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A Level

Biology

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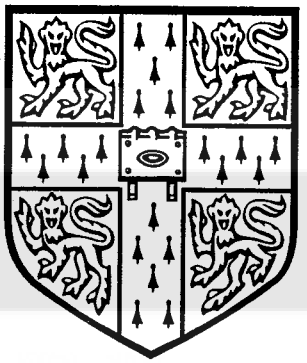


GCE Examinations June 1994

MARKING SCHEME
for
BIOLOGICAL SCIENCES

This marking scheme is a working document prepared for use by Examiners. All Examiners are required to attend a Coordination meeting to ensure that the Marking Scheme is consistently interpreted and applied in the marking of candidates' scripts.

UCLES will not enter into any discussion or correspondence about any Marking Scheme. It is acknowledged that there may be different views about some matters of emphasis or detail of a Marking Scheme. It is also recognised that, without the benefit of attendance at a Coordination meeting, there may be different interpretations of the application of a Marking Scheme.

JUNE 1994

BIOLOGY

GCE

9260

Paper 9260/01

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

1 (a) (i) A / adenine ; ® *adenosine correct spelling only*

(ii) G / guanine ; *correct spelling only* 2

(b) change amino acid ;
different R group / charge ;
affect / change configuration / shape / folding / bonding / active site / structure / characteristics / conformation ; 3

(c) redundancy in genetic code / more than one codon for each amino acid / 20 amino acids and 64 possible codons / degenerate code ;
depends on the position within protein molecule ;
the shape of some parts of the protein more important than others ;
not a frame shift so will not have major effect ;
ref. to introns ;
ref to similar R groups ; max 2

(d) transmembrane protein with central pore in phospho-lipid bilayer ;
hydrophobic / non polar regions in protein ;
hydrophobic / non polar regions in membrane / phospholipid bilayer ;
3

allow all above points on drawing or written in part (ii)

QUESTION TOTAL 10

(2)

(a) (i) as ventricle contracts volume decreases ;
figures 115 - 125 to 40 - 45 cm^3 ;

(ii) as ventricles contract pressure increases ;
figures 2.0 - 2.5 to 15 kPa ;
penalize once for no units 4

(b) P wave as impulse passes through atrium / atrial contraction / depolarisation/ systole ;
QRS as ventricular depolarisation / contraction / systole ;
ref to AVN and Purkinje fibres / bundle of His ; max 2

(c) P atrium > P ventricle / P in atrium increases bicuspid valve open ;
P atrium < P ventricle / P in ventricle increases bicuspid valve closed ;
P ventricle > P aorta / P in ventricle increases semilunar valve open ;
P ventricle < P aorta / P in ventricle decreases semilunar valve closed ;
4

(d) closing of bicuspid / atrio-ventricular / mitral valve ;
closing of semi-lunar / aortic / pocket valve ; 2

QUESTION TOTAL 12

(3) (a) (i) as depth increases productivity / oxygen production decreases ;
0 - 4 m decreases from +1.0 to 0 ;
4 - 5.8 m decreases from 0 to -0.25 ;
0 - 5.8 m decreases from +1.0 to -0.25 ;
from 2 metres decrease 0.15 units / m^{-1} ;

allow any correct figures with max 1 for figures

(ii) as depth increases light decreases ;
ref. absorption of different wavelengths / not all wavelengths penetrate to same depth ;
this is a limiting factor ;
less light for photosynthesis / rate of photosynthesis less ; max 4

(b) (i) net primary production is the excess of photosynthetic product over respiratory losses / gross product minus respiratory losses ;
increase in dry mass / biomass / energy available for growth / next trophic level ;

(ii) oxygen is given off in photosynthesis ;
and used in respiration ;
therefore oxygen balance indicates the balance between the two processes ;
max 4

(c) compensation point at 0 oxygen exchange ; 1

QUESTION TOTAL 9

(4) (a)

correct use of symbols in key ;

penalise once if no X and Y symbols used

black female	X	ginger male	ginger female	X	black male
X^BX^B		X^bY ;	X^bX^b		X^BY ;

tortoiseshell female	black male	tortoiseshell female	ginger male
X^BX^b	X^BY ;	X^BX^b	X^bY ;

5

(b)

tortoiseshell female	black female	ginger male	black male
X^BX^b ;	X^BX^B ;	X^bY ;	X^BY ;

4

QUESTION TOTAL 9

5

(a) predation / eaten by crabs / low survival rates ;
do not live longer than year / short life cycle ;
genetically determined ; max 2

(b) avoid visual predation / predator unable to see them ;
camouflage shell against background / correct seaweed ; 2

(c) predation favours shorter life-cycle / shell colour ;
higher on shore less predation live longer and grow larger;
lower on shore complete life cycle in one year ;
different backgrounds favour different shell colours ;
hybridisation produces infertile offspring ; max 4

(d) (i) unable to compete with *L. obtusata* ;
shell colour no longer camouflaged ;
absence of *Fucus serratus* / absence of food plant / do not feed on the seaweed found there ;
ref. dessication ; *any one from four* max 1

(ii) unable to complete life-cycle in one year / unable to reproduce ;
due to predation by crabs ;
conspicuous / shell colour no longer camouflaged ;
absence of *Ascophyllum nodosum* / absence of food plant / do not feed on the seaweed found there ; *any one from four* max 1

QUESTION TOTAL 10

6

(a) fix ;
glutaraldehyde / osmic acid / osmium tetroxide ;
anchor / stabilise / retain the subcellular / original structures ;
dehydrate with alcohol ;
water would vapourize in vacuum ;
stain - heavy metals / lead nitrate / osmium tetroxide / uranyl acetate ;
to deflect / scatter electrons ;
embed in resin / araldite ;
section using an ultramicrotome ;
sections must be thin due to poor penetrating power of electrons ;
mount on copper grid ;
ref to negative staining ;
freeze fracturing / freeze etching ;
shadowing with heavy metals ; max 8

(b) beam of electrons in vacuum ;
focus using electromagnets / electric coils ;
pass through section ;
heavy metals deflect electrons / stain so electron opaque ;
image formed on fluorescent screen ;
photographic film ; max 4

(c) *advantages* greater resolution ; ® magnification only
more details of cell structure revealed ;
disadvantages dead / living material cannot be examined ;
treatment disrupts / creates artefacts ;
time to prepare material ;
thin section only ;
monochrome / black and white image ;
cost / skilled operator required ; max 6

CONTENT 18

QUALITY OF EXPRESSION 2

QUESTION TOTAL 20

7

(a) glomerulus ;
Bowman's capsule ;
proximal convoluted tubule ;
loop of Henlé ;
distal convoluted tubule ;

pores / fenestrations in capillary lining ;
basement membrane ;
podocytes ;

microvilli / brush border ;
large number / many mitochondria ;
tight junctions ;
allow all above points on drawings if labelled max 8

(b) osmotic / Ψ_w / Ψ_{sol} gradient in medulla ;
due to increasing NaCl / Na^+ / urea ;
counter current multiplier in loop of Henlé ;
reabsorption of water in the collecting ducts ;
by osmosis ;
pass into blood / capillaries / vasa recta ;
ref. role of ADH ; max 6

(c) plasma pH 7.4 and urine pH 4.5 - 8.5 ;
distal convoluted tubule ;
excretes H^+ / retains HCO_3^- if blood pH falls / becomes more acid ;
excretes HCO_3^- / retains H^+ if blood pH rises / becomes more alkaline ;
also produces NH_4^+ / NH_3 if blood pH falls / becomes more acid; max 4

CONTENT 18

QUALITY OF EXPRESSION 2

QUESTION TOTAL 20

8

(a) *no mark for name of habitat but technique must relate to type of habitat penalise once if no named habitat*

transects ;
belt or line ;
length or width ;
details of recording ie. cover / abundance / frequency ; allow max 3
different species;
any abiotic factors ;
positioning ;

quadrats ;
type / size ;
positioning / random numbers / grid ;
number of quadrats ;
details of recording ie. cover / abundance / frequency ; allow max 3
different species;
any abiotic factors ;

kick sampling / sweep netting;
time / duration ;
location / position ;
details of recording ie. different species ; allow max 3
numbers ;
any abiotic factors ;
repetition ;

map of area ;
location / positioning of sampling ;
sampling technique ie pitfall traps / capture - mark - release - recapture ; must be related to area
details of recording ie. different species ; allow max 3
numbers ;
any abiotic factors ;
repetition ; max 10

(b) habitat a place where an organism lives;
ref. other species in the same habitat ;
niche ecological role of an organism / trophic level ;
producer / consumer / detritivore / parasite ;

fundamental / realized / restricted by competition ; max 4

(c) initial trapping of sunlight by photosynthesis ;
rate of production ;
difficulties of measurement / units kJ / m^{-2} / yr^{-1} ;
reduction at each level ;
due to respiration / heat ;
excretion ;
indigestible residue / uneaten parts ;
limit to how many stages / only a few trophic levels in an ecosystem ;
max 4

CONTENT 18

QUALITY OF EXPRESSION 2

QUESTION TOTAL 20

OPTION 1. DIVERSITY OF ORGANISMS

1 (a) More transmission in oceanic;
100%/maximum, at, 400/500nm/blue, in oceanic; (A)range and approximates)
60%/maximum, at, 575/600nm/yellow, in coastal; (A)range and approximates)
much lower, blue/short wave, transmission in coastal;
much less/no, U.V. transmission in coastal;
minimum at, 700nm/red, in oceanic;

oceanic;
light for photosynthesis penetrates deeper; [6]

(b) not supported;
both have, wide range/no clear trend, in depth range/green species deepest/
three of deepest five spp. are green/ref. to suitable depth figures; [2]

(c) same, pattern/red and blue peaks, as chlorophyll a in both;
red peak differs as different form of chlorophyll a;
fucoxanthin present in browns;
brown algae absorb more at, 550nm/green;
chlorophyll b present only in greens;
chlorophyll c present only in browns; [3]

(d) (release of) minerals/fertilisers/salts/ion/nutrients;
humus/organic matter;
water retention;

algae, richer in/more, protein than fish;
producer/consumer, so algae more energy efficient;
depletion of fish stocks;
fibre/roughage;
minerals/iodide;
less, oil/fat; [4]

Total mark: 15

OPTION 1. DIVERSITY OF ORGANISMS

2 (a) 20-300nm;
5-30mm;
10-50μm; [3]

(b) (i) W cell membrane/cell surface membrane;
X cell wall/capsule/slime layer;
Y cytoplasm;

(ii) Z nucleosome/chromoneme/DNA loop/naked DNA/DNA molecule;
(R)nucleus/chromosome)
half mark each - round halves up [2]

(c) fraction (approx) 156/92 / 152/90 ;
1.69/1.68μm; (A)1.6 - 1.7μm) [2]

(d) A testa/seed coat;
B tap root/primary root/radicle;
C lateral root;
D root hairs; half mark each - round halves up [2]

(e) true nucleus/nuclear membrane, v. no nucleus;
protein/histone, in chromosome v. naked DNA;
cellulose cell wall v. wall of other material;
80S ribosomes v. 70 S ribosomes;
endoplasmic reticulum v. none;
Golgi v. none;
microtubules v. none;
mitochondria v. none/mesosome; or membrane-bounded organelles
chloroplasts v. none/vesicles only; v. none;
larger v. smaller;
mitosis v. no mitosis; [4]

(f) supplies plant with, fixed nitrogen/nitrogen compound;
no N fertiliser need be applied;
lower, cost/leaching/pollution; [2]

Total mark: 15

OPTION 1. DIVERSITY OF ORGANISMS

3 (a) (i) Hair;
mammary glands;
external ear present;
sebaceous/sweat, glands; [3]

(ii) gas exchange surface, in lungs/internal;
large SA as many alveoli;
thin walled alveolus for rapid diffusion;
ventilation maintains concentration gradients;
pulmonary circulation maintains concentration gradients;
bronchioles, bronchi;
trachea, larynx;
two functions of nose;
C-rings of cartilage;
diaphragm between thorax and abdomen;
pleura between lungs and thorax wall;
external and internal intercostals;
contraction, lowers diaphragm/enlarges thorax;
external intercostal contraction raises ribs;
internal intercostal contraction lowers ribs;
thorax volume change causes pressure change;
ventilation due to pressure difference; [12]

(iii) common ancestor;
phylogenetic relationship;
original chordate was, marine/aquatic;
evolution onto land;
idea of "recapitulation";
no functional gills in some;
suggests, divergence/evolution/adaptive radiation;

[3]

CONTENT 18
QUALITY OF EXPRESSION 2
QUESTION TOTAL 20

OPTION 1. DIVERSITY OF ORGANISMS

3 (b) (i) Cylindrical shape;
segmentation;
chaetae;
nephridiopores;
mouth;
prostomium;
peristomium;
clitellum;
spermathecal openings;
oviducal openings;
genital grooves/vas deferens openings;
flattened posterior;
anus;
dorsal surface darker/ventral lighter;
mucus/cuticle;

half mark each - round halves up [4]

(ii) three tissue layers;
ectoderm (on outside);
ectoderm is protective;
ectoderm, sensory/nervous;
endoderm forms gut lining;
endoderm, digests/absorbs, food;
mesoderm between other two layers;
mesoderm contains muscle;
muscle around gut for peristalsis;
muscle in body wall for locomotion;
mesoderm can form, blood/connective tissue;
coelom is fluid filled cavity;
coelom separates body wall and gut;
coelom allows independent locomotion and digestion;
coelom allows space for organs;
ref. to increased specialisation;
e.g., organs/systems;

[10]

(iii) no rigid skeleton;
soil/water, provides support;
coelom/hydrostatic skeleton, allows burrowing;
safety from predators in burrows;
risk of desiccation on land;
ectoderm/cuticle, not waterproof;
ref. to gas exchange surface and loss of water

[4]

CONTENT 18
QUALITY OF EXPRESSION 2
QUESTION TOTAL 20

OPTION 2. APPLIED PLANT SCIENCE

1 (a) (i) Grain yield, less/similar, in 1970 (to 1969);
ear population, higher in 1970/lower in 1969;
but ear size/number of grain per ear, lower in 1970/higher in 1969;

(ii) grain yield (5.7 tonne ha^{-1}) represents 40% of crop;
total crop biomass = 14.25 tonne ha^{-1};

(iii) drought/ref. rain;
flooding;
too, cold/hot;
late frosts;
disease;
overcast/cloudy;
OVP;
Ⓡ conditions of cultivation/genetic variation) [5]

(b) (i) *deep ploughing opposed to direct drilling*
- gives higher grain yield (at all nitrogen applications);
- yields increase to 5.7 tonne ha^{-1};
- increase in, ear population/number of ears;
- little/no, effect on, ear size/number of grains;

Ⓐ appropriate alternatives for direct drilling)

(ii) *nitrogen fertiliser*
- gives higher grain yield for both cultivation techniques;
- 5.7 tonne ha^{-1} at 100 kg ha^{-1} for deep ploughing;
- 4.9 tonne ha^{-1} at 150 kg ha^{-1} for direct drilling;
- maximum yield may not be reached for direct drilling;
- ear population increased by application of fertiliser;
- little/no, effect on, ear size/number of grains;

[6]

(c) amino acid synthesis; (Ⓐprotein)
synthesis of, purine/pyrimidine, bases;
chlorophyll synthesis;
synthesis of, co-enzymes/ATP/NAD/NADP;
any other N-containing compound; [2]

(d) development of better soil structure;
improved drainage;
reduced costs as land does not need so much preparation;
reduced soil erosion;
reduced annual weed germination;
continuous cropping;
retains soil moisture/less evaporation (from soil surface);

[2]

Total mark: 15

OPTION 2. APPLIED PLANT SCIENCE

2 (a) (i) Fruit grows only in the areas with ovaries/not elsewhere;
if source were in rest of plant then whole fruit would develop evenly;

(ii) remove, all /no, ovaries;
keep in identical conditions;

(iii) remove all ovaries;
add auxin (in lanolin) to fruit and, observe/measure, growth;

[6]

(b) (i) two main periods of fall;
maximum/500 per day, late June of unripe;
second peak/200 per day, early August of ripe;
no fruits fall late July and early June periods;

(ii) fruits, fall when IAA concentration is low/do not fall when IAA high;
early fall result of, flowers not pollinated/pollen tubes not present as source of auxin;
fruits that remain (contain seeds) and fall in August when IAA low;

(iii) prevents early fall of fruits/fruits remain on trees for harvest;
assists setting of fruit/supplements source from pollen tubes;
increases size of fruits since they remain on trees for longer;

[7]

(c) A maintains potatoes in store for longer/maintains quality/inhibits use of resources;

B increases proportion of cuttings that become established/ref. to uptake of water or minerals/increases rate at which cuttings, grow/develop;

[2]

Total mark: 15

OPTION 2. APPLIED PLANT SCIENCE

3 (a) (i) Diffusion of water vapour through stomata;
evaporation into air space;
wet/moist, cell walls;
spongy mesophyll;
water potential lowered;
movement of water, from cell to cell/via symplast;
movement of water, in between cells/via apoplast;
water potential gradient through leaf to atmosphere;
movement of water through xylem;
transpiration pull/cohesion-tension;
forces of cohesion between water molecules;
OVP; (e.g. of plant/environmental factor affecting transpiration)

[9]

(ii) stomata, open when guard cells turgid/closed when flaccid;
ventral cell wall/wall adjacent to stoma, much thicker than, dorsal wall/wall adjacent to epidermal cells;
guard cells attached to each other at either end of stoma;
on gaining fluid/becoming turgid, thin outer wall buckles outward pulling rest of cell;
reverse when cell, loses fluid/becomes flaccid;
cellulose microfibrils arranged so ventral wall is less elastic;
hoops of microfibrils restrict guard cells so change in length when turgid;
cells becoming more semi-circular;

[4]

(iii) stomata represent a pathway of resistance for CO_2;
resistance increases as stomata close;
rate of, photosynthesis/carbon fixation, depends on stomatal aperture;
guard cells respond to environmental stimuli;
2 e.g.s (light/humidity/windspeed/CO_2 concentration);;
close in response to ABA;
made by mesophyll cells when plant is under water stress;
ref. production/yield, related to, stomatal activity/water stress;
OVP;

[5]

CONTENT 18
QUALITY OF EXPRESSION 2
QUESTION TOTAL 20

OPTION 2. APPLIED PLANT SCIENCE

3 (b) (i) Compete with crop for, nutrients/light/water/space;;
readily invade;
becoming established before crop;
physically interfere with growth of crop (e.g. bindweed causing lodging);
taints food;
poisons animals;
becomes entangled in machinery;
lowers, yield/profit;
may harbour pests;
weed seeds need to be removed post-harvest/crop needs cleaning;
weeds have high seed output;
weel-developed dispersal mechanisms;
persistance of perennial weeds;
weed seeds remain dormant for long periods of time;
OVP; [8]

(ii) (A) any suitable method; (R) unqualified `weedkiller`)
advantage;
disadvantage;
e.g.s:-
deep ploughing buries seed;
kills established annual and perennial weed growth;
but brings seed to surface;
germinates;
harowing/discing, kills seedlings;
minimal tillage/direct drilling, keeps seeds near surface instead of being buried;
reduces annual weed germination;
but increases problems of perennial weeds;
ploughing splits perennating structures into many parts so spreading weed;
crop rotation reduces establishment of weeds associated with particular crops;
winter cereals compete well with spring germinating weeds;
contact herbicides - rapid action;
pre-emergence/before crop germinates;
systemic - absorbed by roots and translocated;
selective/non-selective;
problem (e.g. herbicide resistance);
other method (e.g. mulching/polythene sheets/burning crop residues/cleaning crop seed so no or little weed seed in seed that is stored);

[10]

CONTENT 18
QUALITY OF EXPRESSION 2
QUESTION TOTAL 20

OPTION 3. APPLICATIONS OF GENETICS

1 (a) Organism/pathogen, which kills pest; (Ⓐvirus)

[1]

(b) (i) spontaneous/chance/natural;
mutation (giving resistance);

(ii) natural selection;
insecticide is selective (agent);
resistant insects survive;
breed/pass on mutation to offspring;
increasing frequency in population;

[4]

(c) control to find mortality rate of larvae in conditions of experiment for comparison;

[1]

(d) initially/2 days, % dead or paralysed larvae the same;
by 6 days both viruses kill or paralyse 100% larvae;
recombinant virus has biggest effect day 2 - 3;
non-engineered virus has biggest effect day 4 - 5;
any comparison of figures on days 3 - 5;

[4]

(e) "library" of mite genes set up;
gene for toxin identified;
via probe;
isolated via scissoring DNA with enzyme;
cloned via, polymerase/polymerase chain reaction;
detail insertion into virus; (e.g. sticky ends/appropriate enzyme/vector DNA)
comment, "on" switch/triggering transcription when virus in host/testing for presence of gene;

[5]

Total mark: 15

OPTION 3. APPLICATIONS OF GENETICS

2 (a) (Dominant) epistasis; [1]

(b) iiCC, iiCc; [1]

(c) P (IICC X iicc)

G (IC) (ic) ;

F_1 IiCc;
all white;

F_1XF_1 IiCc X IiCc;

G (IC) (Ic) (iC) (ic) X same;

F_2 correct genotypes;
genotypes correctly related to phenotypes;
ratio 13:3;
white:coloured; [9]

(d) each locus codes for an, enzyme/polypeptide/protein;
working in the same metabolic pathway/pathway shown;
appropriate suggestion I/i; (inhibitor idea)
appropriate suggestion C/c; (pigment) [4]

Total mark: 15

OPTION 3. APPLICATIONS OF GENETICS

3 (a) (i) *ADVANTAGES*

Sperm from one superior male used to fertilise large no. different females;
- speeds up progeny testing procedure;
- speeds up artificial selection;

saves cost of keeping male;
or problems of running male with, flock/herd;
or cost/danger, of male/female, travelling for mating;
fertilise different females with different sperm;
- therefore reducing inbreeding;

allows, international/intercontinental, mating;
AI quickly available;
sperm can be sexed;
sperm can be checked for genetic defect before use;
AI less stressful than mating;
OVP;

DISADVANTAGES

Whole procedure depends on ability to store sperm;
may be difficult to store sperm;
liquid N_2/low temperature, storage may damage sperm;
so more used per insemination;
AI may not make economic sense (storage + vet.);
danger of inseminating too many females with sperm from small no. males;
- causing inbreeding;
- with consequent e.g. of problem;
- causing loss of alleles from gene pool;
- which might be, important/needed, in future;

OVP; [5 + 5]

(ii) AIH overcomes intromission problems;
introduces no third party into relationship;
problem to those who disapprove of any intervention in natural process;
AID allows couple to have child that is mother's;
rather than adopt child derived from neither parent;
introduces third party into relationship;
anonymity of donors;
child's right to information about genetic parent;
donor must not be overused;
- in case unknown genetic defect;
- in case siblings intermarry;

donor should "match" in race;
- and in some cases, religion;

donor must be free from, HIV/etc.;
OVP;;; (Allow up to three marks for detail of existing legislation/proposed changes/cases in headlines) [8]

CONTENT 18 QUALITY OF EXPRESSION 2 QUESTION TOTAL 20

OPTION 3. APPLICATIONS OF GENETICS

3 (b) (i) Measurement of variation shown by, quantitative character/continuous variable;
i.e. one controlled, polygenically/by many cumulative genes;
measure of how spread out distribution curve is;
flat wide curve = high variance/reverse/curves shown;
calculated $s^2 = \sum(x - \bar{x})^2/n - 1$;
phenotypic variance has genetic and environmental components/$V_P = V_G + V_E$; [4]

(ii) phenotype affected by genotype + environment (give either above or here);
must establish heritability;
additive genetic component of variance inherited;
dominance/interaction, variances are not;
genetic variance
---------- = broad sense heritability;
phenotypic variance
not a useful value;
additive genetic variance
---------- = narrow sense heritability;
phenotypic variance
is true measure of genetic contribution;
heritability can be estimated by parent-offspring regression;
using mid-parent value;

clone/genetically identical;	genetically different;
e.g.;	e.g.;
in different environments;	in same environment;
e.g. environments;	e.g. environment;
character measured;	character measured;
any variation is environmental;	any variation is genetic;
study of twins;	

[10]

(iii) provides raw material;
for artificial selection;
parents chosen for their desirable characteristics;
and interbred;
otherwise dependent on mutation;
ref. gene banks;
ref., wild types/ancient breeds/etc.; [4]

CONTENT 18
QUALITY OF EXPRESSION 2
QUESTION TOTAL 20

OPTION 4. GROWTH, DEVELOPMENT AND REPRODUCTION

1 (a) (i) *leaves* - rise from week 1 to, 120/130mg;
- level/plateau, week 4 to week 8;
- fall to zero week 8 to week 11;

roots - rise from week 1;
- maximum/300mg approx., at week 8;

(ii) flower stem and ear start growth, at week 3/after leaf;
after, initiation of flowering/signal from leaves;
nutrients from leaf/ref. photosynthesis of leaf;
flower stem photosynthesises;
leaf dies off;
seeds form; [5]

(b) (i) large numbers of/ 50+, seeds;
removal of sample at intervals with soil washed off;
division into parts;
drying at 100°C approx.; (A 90 - 120°C)
to constant mass;
ref. to, desiccator/cooling, before weighing;

(ii) killing samples; [5]

(c) (i) critical minimum, photoperiod/light;
idea dark, matters/should not be more than a maximum;
conversion of P_R to P_{FR};
P_{FR} removes inhibition;
perception by leaves;
ref. to graph;
possible hormone;
translocated in phloem;
vegetative apex switched to floral;
ref., genes/differentiation;

(ii) flowering depends on critical photoperiod;
idea day and night approx. equal;
idea day may not be long enough; [5]

Total mark: 15

OPTION 4. GROWTH, DEVELOPMENT AND REPRODUCTION

2 (a) (i) Hormones, controlling/affecting, ovary and testis;

(ii) protein, with/conjugated with, carbohydrate;

(iii) secretion from, nerve ending/axon/synapse;

(iv) blood supply with two sets of capillaries (carrying materials);

(v) regulatory/control, mechanism corrects/reduces, deviation;
(to the proper level)

[5]

(b) *OVARY*
FSH promotes oogenesis;
promotes follicular, growth/development;
stimulates oestrogen secretion with LH;

TESTIS
FSH, promotes spermatogenesis/germinal cells stimulated;
causes, Sertoli/nurse cells;
to produce androgen binding protein;
to provide high levels of testosterone;

[4]

(c) ribosomes;
Golgi body;

[2]

(d) receptors in the cell surface membrane, specific/can only receive one hormone;

[1]

(e) amplification/idea of cascade/small quantity can produce large amount of product;

[1]

(f) higher centres interact with hypothalamus;
GnRH release affected;
so, LH/FSH, affected;

[2]

Total mark: 15

OPTION 4. GROWTH, DEVELOPMENT AND REPRODUCTION

3 (a)(i) *STEM* site of meristem = shoot apex;
ref. to planes of division;
one plane parallel to surface for epidermis;
division in all planes for cortex;
vascular bundles;
pith;
procambial strands;
leaf primordia;
axil bud primordia;
superficial origin of lateral shoots;

ROOT site of meristem = just behind root cap;
root cap produced;
(single) procambial strand;
internal origin of lateral roots;
ref. root hairs;

EITHER STEM OR ROOT
mitosis;
elongation of cells;
detail of elongation (e.g. vacuolation);
action of, IAA/auxin;
on cell walls;
zone of differentiation;

XYLEM VESSELS
protoxylem;
annular/spiral, thickenings;
allow for, elongation/stretching;
lateral enlargement;
middle lamella swells;
intervening walls broken down;
secondary wall of lignin;
vessel without living contents;
files of vessel elements/end to end idea;
pits; [14]

(ii) differentiation/specialisation;
different genes switched on;
gradients of chemicals;
environmental effects;
DNA binding protein;
sequence specific;
hormones;
idea of permanency of switching;
position of tissues;
ref. embryonic development;
role of cytoplasm;
[4]

CONTENT 18
QUALITY OF EXPRESSION 2
QUESTION TOTAL 20

OPTION 4. GROWTH, DEVELOPMENT AND REPRODUCTION

3 (b) (i) *MAMMALS*
ref. haploid gametes fusing to diploid zygote;
capacitation of sperm;
removal of glycoprotein coat on acrosome;
ref. enzymes from, follicle/cumulus;
acrosomal enzymes digest 'egg' membranes;
detail of, hyaluronidase/acrosin;
fusion of sperm cell surface membrane and 'egg';
sperm enters 'egg';
zona pellucida becomes impermeable to other sperm;
secondary oocyte completes meiosis II;
expelling polar body;
male pronucleus, forms/enlarges;
(pro)nuclei fuse;
occurs in, oviduct/fallopian tube;
ref. chemotaxis;

ORIGIN OF GENETIC DIVERSITY
idea of two sexes contributing;
X and Y sperm;
meiosis;
primary, oocyte/spermatocyte, meiosis I;
secondary, oocyte/spermatocyte, meiosis II;
crossing over;
detail of crossing over;
independent assortment;
detail of independent assortment;
segregation of, alleles/genes;
random fusion of gametes; [14]

(ii) mutation;
point/gene, mutation;
change in bases on DNA;
e.g., addition/inversion/translocation/etc;
chromosome mutation;
aneusomy/polysomy;
ref. non-disjunction (at mitosis);
polyploidy/increase in chromosome sets;
detail of polyploidy (e.g. autopolyploidy); [4]

CONTENT 18
QUALITY OF EXPRESSION 2
QUESTION TOTAL 20

University of Cambridge
Local Examinations Syndicate

BIOLOGY (9260/4)
INVESTIGATIVE ASSIGNMENT
GCE A LEVEL 1994

Please read the instructions printed overleaf before completing this form.

Centre Number		Centre Name	
Candidate Number		Candidate Name	
Subject or Brief Title		Teacher's Estimated Grade	

1. Title and Hypothesis (5 marks)

a. Title
Award 1 mark each for:
- concise wording;
- clear indication of the nature of the investigation. (2)

b. Hypothesis
- aim only; *(1 mark only)*
- aim amplified; *(2 marks only)*
- clear statement of an hypothesis; *(3 marks)* (3)

2. Abstract (5 marks)

Award 1 mark each for:
- fair summary;
- concise statement of problem;
- concise statement of methods;
- summarised results;
- summarised conclusions. (5)

3. Presentation (5 marks)

Award 1/2 mark for each of the section headings as specified:
abstract,contents list (including page numbers), introduction,hypothesis, methods,results, conclusions, limitations, modifications/further work, acknowledgements. – (5)

4. Introduction (5 marks)

concise;
context of list B option. (5)

5. Method (20 marks)

Award up to 5 marks for each of the following:
a. Account - full and clear enough for the work to be repeated from account given;(5)
b. Practical techniques include where appropriate:
pilot, adequate controls, adequate replicates, adequate sample size, frequency of readings; (5)
c. Use of appropriate apparatus and techniques; (5)
d. Quality of design of the investigation and methods used. (5)

6. Results (20 marks)

Award up to 5 marks for each of the following:
a. suitable recording of raw data; (5)
b. quality of results presentation, quality and appropriateness of graphical expression; (5)
c. quality of observation and measurement, quality of data collected; (5)
d. statistical analysis of results if appropriate or evidence of data analysis. (5)

7. Conclusions (15 marks)

Award up to 5 marks for each of the following:
a. conclusions logically derived from results; (5)
b. quality of discussion; (5)
c. discussion of initial aims and implications. (5)

8. Limitations, Reliability and Sources of Error (5 marks)

Award 1 mark for each limitation and/or source of error linked to the reliability of data. (max 5)

9. Modifications/Further Work (5 marks)

Award 1 mark for each suggested modification or piece of further work, which must be realistic in terms of the original investigation. (max 5)

10. Style (5 marks)

Award up to 5 marks for clear, concise and accurate usage of English. (5)

11. Quality/Overall Academic Standard (5 marks) (5)

Total (95)

Comments .....

.....

.....

Examiner Name .....

Examiner Number .....

Copy: 1. Unit 8, UCLES; 2. Team Leader/Chief Examiner; 3. Retain for Reference

9260/04/WMS

Question 1

1	(a)	6 values recorded in table;;	**2 or 0**
	(b)	*Graph* : axes correctly and fully labelled; variables on correct axes; points plotted accurately; (cumulative); joined appropriately;	**5**
	(c) (i)	carbon dioxide produced; absorbed by soda lime; oxygen absorbed causes volume reduction; hence proportional movement by fluid;	**4**
	(ii)	to facilitate gaseous exchange;	**1**
	(iii)	$22/7$ x 0.4^2 x total distance (mm); x10; correct answer relative to data; correct units;	**4**
	(iv)	constant over the time period;	**1**
	(v)	correct interpretation of validity; by reference to shape of graph;	**2**
	(d) (i)	3 values recorded;	**1**
	(ii)	extent of movement [is] due to activity of beam; indicates compensation needed [if any] for movements; eg. to temperature fluctuations (i.e. a thermobar) or absorption by soda lime;	**3**
	(e) (i)	6 values recorded; direction recorded;	**2**
	(ii)	*comment on carbon dioxide evolution* : oxygen uptake; ref. to respiratory substrate (or anaerobic resp);	**2**

cont.

(f) *any 1 point*

eg microclimate changes in syringe/lack of control of manometer fluid; 1

Max 28

Question 2

2 (a) (i) *Drawing marks* :

four <u>different</u> (credible) cells;
drawn to same scale;
cells drawn with square shape and angular corners;
chromosomes shown by double lines;
2 marks for good details for <u>each</u> drawing (e.g. presence of centromere;;;;
good shape of chromosomes/alignment);;;; **12**

(ii) appropriate (visible) feature identified for <u>each</u> drawing (4x1);;;; **4**

(iii) sequence correct; **1**

(b) (i) ie cigar-shaped + pointed (free) end **1**

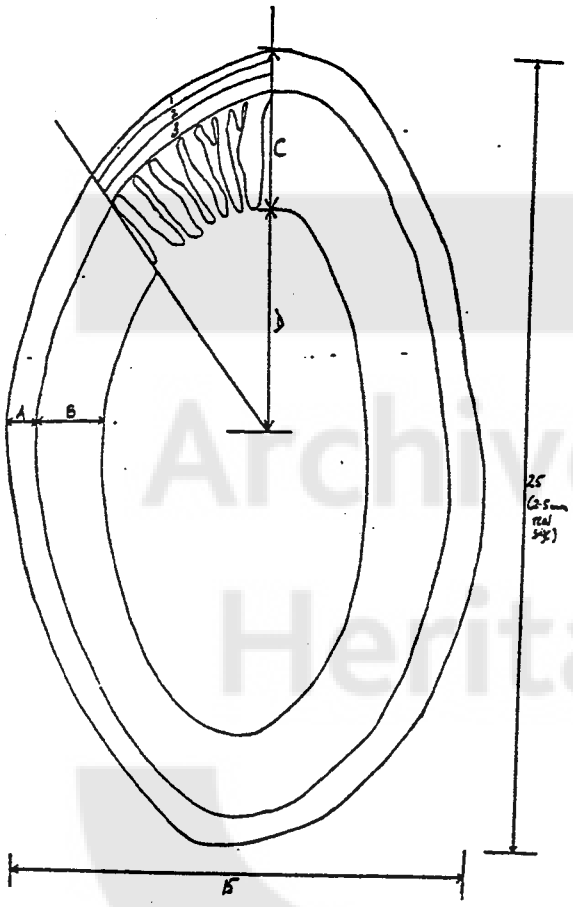
(ii) Ⓐ x 5 to x 15; **1**

(iii) diploid → haploid;
introduction of different gene combinations (by crossing over OR shuffling); **2**

Max 21

Question 3

3 (a) (i) Plan **K3** :



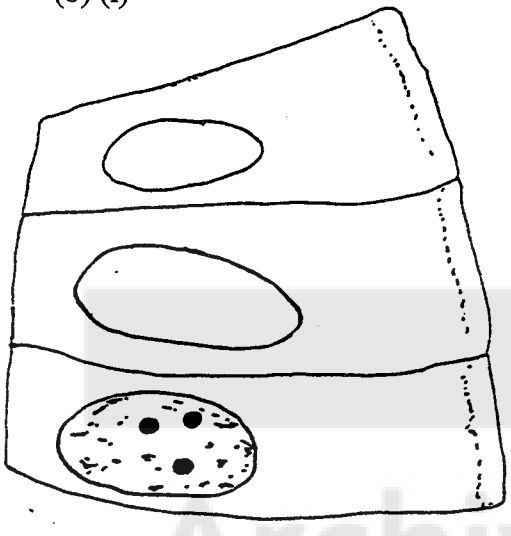
Drawing Marks :
shape (not circular);
longit.(1) approx circular(2);
circular(2) submucosa;
B at least twice A; **4**

(ii) magnification + method of calculation; **1**

(iii) for peristalsis (or ≡);
different kinds of movement; **2**

(iv) increase surface area;
for more efficient absorption; **2**

(b) (i)



Drawing Marks :
columnar shape;
brush border;
detail of nucleus; **3**

(ii) larger;
no visible nucleus;
flask-shaped (or ≡);
no brush border OR homogeneous contents; **4**

(iii) lubrication;
prevent auto-digestion; **2**

(c) t test; **1**

Max 19
