctive ; **5** response the same each time / stereotypical ; **6** AVP ; e.g. safety / survival	3 max
		(iii)	**1** distortion / AW ; **2** Na^+, gates / channels, open ; **A** sodium / Na **3** Na^+ / sodium ions, enter ; **R** sodium / Na **4** depolarisation / –65mV to +40mV ; **5** receptor / generator, potential ; **6** ref to threshold ; **7** action potential ; *allow only if linked to idea of threshold reached*	3 max
		(iv)	neurotransmitter only, in presynaptic knob / released from presynaptic membrane ; receptors only on postsynaptic membrane ; ref to refractory period / hyperpolarisation ;	2 max
				[Total:15]

Mark Scheme 2806/01
June 2007

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Question	Expected Answers	Marks
1 (a)	snails have shell for protection **;** *ora* poison is a defence **;** bright colours for, warning / recognition by predators **;** **A** AW	**2 max**
(b)	alternative measurement **;** e.g. mass of food / frequency of visits control qualified **;** e.g. same food in different coloured rings / different food in same colour rings / swap position of rings repeats / more times **;** use, many / one, fish **;** test different <u>species</u> of fish **;** ref to taste, diffusing / dissolving / spreading **;** control variables identified, e.g. same, temperature / age fish / size fish / size rings / size food **; ;** AVP **;** e.g. different, ring colours / chemicals / types of food / >10 days	**3 max**
(c) (i)	ref to fish learning **;** shared pattern minimises fish attacks / AW **;**	**2**
(ii)	**1** <u>natural selection</u> **;** **2** predation (by fish) is selective agent **;** **A** AW (e.g. white ones get eaten) *ora* **3** random / spontaneous / chance, mutation **;** **4** in gene qualified **;** e.g. for red spots / pigment (protein) / enzyme to make pigment **5** survivors / those with red spots, reproduce **;** *ora* **6** pass on (red-spot), <u>allele</u> / <u>mutated gene</u> **;** **7** allele increases in frequency in population **;** **8** further mutations improving pattern selected for **;**	**4 max**
(d)	gains, starch / carbohydrate / sugars / lipid / protein **;** **R** food / energy for growth / metabolism / alternative food source **;** gains oxygen **;** for respiration / in low oxygen conditions **;** carbon dioxide removed (from tissues by algae) **;** ref to pH **;** AVP **;** e.g. gains, camouflage / protection / AW	**3 max**

[Total: 14]

Question			Expected Answers	Marks
2	(a)	(i)	to take account of variation / AW ; reliable or representative / smaller SD or % uncertainty ; **ignore** "accurate", "precise" so result not skewed by, anomalies / extreme or unusual results ; to ensure statistical significance ;	**2 max**
		(ii)	permanent record ; avoid, heating effect / light, of microscope lamp ; stomata size may change (under microscope) ; photograph can be enlarged ; measuring can be done at leisure ; AVP ; e.g. system or method of measuring	**2 max**
	(b)		stomata are, curved / elliptical / oval / rounded ; not rectangular ; figure obtained is too big ;	**1 max**
	(c)	(i)	**1** (rate of) transpiration / water loss, greater than (rate of) uptake ; **2** less water entering, roots / root hairs ; **3** transpiration stream less / AW ; **4** transpiration / evaporation / diffusion of water <u>vapour</u> ; **5** down water potential gradient ; **6** through, stomata / cuticle ; **7** water used for photosynthesis ; **8** solutes, remain / made ;	**4 max**
		(ii)	**1** ABA rises, at time of water stress / as leaf loses water / as water potential falls / days 3 - 6 ; **2** resistance to air flow rises, at time of water stress / as leaf loses water / as water potential falls / days 3 – 5 ; **3** correlation / positive relationship, between ABA and resistance ; **A** AW **4** correlation does not prove causal link ; **5** alternative explanation ; e.g. flaccid guard cells, alternative anti-transpirant	**2 max**

[Total: 11]

Question		Expected Answers	Marks
3	(a)	**1** <u>eutrophication</u> **;** **2** increased growth of, algae / seaweeds **;** **3** block, light / space **;** **4** ref to competition **;** **5** (so) alters food chain / example **;** **6** decomposition of, sewage / dead organisms **;** **7** ref to aerobic bacteria / increased BOD / less oxygen in water **;** **8** fish / sea slugs / sponges / corals, die **;** (linked to oxygen loss) **9** AVP **;** e.g. increased mineral nutrients increases susceptibility of corals to disease, increased numbers of anaerobic species, ref to heavy metal toxicity	**4 max**

continued on next page

(b) **1** hydrogen bonding **;**
2 detail **;** e.g. (electro)negative oxygen atom can hydrogen bond to (electro)positive H atom/ one water molecule hydrogen bonds with up to 4 others / H bonds individually weak / large collective effect of many hydrogen bonds

coral algae
3 (high) thermal stability / temperature remains fairly constant **;**
4 water has high specific heat capacity **;**
5 much energy needed to break hydrogen bonds **;**

polar bears
6 cooling allows maximum number of hydrogen bonds to form **;**
7 water molecules space out to allow this **;**
8 water expands as it freezes / ice is less dense than water **;**

mussels, filter-feeders and sessile animals
9 water is transport medium for, food particles / gametes **;**
10 (tentacles / appendages / cilia) create currents bringing food **;**
11 ref. tides / ocean currents **;**
12 medium for, male gametes to swim / external fertilisation **;**
13 no desiccation of gametes **;**
14 ref to low viscosity / AW **;**

corals
15 minerals / ions, are soluble in water **;**
16 water is polar / detail of electrostatic attraction **;** **A** AW

seaweeds, fish eyes
17 water is transparent to light **;**
18 photosynthesis possible (in shallow water) **;**
19 wavelength of light varies with depth **;**

whales, jellyfish
20 cohesion / water molecules stick to each other **;**
21 water not easily compressed **;**
22 gives support to large bodies / detail of upthrust or relative density **;**
23 acts as hydrostatic skeleton **;**
24 AVP **;** e.g. zonation / pigments
25 AVP **;** e.g. solubility of named gas linked to use in named organism **7 max**

QWC – legible text with accurate spelling, punctuation and grammar **1**

[Total: 12]

Question	Expected Answers	Marks
4 (a)	humans are eukaryotes / *Escherichia coli* is a prokaryote ;	
	humans / eukaryotes have (accept ora) larger, proteins / genes ; introns ; 'junk' DNA / non-coding DNA ; repeating sequences ; centromeres / telomeres ; fossil genes ;	
	E. coli cell much smaller ; *ora* selection for, less waste of space / more compact genome ;	**2 max**
(b)	2 μm x 10^6 ; 2 m / 2 000 mm / 2 000 000 μm ;	**2**
(c) (i)	semi-conservative replication ; DNA, polymerase / helicase ; breaks hydrogen bonds between two DNA strands / unzips DNA ; each DNA strand acts as a template / both strands copied ; complementary base-pairing (with free DNA nucleotides) ; sugar-phosphate backbone forms ;	**2 max**
(ii)	crossing-over ; in prophase ; recombination of, non-sister / maternal and paternal, DNA ; AVP ; e.g. matching cuts in DNA DNA ligase	**2 max**
(iii)	synapsis / to hold, (homologous) chromosomes / bivalent, together ; (so close enough) for crossing-over ; so can be evenly segregated ; AVP ; e.g. to package or support chromosomes, avoid DNA breaking, easier to move DNA	**2 max**

[Total: 10]

Question			Expected Answers	Marks
5	(a)	(i)	deaminase / transaminase / alcohol dehydrogenase / lactate dehydrogenase ; AVP ; e.g. respiration enzyme, catalase, lysosomal enzyme	1 max
		(ii)	chronic is long-term / acute is short-term ; chronic is slow onset / acute is rapid onset ;	2
	(b)	(i)	mRNA leaves nucleus ; *ora* mRNA, translated / used to make, protein ; DNA, transcribed / used to make, mRNA ; mRNA short-term / DNA (long-term) store ;	2 max
		(ii)	siRNA smaller / fewer nucleotides / only matches part of gene ; *ora* siRNA double-stranded ; *ora*	2
	(c)		(complementary) base-pairing ; hydrogen bonding ; between purines and pyrimidines ; A with U ; **R** A with T C with G ; ref to 2 or 3 bonds (correct context) ;	3 max
	(d)	(i)	*(CCR5 / macrophages)* (siRNAs continue to work) in long-lived cells ; only one treatment needed for macrophages / CCR5 ; (siRNAs diluted) as lymphocytes divide ; *ora* repeat treatments needed for, lymphocytes / CD4 ;	2
		(ii)	*(CCR5)* because no essential function in body / absence not a problem ;	1

[Total: 13]

Mark Scheme 2806/03
June 2007

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6. Correct answers to calculations should gain full credit even if no working is shown, unless otherwise indicated in the mark scheme. (An instruction on the paper to 'Show your working' is to help candidates, who may then gain partial credit even if their final answer is not correct.)

7. Strike through all blank spaces and/or pages in order to give a clear indication that the whole of the script has been considered.

8. An element of professional judgement is required in the marking of any written paper, and candidates may not use the exact words that appear in the mark scheme. If the science is correct and answers the question, then the mark(s) should normally be credited. If you are in doubt about the validity of any answer, contact your Team Leader/Principal Examiner for guidance.

Abbreviations, annotations and conventions used in the Mark Scheme	/	=	alternative and acceptable answers for the same marking
	;	=	point
	NOT	=	separates marking points
	R	=	answers which are not worthy of credit
	( )	=	reject
	___	=	words which are not essential to gain credit
	ecf	=	(underlining) key words which **must** be used to gain credit
	AW	=	error carried forward
	A	=	alternative wording
	ora	=	accept or reverse argument

Planning Exercise

Marking points **A** to **U** follow the coursework mark descriptors for Skill P.

Indicate on the Plan where the marking points are met by using a tick and an appropriate letter. There are 14 marking points for aspects of the plan and two marks for quality of written communication (QWC).

Practical Test

The mark scheme for Practical Test follows on from that for the Planning Exercise.

Planning exercise

Checking Point	Descriptor	The candidate
A	P.1a	plans a suitable procedure that uses **one** continuous and **one** discontinuous variable with a suitable test, e.g. iodine test for starch / dry mass change **;** **R** if done in light as photosynthesis
B	P.1a	gives a prediction about the effect of either species of plant or nature of sugar **and** size of leaf disc or concentration of sugar on rate of starch synthesis **;**
C	P.1b	chooses suitable materials and equipment (applicable to **their** method), e.g. apparatus to cut leaf samples / timer / apparatus for starch test on leaf (iodine / ethanol) / apparatus for dry mass estimation **;**
D	P.3a	describes mechanism of starch production, e.g. condensation / glycosidic bonds / amylose / amylopectin **;** **A** from diagram
E	P.3a	identifies at least **two** other key factors to control or take account of, e.g. part of leaf used for discs / volume of sugar solutions / time (hours) allowed for reaction / light intensity (no light or control of ambient light) / temperature **;**
F	P.3b	uses appropriate timescale – hours / days **;**
G	P.3b	decides on range of measurements to take – minimum of **two** different, species / sugars and **five** different, disc sizes / concentrations **;**
H	P.3b	describes ways of obtaining reliable results by including replicates – minimum of **three** measurements for each step in the range of each variable chosen **;**
I	P. 5a	uses appropriate scientific knowledge and understanding in developing plan, e.g. explains need for conversion of maltose / sucrose to glucose for starch synthesis, explains that photophosphorylation provides ATP for starch synthesis in chloroplasts in the light so exp must be kept in dark, mechanism of removing starch when leaf in dark **;**
J	P.5a	**uses** information / results from **one** source, e.g. written / electronic / practical **;** *must be referenced in the text*
K	P.5a	refers to safety aspect (hazard **and** precaution), e.g. alcohol flammable so switching off heat source **;**
*L**	*P.*	*gives a clear account, logically presented with accurate use of scientific vocabulary (QWC)* **;**
M	P.5b	**describes** a way of producing precise results, e.g. ref to measuring volumes accurately / accuracy of balance to 0.01g / use of colour comparator **;**
N	P.7a	**uses** information / results from a **second** identified source, e.g. written / electronic / practical **;** *must be referenced in the text*
O	P7a	shows how data are to be presented in the form of a table / tables with correct headings and units (time taken for starch synthesis / rate for both chosen variables) **;**
P	P.7a	uses appropriate scientific knowledge and understanding in developing plan, e.g. enzyme specificity / transport of sugars into cells / differences in leaf structure of different species / ref to phosphorylation of glucose / glucose units linked to form starch by starch synthases / formation of side branches by changing 1,4 bonds to 1,6 bonds / relates chemical structure of sugars to their method **;**

*Q**	*P.7a*	*uses spelling, punctuation and grammar correctly (QWC)* **;**
R	P.7a	explains / shows how data are to be illustrated in **one** graph i.e. all species / sugars on one graph: *x* axis = size of leaf disc / concentration of sugar, *y* axis = rate **;**
S	P.7a	shows how rates would be calculated, e.g. 1000/t / gradients from graph **;**
T	P.7b	shows how rates will be compared quantitatively, e.g. use of stats (e.g. *t* test) to test significance **;**
U	P.7b	comments on how precision could be improved, e.g. by referring to how and why colour comparator is used to identify when starch is synthesised or judge end point / difficulty in obtaining accurate results from very small dry masses **;**
V	P.7b	comments on validity, e.g. by identifying variables that cannot be controlled – thickness of cut edge of discs / test for starch is not quantitative / effect of ambient light / discs with stomata uppermost / osmotic effect of high sugar concentrations **;**

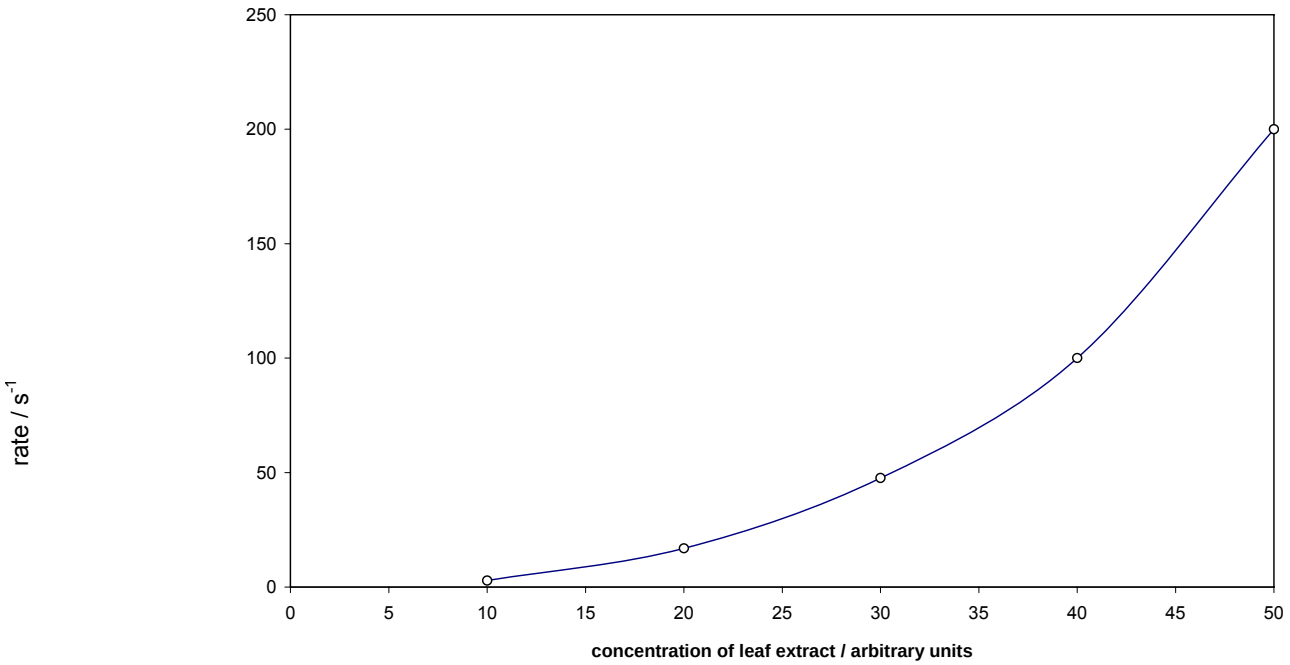
Point mark up to **14** by placing letters A to V, **excluding L and Q**, in the margin at appropriate points. Then award **1** mark for each of **L** and **Q** (QWC).

[Total: 16 max]

Sample results for Q.1 (a)

tube	leaf extract concentration / %	time / s	rate / s^{-1}
A	50	5	41.6
B	40	10	24.4
C	30	21	14.1
D	20	59	2.0
E	10	351	0.0

Sample graph for Q.1 (b)



Question	Expected Answers	Marks
1 (a)	results in the form of a table with concentration of leaf extract in first or second column **;** informative column headings (concentration of leaf extract / time / rate) **;** appropriate units (au / min/s / s^{-1}) in column headings **;** time recorded in seconds **;** all rates calculated correctly to at least 1 d.p. **;** results show correct trend **;**	**6**
(b)	axes round right way (*x* axis = concentration of leaf extract, *y* axis = rate/time) **;** axes scaled with ascending scale starting at 0,0 **;** axes with correct titles and units **;** points accurately plotted **;** points joined, clearly / neatly, by straight lines (unless conform to line/curve of best fit) showing (exponential) curve **;**	**5**
(c)	decreasing time / increasing rate, with increasing concentration of leaf extract **;** *ora* suitable, comment / description, of own results **;** e.g. linear / exponential / sigmoid / correct ref to their own data *linked to* photolysis **;** concentration of, pigments / chlorophylls **;** ref to <u>NADP</u> as, hydrogen / H / H^+, acceptor **;** density of, thylakoids / grana **;** **A** number concentration / number, of chloroplasts **;**	**5 max**
(d) (i)	**R** *first ref to cells* (sucrose solution) same, water / solute, potential ; as stroma ; (to) stop, envelope / chloroplasts, bursting ; **A** ora by osmosis / prevent osmotic damage ; **A** ora – but must be good, detailed explanation sucrose concentration is a variable that needs to be controlled ; AVP ;	**4 max**
(ii)	**R** *first ref to cells* chloroplasts, burst / rupture **;** thylakoids exposed to potassium manganate **;** (so solution) discoloured more quickly **;** **A** faster reaction	**2 max**

(e) sucrose solution with acid and potassium manganate VII **;**
to show leaf extract necessary for colour change **;**

leaf extract (and sucrose) with potassium manganate VII **;**
to show acid needed for colour change **;**

leaf extract (and sucrose) with acid and potassium manganate VII in dark **;**
to show light necessary for colour change **;** **4 max**

(f) *limitations **discussed***
reject refs to contamination / bad technique throughout

1 measuring volumes using syringes due to e.g. air bubbles / sticky plungers **;**
2 temperature not controlled / heating effect of bulb, so e.g. rate of reaction may increase due to increased enzyme action **;**
3 light intensity not controlled so rate (of photosynthesis) may fluctuate **;**
4 judging colour changes is subjective / AW **;**
5 judging colour change consistently **;** e.g. ref to colour may change over time
6 no repeats so no way of, identifying anomalies / assessing accuracy of results **;**
7 pH increase as carbon dioxide used up so electron carriers affected **;**
8 variable concentration of (chloroplasts in) leaf extract due to sedimentation **;**
9 insufficient readings within range / AW, so graph less accurate / AW**;**
10 AVP **;**

*improvements **suggested***
11 use, graduated pipette / burette, to measure volumes correctly **;**
12 use, heat screen / thermostatically-controlled water bath **;**
13 way to control light intensity **;** e.g. light box / darkened room with single light source
14 use colorimeter (to judge end points) / use colour comparator **;**
15 use of standard in colorimeter to define end point **;**
16 perform two or more repeats and calculate means **;**
17 use buffers to control pH **;**
18 stir leaf extract before removing sample **;**
19 take more readings within range / AW **;**
20 AVP **;** e.g. use a data logger **8 max**

[Total: 28 max]

Question	Expected Answers	Marks

2 (a) (i) results recorded for 3 counts of each of X, Y and Z **;**
correct calculation of mean % for X **;**
results show expected trend (more stomata open in X than in Y or Z) **;** **3**

(ii) *credit correct explanations of candidate's own results for results with open stomata (ora for closed) – award only once wherever found*

open stomata

1 channels in guard cell membranes are selective **;**
2 entry of K^+ / potassium ions,reduces water potential **;** **R** K / potassium
3 water enters by osmosis **;**
4 down water potential gradient **;**
5 making (guard) cells turgid **;**
6 opening stomata **;**

if (own) data is anomalous

7 ref to anomalous data **;** e.g. Z similar results to X
8 explanation for anomalous data **;**
e.g. reason why, acid / H^+, not having an effect
9 AVP **;**

result with most stomata open (X or Z)

10 (relatively) high concentration of, K^+ / potassium ions, outside cells **;**
R K / potassium
11 K^+ moves into guard cells **;**
12 by diffusion **;**

result in Y

13 (relatively) high concentration of, Na^+ / sodium ions, outside cells **;**
R Na / sodium
14 Na^+ enters guard cells slowly / Na^+ does not enter guard cells **;**
15 AVP **;** e.g. acts as competitive inhibitor with K^+

result in Z

16 (relatively) high concentration of, H^+ / hydrogen ions, outside cells **;**
17 slows down / prevents removal of, H^+ / hydrogen ions, from guard cells **;**
18 no $[H^+]$ gradient **;**
19 low pH affecting enzymes **;**
20 distortion of active site / denaturation / AW **;**
21 respiration reduced **;**
22 therefore less ATP available for active transport **;** **8 max**

(iii) chloroplasts carry out light-dependent stage **;**
producing ATP **;**
(by) photophosphorylation **;** **R** phosphorylation
ATP, hydrolysed / provides energy, for removal of H^+ **;**
A ref to photolysis providing H^+ **3**

(b) *ignore labelling*

clear continuous lines, not too feint / bold, not overlapping **;**
cellulose walls double lines **;**
correct shape of guard cells **;** (*e.g. touching with rounded ends*)
guard cells have thicker inner wall **;**
chloroplasts in guard cells and not in epidermal cells **;**
correct shape of epidermal cells **;** (*e.g. square or rectangular*)
R hexagonal / jigsaw-pieces **5 max**

[Total: 16 max]

Advanced GCE Biology (3881 / 7881)
June 2007 Assessment Series

Unit Threshold Marks

Unit		Maximum Mark	a	b	c	d	e	u	entry
2801	Raw	60	46	43	38	33	28	0	18169
	UMS	90	72	63	54	45	36	0	
2802	Raw	60	44	39	34	29	25	0	27236
	UMS	90	72	63	54	45	36	0	
2803A	Raw	120	93	82	71	60	49	0	12155
	UMS	120	96	84	72	60	48	0	
2803B	Raw	120	93	82	71	60	49	0	1055
	UMS	120	96	84	72	60	48	0	
2803C	Raw	120	92	81	71	61	51	0	14163
	UMS	120	96	84	72	60	48	0	
2804	Raw	90	60	52	45	38	31	0	10115
	UMS	90	72	63	54	45	36	0	
2805A	Raw	90	65	58	51	44	38	0	2112
	UMS	90	72	63	54	45	36	0	
2805B	Raw	90	59	51	43	36	29	0	1435
	UMS	90	72	63	54	45	36	0	
2805C	Raw	90	64	58	53	48	43	0	1005
	UMS	90	72	63	54	45	36	0	
2805D	Raw	90	58	52	46	40	34	0	985
	UMS	90	72	63	54	45	36	0	
2805E	Raw	90	67	60	54	48	42	0	9946
	UMS	90	72	63	54	45	36	0	
2806A	Raw	120	83	74	65	56	47	0	6794
	UMS	120	96	84	72	60	48	0	
2806B	Raw	120	86	74	65	56	47	0	349
	UMS	120	96	84	72	60	48	0	
2806C	Raw	120	72	62	52	43	34	0	7350
	UMS	120	96	84	72	60	48	0	

Specification Aggregation Results

Overall threshold marks in UMS (i.e. after conversion of raw marks to uniform marks)

	Maximum Mark	A	B	C	D	E	U
3881	300	240	210	180	150	120	0
7881	600	480	420	360	300	240	0

The cumulative percentage of candidates awarded each grade was as follows:

	A	B	C	D	E	U	Total Number of Candidates
3881	17.5	34.9	53.3	71.0	85.7	100.0	20388
7881	26.0	47.4	68.1	85.3	96.4	100.0	15824

3881

20388 candidates aggregated this series

7881

15824 candidates aggregated this series

For a description of how UMS marks are calculated see;
http://www.ocr.org.uk/exam_system/understand_ums.html

Statistics are correct at the time of publication

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