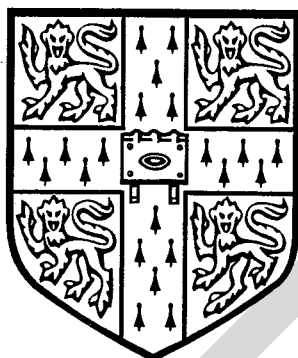


A Level

Biology

Session: 1994 June
Type: Mark scheme
Code: 9260

University of Cambridge
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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.

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GCE ADVANCED LEVEL EXAMINATIONS
MARKING SCHEME JUNE 1994

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JUNE 1994

BIOLOGY

GCE

9260

Paper 9260/01

<i>Question Number</i>	<i>Key</i>	<i>Question Number</i>	<i>Key</i>
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



GCE ADVANCED LEVEL EXAMINATIONS
MARKING SCHEME JUNE 1994

Page2.....

- ②
- (a) (i) as ventricle contracts volume decreases ;
figures 115 - 125 to 40 - 45 cm³ ;
- (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



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

$X^B X^B$ $X^b Y$; $X^b X^b$ $X^B Y$;

tortoiseshell female black male tortoiseshell female ginger male

$X^B X^b$ $X^B Y$; $X^B X^b$ $X^b Y$;

5

(b)

tortoiseshell female black female ginger male black male

$X^B X^b$; $X^B X^B$; $X^b Y$; $X^B Y$;

4

QUESTION TOTAL 9



3

- (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



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 $\text{kJ} / \text{m}^{-2} / \text{yr}^{-1}$;
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; [6]
light for photosynthesis penetrates deeper;
- (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; [3]
chlorophyll b present only in greens; [3]
chlorophyll c present only in browns;
- (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; [4]
minerals/iodide;
less, oil/fat;

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]



OPTION 1. DIVERSITY OF ORGANISMS

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

[12]

[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]



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 ($5.7 \text{ tonne ha}^{-1}$) represents 40% of crop;
total crop biomass = $14.25 \text{ tonne ha}^{-1}$;
- (iii) drought/ref. rain; disease;
flooding; overcast/cloudy;
too, cold/hot; OVP;
late frosts;
(R) 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 $5.7 \text{ tonne ha}^{-1}$;
- increase in, ear population/number of ears;
- little/no, effect on, ear size/number of grains;
(A) appropriate alternatives for direct drilling
- (ii) *nitrogen fertiliser*
- gives higher grain yield for both cultivation techniques;
- $5.7 \text{ tonne ha}^{-1}$ at 100 kg ha^{-1} for deep ploughing;
- $4.9 \text{ tonne ha}^{-1}$ 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; (A) 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;
- (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;
- (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;

[6]

[7]

[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]



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;
well-developed dispersal mechanisms;
persistence 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;
harrowing/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]



OPTION 3. APPLICATIONS OF GENETICS

- 1 (a) Organism/pathogen, which kills pest; (A)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 \textcircled{IC} \textcircled{ic} ;
- F₁ IiCc;
all white;
- F₁XF₁ IiCc X IiCc;
- G \textcircled{IC} \textcircled{Ic} \textcircled{iC} \textcircled{ic} X same;
- F₂ 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 N₂/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;

(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)

[5 + 5]

[8]



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 $s^2 = \frac{\sum(x - \bar{x})^2}{n - 1}$;
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;
- | | |
|---|--|
| <p>clone/genetically identical;
e.g.;</p> <p>in <u>different</u> environments;
e.g. environments;
character measured;
any variation is environmental;
study of twins;</p> | <p>genetically different;
e.g.;</p> <p>in <u>same</u> environment;
e.g. environment;
character measured;
any variation is genetic;</p> |
|---|--|
- [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]



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]



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

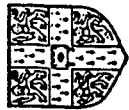
idea of two sexes contributing;
X and Y sperm;
meiosis;
primary, oocyte/spermatocyte, meiosis I;
secondary, oocyte/spermatocyte, meiosis II;
crossing over;
detail of crossing over;
independent assortment;
detail of independent assortment;
segregation of, alleles/genes;
random fusion of gametes;

[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]



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

<p>1. Title and Hypothesis (5 marks)</p> <p>a. Title <i>Award 1 mark each for:</i></p> <ul style="list-style-type: none"> - concise wording; - clear indication of the nature of the investigation. <p>b. Hypothesis</p> <ul style="list-style-type: none"> - aim only; (1 mark only) - aim amplified; (2 marks only) - clear statement of an hypothesis; (3 marks) 	(2)
<p>2. Abstract (5 marks)</p> <p><i>Award 1 mark each for:</i></p> <ul style="list-style-type: none"> - fair summary; - concise statement of problem; - concise statement of methods; - summarised results; - summarised conclusions. 	(3)
<p>3. Presentation (5 marks)</p> <p><i>Award 1/2 mark for each of the section headings as specified:</i></p> <p>abstract, contents list (including page numbers), introduction, hypothesis, methods, results, conclusions, limitations, modifications, further work, acknowledgements - (5)</p>	(5)
<p>4. Introduction (5 marks)</p> <p>concise; context of list B option.</p>	(5)
<p>5. Method (20 marks)</p> <p><i>Award up to 5 marks for each of the following:</i></p> <p>a. Account - full and clear enough for the work to be repeated from account given; (5)</p> <p>b. Practical techniques include where appropriate: pilot, adequate controls, adequate replicates, adequate sample size, frequency of readings; (5)</p> <p>c. Use of appropriate apparatus and techniques; (5)</p> <p>d. Quality of design of the investigation and methods used. (5)</p>	(5)

<p>6. Results (20 marks)</p> <p><i>Award up to 5 marks for each of the following:</i></p> <p>a. suitable recording of raw data; (5)</p> <p>b. quality of results presentation, quality and appropriateness of graphical expression; (5)</p> <p>c. quality of observation and measurement, quality of data collected; (5)</p> <p>d. statistical analysis of results if appropriate or evidence of data analysis. (5)</p>	
<p>7. Conclusions (15 marks)</p> <p><i>Award up to 5 marks for each of the following:</i></p> <p>a. conclusions logically derived from results; (5)</p> <p>b. quality of discussion; (5)</p> <p>c. discussion of initial aims and implications. (5)</p>	
<p>8. Limitations, Reliability and Sources of Error (5 marks)</p> <p><i>Award 1 mark for each limitation and/or source of error linked to the reliability of data.</i></p>	(max 5)
<p>9. Modifications/Further Work (5 marks)</p> <p><i>Award 1 mark for each suggested modification or piece of further work, which must be realistic in terms of the original investigation.</i></p>	(max 5)
<p>10. Style (5 marks)</p> <p><i>Award up to 5 marks for clear, concise and accurate usage of English.</i></p>	(5)
<p>11. Quality/Overall Academic Standard (5 marks)</p>	(5)
Total (95)	

Comments

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) $\frac{22}{7} \times 0.4^2 \times \text{total distance (mm)}$;
 $\times 10$;
 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

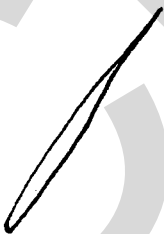
cont.

- (f) *any 1 point*
eg microclimate changes in
syringe/lack of control of
manometer fluid;

1

Max 28

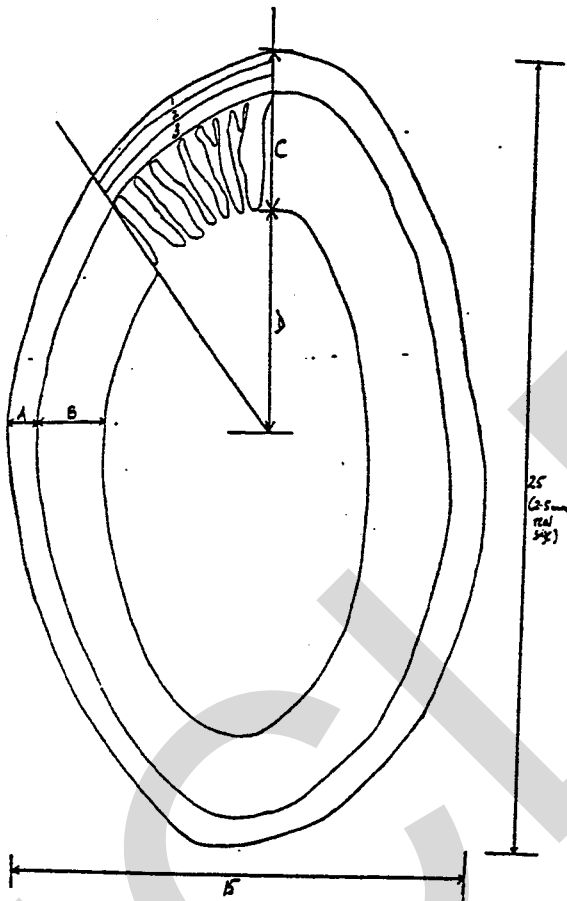
Question 2

- 2 (a) (i) *Drawing marks :*
 four different (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 each
 drawing (e.g. presence of
 centromere);;*
 good shape of
 chromosomes/alignment);;;; **12**
- (ii) appropriate (visible) feature identified for
each drawing (4x1);;;; **4**
- (iii) sequence correct; **1**
- (b) (i) ie cigar-shaped + pointed
 (free) end **1**
- 
- (ii) (A) 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;

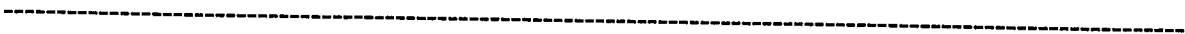
1

(iii) for peristalsis (or \equiv);
 different kinds of movement;

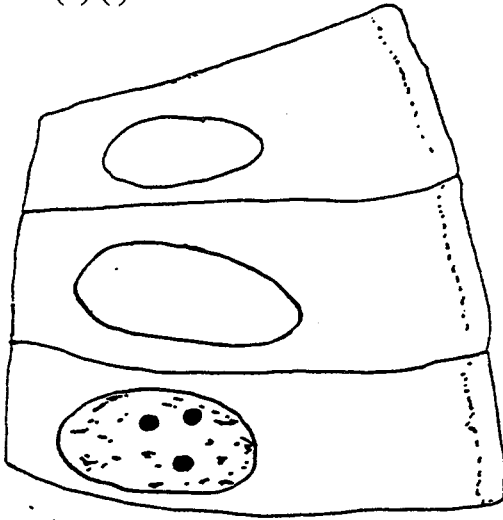
2

(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 \equiv);
no brush border OR homogeneous
contents;

4

(iii) lubrication;
prevent auto-digestion;

2

(c) t test;

1

Max 19
