RECOGNISING ACHIEVEMENT

Subject: Central Concepts Code: 2804

Session: June Year: 2002

Mark Scheme

MAXIMUM MARK	90

ADVICE TO EXAMINERS ON THE ANNOTATION OF SCRIPTS

1. Please ensure that you use the **final** version of the Mark Scheme.
   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.

3. The following annotations may be used when marking. No comments should be written on scripts unless they relate directly to the mark scheme. Remember that scripts may be returned to Centres.

   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. 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.

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 ; = separates marking points NOT = answers which are not worthy of credit R = reject ( ) = words which are not essential to gain credit __ = (underlining) key words which **must** be used to gain credit ecf = error carried forward A = accept AW = alternative wording ora = or reverse argument

Question			Expected Answers	Marks
1	(a)	(i)	adenine;	1
		(ii)	ribose;	1
	(b)		produced where energy is released/ ADP + P + energy → ATP; moved around cell; breaks down to release energy where required/ ATP → ADP + P + energy; immediate source of energy; energy released in small 'packets'; rapid turnover; couples catabolic and anabolic processes; (found) in all / most, cells / all organisms; **R** energy store or high energy compound	**4 max**
	(c)		named anabolic reactions;;; **A** anabolism / anabolic reactions for 1 mark **A** glycolysis, named active transport processes;;; **A** active transport for 1 mark cell division / mitosis / meiosis; **R** growth, photosynthesis, respiration, synthesis of carbohydrates. *Mark first three points / statements only*	3
	(d)	(i)	inner (mitochondrial) membrane (plus space) / cristae / stalked particles; **R** ATPase	1

(ii)
1 reduced NAD / reduced FAD;
2 dehydrogenase enzymes;
3 remove hydrogen from coenzymes / hydrogen split into H+ and electrons;
4 electrons flow through carriers / cytochromes;
5 release energy;
6 protons pumped across membrane;
7 into intermembrane space;
8 proton gradient established / proton motive force / electrochemical gradient / pH gradient;
9 protons flood back through ATPase / ATP synthase / stalked particles;
10 formation of ATP (from ADP and Pi);
11 role of oxygen as final hydrogen acceptor;
12 chemiosmosis; **5 max**

[Total: 15]

Question	Expected Answers	Marks
2 (a)	plant gives off, oxygen / gas / air (in photosynthesis); bubbles trapped; drawn into capillary tube by syringe; length of bubble measured; after certain length of time; repeat; move lamp towards / away / set distance (from plant); use a light meter to measure intensity / light intensity proportional to $1/d^2$; let apparatus settle (at each distance); monitor temperature; darkened room / lamp only light source; ref to calculate volume of oxygen; AVP; e.g. vaseline joints, same plant, same CO_2 content of water	**6 max**
(b) (i)	*high light intensity* increases with temperature / peaks at 30 °C; Q_{10} = 2 between 10 - 30 °C; rate declines above 30 °C; any correct ref to volume figures, with units and temp;	**2 max**
	low light intensity no increase as temp increases; decreases above 30 °C; any correct ref to volume figures, with units and temp;	**2 max**
(ii)	*high light intensity* light is not limiting factor; temperature is limiting factor; ref to collision theory; denaturing of enzymes lowers rate at high temperatures /30 °C; *max 3 marks* *low light intensity* light is limiting factor; temperature is not limiting factor; no enzymes involved in light reaction; high temperatures damage photosystems / membranes; *max 3 marks*	**4 max**
(c)	respiration utilises oxygen / oxygen dissolves in water;	**1**
		[Total: 15]

Question		Expected Answers	Marks
3	(a)	starts with previously uncolonised area / bare ground / bare rock / AW; ref to pioneer species / named pioneer; series of recognisable, seres / stages; progresses to, climax / final equilibrium stage;	**2 max**
	(b)	stabilise environment; soil development / increase humus / organic material; change soil pH; hold more water; release more minerals or nutrients / increase N content or fix N / hold ions; form microhabitat / reduce exposure / provide shelter / reduce erosion;	**3 max**
	(c)	grazing; burning; mowing / application of fertilizer / application of selective herbicide; exposure to wind; grass able to continue to grow (*linked to a statement above*);	**2 max**
	(d)	increases; plants at later stages are large / plants in early stages are small; trees / shrubs. are woody, appear later in succession;	**2 max**

(e) 1 economic definition of sustainable; e.g. similar quantities of timber can be harvested year on year
2 ref to clear felling having negative effects;
3 coppicing;
4 pollarding;
5 (deciduous trees) regrow from base;
6 idea of rotation / cycle;
7 standards / large trees not coppiced;
8 encourages biodiversity;

9 softwood sp. / conifers / named conifer / fast growing sp. planted; planting to ensure sustainable harvest rate;
10 deciduous broadleaved species around edges;
11 aesthetic reasons;
12 stands of different ages;
13 only mature trees removed / selective felling / individual trees;
14 some clearings / rides / glades in woodland / strip felling;
15 creates different habitats / named habitat / protected habitats;
16 some fallen trees left to rot;
17 trees not planted too closely together;
18 species planted that are suitable for prevailing conditions /
19 native spp;
control of, pests / diseases;
20 grants for planting forests / management schemes ;
21 support young trees;
22 prevent damage from grazing animals;
23 risk of fire and prevention;
24 ref to soil erosion;
25

max 6

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

[Total: 16]

Question	Expected Answers	Marks
4 (a) (i)	2 different alleles / both alleles, in heterozygote make a contribution to the phenotype; (individual / genotype), having two different alleles for a characteristic / gene / at a locus;	2
(ii)	*genetic diagram accept other symbols if a key is provided. Candidates can gain full marks if they use superscript letters only.* *ecf applies once only. Do not take off marks for incorrect transfer from Punnett square to lines* parental genotypes $C^BC^WA^SA^F$ $C^WC^WA^FA^F$; gametes C^BA^S, C^BA^F, C^WA^S, C^WA^F + C^WA^F ; genotypes $C^BC^WA^SA^F$, $C^BC^WA^FA^F$, $C^WC^WA^SA^F$, $C^WC^WA^FA^F$; (correct phenotypes to match genotypes) grey mild frizzle, grey frizzled, white mild frizzled, white frizzled; ratio of 1:1:1:1 / 4;4;4;4;	5
(b)	black, straight with white, frizzled / $C^BC^BA^SA^S$ x $C^WC^WA^FA^F$; black, frizzled with white, straight / $C^BC^BA^FA^F$ x $C^WC^WA^SA^S$;	2
(c)	two different sized chromosomes in each gamete; correct four different arrangements;	2
(d)	independent assortment / description of independent assortment; crossing over / chiasma formation; mutation; **A** two different references to independent assortment i.e. metaphase 1 for homologous chromosomes and metaphase 2 for chromatids	3
		[Total: 14]

Question	Expected Answers	Marks
5 (a) (i)	*natural selection* *may be answered in context of an example* mechanism for evolutionary change; variation within a population; overproduction of offspring; differential survival / differential mortality; competition / selection pressure / survival of fittest idea; selective advantage of features / named feature; ref to effects of different alleles; ref to frequency of alleles in the population; (changing / staying the same) ref to allele(s) passed on to the next generation; AVP; e.g. directional, stabilising selection	**5 max**
	species members of a population which (freely) interbreed; produce fertile offspring; **R** viable ecological definition / occupy unique individual niche; similar physiological, morphological ,biochemical, behavioural traits; *must have two in list for mark*	**2 max**
(b) (i)	*batch A* seeds collected close to mine all survive / AW; few tolerant seedlings in samples further away / AW; all tolerant plants have little variation in height; *batch B* all seedlings grow / survive; seedlings closer to mine are shorter / from 30m away are taller; no significant difference in samples from 30 m away; *general* batch A seedlings shorter / ora; more survive in batch B / ora; difference in height between A and B greater with distance from mine / ora;	**4 max**
(ii)	soil closer to mine has higher copper content; plants are adapted to copper content in soil; gene / allele, for copper tolerance; selection has favoured copper tolerant plants / alleles; only copper tolerant plants grow here / all non tolerant die off;	**3 max**

(iii) wind pollinated / pollen carried in wind; **A** cross pollination;
pollen contains allele for copper tolerance;
seeds dispersed / AW;
soil contaminated / contains Cu;
plant contains copper tolerant allele / gene; **2 max**

[Total: 16]

Question		Expected Answers	Marks
6	(a)	1 gibberellin / GA released from scutellum / embryo; diffusion to aleurone layer; 2 gibberellin triggers enzyme production*;* *(could appear in 1 but credit once only)* amylase / maltase / carbohydrase / lipase / protease; enzymes into endosperm; breakdown / hydrolyse / digest, reserve / named reserve; **R** food *(could appear in 3 but credit once)* 3 simple soluble substances / named example; (move / diffuse), to embryo;	**6 max**

(b) *similarities*

1 number of different chemicals involved;
2 transported to different part of organism;
3 act on specific cells/ tissues;
4 released from specific cells;

differences

5 greater number of hormones in mammals;
6 move more rapidly to target tissues in mammals;
7 in bloodstream;
8 mammalian hormones produced in endocrine glands;
9 name of gland with correct hormone;
10 many mammalian hormones proteins or steroids;
11 response to hormones faster in mammals / ora;
12 transported in xylem / phloem in plants;
13 can be diffusion / active transport in plants;
14 can act in cells where produced in plants;
15 in plants different concentrations has different effects;
16 example of above eg apical dominance, leaf abscission;
17 plant chemicals active at very low concentrations;
18 no negative feedback in plants;
19 plant chemicals produced in a variety of tissues;
20 often at meristems / dividing cells;
21 example of meristem and chemical; e.g. shoot apical meristem and auxin.
22 synergism often shown in plants / AW;
23 example of synergism; e.g. auxin and GA in stem growth.
24 plant chemicals are acids / terpenes;
25 AVP; e.g.pheromones in animals / scents in plants **7 max**

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

[Total: 14]