Cambridge Assessment

# A Level

## Biology

**Session:** 2000 June
**Type:** Mark scheme
**Code:** 9264

Oxford Cambridge and RSA Examinations

OCR

RECOGNISING ACHIEVEMENT

# A LEVEL
(former Cambridge linear syllabus)

A 9264

# BIOLOGY



## MARK SCHEME FOR COMPONENTS
TAKEN IN JUNE 2000

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## Linear A Level Biology 9264
## June 2000 Assessment Session

### Component Threshold Marks

| Component | Maximum Mark | A | B | C | D | E | N |
|---|---|---|---|---|---|---|---|
| **9264/1** | 100 | 64 | 57 | 50 | 43 | 37 | 31 |
| **9264/2** | 40 | 32 | 29 | 25 | 21 | 18 | 15 |
| **9264/3** | 75 | 54 | 49 | 43 | 37 | 31 | 25 |
| **9264/4** | 36 | 33 | 30 | 26 | 22 | 19 | 16 |
| **9264/5** | 60 | 40 | 32 | 29 | 26 | 23 | 20 |
| **9264/6** | 12 | 10 | 9 | 8 | 7 | 6 | 5 |
| **9264/9** | 36 | 33 | 30 | 27 | 24 | 21 | 18 |

**The cumulative percentage of candidates achieving each grade was as follows:**

| Component | A | B | C | D | E | N | Total Number of Candidates |
|---|---|---|---|---|---|---|---|
| **9264/1** | 25.82 | 41.98 | 56.87 | 70.60 | 81.17 | 88.34 | 1657 |
| **9264/2** | 23.08 | 38.28 | 59.90 | 78.62 | 87.95 | 94.91 | 1657 |
| **9264/3** | 18.41 | 33.37 | 49.61 | 65.84 | 78.38 | 88.07 | 1657 |
| **9264/4** | 50.06 | 71.80 | 86.96 | 94.04 | 97.39 | 98.63 | 807 |
| **9264/5** | 17.73 | 56.36 | 68.18 | 81.36 | 88.18 | 94.55 | 221 |
| **9264/6** | 63.80 | 78.73 | 86.43 | 94.12 | 97.29 | 99.10 | 221 |
| **9264/9** | 44.70 | 68.49 | 82.80 | 93.57 | 97.75 | 98.88 | 622 |

OCR

RECOGNISING ACHIEVEMENT



# Markscheme 9264/1
# June 2000

## OPTION 1 - BIODIVERSITY

**1 (a)** low oxygen concentration;
varying oxygen solubility with temperature;
problem of ventilation;
difficulty moving due to high, density/viscosity, of water;
no surface to push against;
currents;
poor light penetration (at depth/in turbid water);
faster conduction of heat;
ref. pressure/vibration;
ref. osmotic problem; **max 3**

**(b)** **X** is a nucleus;
macronucleus/meganucleus;
polyploid/contains, copies of genes/amplified genes;
ref. staining;

**Y** is a food vacuole; ( *R 'store'*)
contains (semi-digested) food particles;
hydrolytic/digestive, enzymes present;

**Z** is a contractile vacuole;
contains, water/salt solution (about to be expelled);
surrounded by, accessory vacuoles/canals; **max 6**

**(c)** $\frac{195/200 \text{ mm}}{750}$ (*no mark*)
0.26mm/0.267 mm/260µm /267µm; **1**

**(d) (i)** protoctista; **1**

**(ii)** *Chlorella*/other alga/*Amoeba*/other protozoan; **1**

**(iii)** eukaryotes;
organisms that, are not plants, animals or fungi/cannot be fitted into other kingdoms;
organisms that do not develop an embryo;
unicells (or aggregations of similar cells); **max 3**

**Total: 15**

2 (a) absorption of carbon dioxide/reduction of greenhouse effect/reduction of global warming/maintenance of oxygen;
source of timber;
source of, drugs/medicine;
source of foods;
gene bank;
ethical reasons for conserving, all species/range of species/maintaining, biodiversity/habitats;
prevention of, landslides/flooding/erosion;
A.V.P.; **max 3**

(b) estimated volume dropped considerably;
significant decrease since 1981;
ref. figures (years and volumes of timber); **max 2**

(c) (i) $\frac{\text{volume in virgin}}{\text{volume in total}} \times 100$ ; $\left(= \frac{0.3}{0.73} \times 100\right)$
41%; (*A 38 - 41%*) **2**

(ii) virgin forests contain more timbers that are, valuable/useful;
the best timber from non-virgin forests has already been removed; **max 1**

(d) fewer, accessible/available, (suitable) logs/trees, remaining;
less demand for, sawn timbers/veneers/wood;
government/international, controls;
valid economic reason;
( *R no timber remaining*) **max 2**

(e) mining;
rail/road, construction/housing;
hydroelectric schemes/reservoirs/dams;
ecotourism;
industrial development; **max 2**

(f) farmed trees can be used for timber (instead of virgin forest trees);
if trees from virgin forests are felled then species relying on them disappear;
only the most desirable tree, species/varieties, are grown;
small area tree farm produces as much useful timber as large area of virgin forest;
alternative source of income for local population (so less need to exploit forest); **max 3**

**Total: 15**

3 (a) (i) *Outline the features which can be used to distinguish between platyhelminths and annelids.* **[6]**

(ii) *Describe the feeding method of a* ***named*** *endoparasitic platyhelminth.* **[6]**

(iii) *Explain the locomotion of earthworms.* **[8]**

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(i) P flat and A, cylindrical/rounded, (in T.S.);
A are segmented and P unsegmented;
A have a coelom but P, do not/are acoelomate;
A have an anus (but P do not);
P have flame cells (but A do not);
A have nephridia (but P do not);
A have blood system (but P do not);
(most) A have chaetae (but P do not); **max 6**

(ii) liver fluke/tapeworm/*Schistosoma*/other example;

soluble foods absorbed through the, cuticle/outside surface;
e.g. soluble food;
by active transport;
ref. large surface area; (e.g. cestode microtriches)
ref. tolerance to defence mechanisms of host;
ref. how position in gut is maintained;

*Trematoda* blood/host cells/mucus/other fluid, ingested;
via, mouth/pharynx;
digestion in, alimentary canal/gut;
undigested remains egested via, mouth/pharynx;

*Cestoda* no gut/foods not ingested;
digestion carried out by host;
some digestive enzymes in membrane forming body's outer surface; **max 6**

(iii) body wall contains circular and longitudinal muscle (fibres);
ref. antagonistic action;
contraction of circular muscles causes a segment to lengthen and narrow;
contraction of longitudinal muscles causes a segment to shorten and widen;
ref. hydrostatic skeleton;
coelomic fluid, transmits force/incompressible, so non-contracting muscles lengthen;
septa separate coelomic fluid in adjacent segments;
intersegmental reflex/mechanical stimulation;
anterior segments of worm lengthen so anterior end moves forwards;
chaetae protruded;
to provide grip;
anterior segments then shorten;
posterior part of worm therefore pulled forward;
waves pass from anterior to posterior;
mucus lubrication;
( *A appropriate points off labelled diagram*) **max 8**

**Total: 20**

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3 (b) (i) *Outline the features which can be used to distinguish between the alga Chlorella and bryophytes.* **[6]**

(ii) *Discuss the ways in which humans use algae.* **[7]**

(iii) *Explain the extent to which bryophytes are adapted to life on land.* **[7]**

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(i) *Chlorella* is a protoctist but bryophytes are plants;
*Chlorella* is unicellular but bryophytes are multicellular;
*Chlorella* is, microscopic/2 - 25μm in diameter, but bryophytes are larger;
(*A microscopic v. macroscopic*)
*Chlorella* has an, ovoid/rounded/coccoid, shape but bryophytes do not;
bryophytes have, a thallus/leaves, which *Chlorella* does not;
bryophytes have rhizoids which *Chlorella* does not;
bryophytes develop archegonia and antheridia which *Chlorella* does not;
bryophytes develop, sporophytes/capsules/sporangia, which *Chlorella* does not;
bryophytes develop from embryos which *Chlorella* does not; **max 6**

(ii) (*Mark as uses + 1 detail mark per use, including those given below.*)
used as a food for, humans/farm animals;
detail; (e.g. high protein content)
releases mineral nutrients as it decomposes;
detail; (e.g. acceptable to, organic farmers/gardeners)
helps with sewage treatment;
detail: (e.g. releases oxygen which other organisms use in aerobic respiration)
source of, iodine/other named mineral;
detail; (e.g. mineral obtained from ash of burned seaweed)
source of agar;
detail; (e.g. used as, gelling agent/growth medium for, bacteria/microorganisms or ref. cosmetic use)
source β carotene/glycol/other chemical;
detail;
A.V.P.;
detail;
**max 7**

(iii) *Adaptations*
spore dispersal by drying of capsule;
detail spore dispersal; (*elators/splash mechanism/teeth*)
rhizoids for, water absorption/anchorage;
tolerant of desiccation/able to rehydrate after drying;
*Limitations*
bryophytes are (mainly) confined to, wet/damp, habitats;
water needed for, male gametes/fertilisation;
no, xylem/vascular tissue, so little support;
bryophytes cannot grow tall;
rhizoids not as efficient as roots;
no/little, cuticle so easily desiccated;
not as well adapted as, filicinophytes/coniferophytes/angiospermophytes/other plants;
**max 7**
**Total: 20**

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## OPTION 2 - APPLIED PLANT & ANIMAL SCIENCE

1 (a) (i) 26 - 30°C; **1**

(ii) light-independent stage of photosynthesis; ( A 'dark stage')
enzymes;
Calvin cycle;
Rubisco;
determines rate of carbon dioxide fixation;
limiting factor up to optimum temperature;
limiting factor above optimum temperature;
denaturation of enzymes at high temperatures;
ref to $Q_{10}$;
ref. to figures; **max 4**

(iii) tropics/equatorial regions;

optimum, range 25 - 35°C/around 30°C;
can maintain high rates of photosynthesis at 40+°C;
ref. to figures; **max 2**

(b) (i) within optimum range for each crop; **1**

(ii) ( *A converse arguments for rice/barley as $C_3$ plants*)
no photorespiration in $C_4$;
detail photorespiration;
efficient use of carbon dioxide;
use very low concentrations of carbon dioxide;
$C_4$ pathway concentrates carbon dioxide in bundle sheath cells;
no competition between carbon dioxide and oxygen for active site of Rubisco;
PEP carboxylase has high affinity for carbon dioxide;
use of figures from Fig. 1.2; **max 4**

(c) cut leaf, discs/other similar sized shape; (*N.B. question refers to 'a leaf'.*)
sample, throughout day/beginning and end of day/at least two occasions between sunrise and sunset;
several samples/replicates/take averages;
dry, discs/etc., to constant mass;
(net) production = difference over the day; **max 3**

**Total: 15**

2 (a) growing cash crops;
still not enough investment;
land unsuitable for improvement;
poorly educated workforce;
land holdings too small;
large scale agriculture not possible;
not suitable for widescale cultivation of high yielding varieties;
poor rainfall/drought;
natural disasters;
A.V.P.;; (e.g. choice not to grow crops/cheap imports) **max 2**

(b) (i) fertilisers/herbicides/pesticides/crop protection chemicals, bought off farm/brought in from outside; **1**

(ii) no/less, reliance on external inputs;
recycling/composting/manuring/crop rotation/interplanting, used;
continued long-term without external inputs; **max 2**

(c) limited variety of foodstuffs;
nutritional status decreases;
more, vitamin/mineral, deficiencies;
example;; (*two marks*)
imported food less, fresh/nutritious; **max 3**

(d) reduce soil erosion;
conserve water;
conserve organic matter;
allow nutrient recycling/stop excessive leaching;
maintain/improve, soil texture by returning organic matter; **max 3**

(e) *Rhizobium*;
nitrogen fixation;
root nodules;
roots left in ground to decompose;
increase nitrogen content of soil;
reduce application of fertilisers;
any beneficial effect on the soil;
avoid eutrophication; **max 4**

**Total: 15**

3 (a) (i) *Explain what the diets of **either** intensively reared pigs or cattle must provide in order to allow rapid growth.* [7]

(ii) *Explain how animal housing helps to maximise productivity.* [6]

(iii) *Discuss the probelms posed by the disposal of farmyard manure.* [7]

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(i) feed *ad libitum*;
provide feed that is easily, digestible/taken up;
dry matter intake must provide enough energy;
(the ration to give this energy) must be consumed in a day;
ref. digestible energy;
ref. metabolisable energy/described;
enough energy for, maintenance/keeping body temperature constant;
energy for growth;
ref. cellulose and ruminant digestion;
sufficient protein to support growth;
all essential amino acids;
idea of limiting amino acids in some feeds;
different feeds complement each other with respect to amino acids;
use of protein concentrates;
ref. use of supplements/example given;
ref. different, nutrient/energy, intakes at different stages of growth;
vitamins/e.g. vitamin;
minerals/e.g. mineral; **max 7**

(ii) temperature so that metabolic heat production is at minimum;
so energy not used for keeping warm;
restricted movement conserves energy;
temperature not so hot that animals reduce food intake;
ventilation;
heating when necessary;
insulation;
protection from extremes of climate;
helps to maintain hygienic conditions;
less chance of disease;
effective disposal of effluent (reduces chance of disease);
ref. control of day length; **max 6**

(iii) large quantities/bulky;
smell;
high BOD if washed into water/ref. eutrophication;
may contain weed seeds;
expensive to, spread/dispose;
difficult to store;
requires heavy machinery to distribute on land;
need large area for effluent ponds;
concentration of heavy metals in soil;
low concentration of nutrients if used as a fertiliser;
nutrients released slowly so not readily available to crops;
risk of spreading animal, diseases/pests;
example; (e.g. stomach worms)
ref. methane; **max 7**

**Total: 20**

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3 (b) (i) *Explain the reasons for large applications of nitrogenous fertilisers in intensive cereal production.* [7]

(ii) *Describe how and when fertiliser is applied during the cultivation of* ***either*** *maize* ***or*** *wheat.* [6]

(iii) *Discuss the problems posed by the widespread cultivation of* ***one*** *crop.* [7]

---

(i) crop removed at harvest so loss of N;
continued cropping exhausts soil;
ref. monoculture;
soil may be naturally deficient;
N not returned by, manuring/ploughing in crop residues;
nitrates readily leached;
mobile ion;
soil erosion;
ammonium salts/nitrates, absorbed in large quantities; ( A macronutrient)
no decomposition and recycling;
little provided by decay of organic matter;
low yields without fertiliser;
ensures near maximum growth rates;
ref. protein for grain yield;
A.V.P.; (e.g. one role of N in plant) **max 7**

(ii) *timing:* at seed bed preparation/before, sowing/drilling;
sowing;
just after emergence;
early growth;
tillering;
flowering;
A.V.P. (e.g. not during, wet weather/autumn)
*method:* mixed with soil in seedbed when cultivated;
pelleted with the seed;
drilled into the soil;
slow release;
broadcast over the soil surface;
top dressing - broadcast onto growing crop;
(liquid) sprayed onto leaves; **max 6**

(iii) pests/diseases, spread very easily;
large quantity of the same food available;
pests/diseases, overwinter and spread onto next year's crop;
few natural predators;
ref. to large scale destruction of a monoculture;
ref. to depletion of nutrients;
decrease in humus content of the soil;
large areas of land devoted to agriculture;
loss of wildlife habitats;
compaction of soil;
no benefits from crop rotation;
single commodity price;
resources required all at one time; **max 7**

**Total: 20**

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## OPTION 3 - APPLICATIONS OF GENETICS

1 **(a)** random/chance/spontaneous/pre-exisisting;
mutation (for resistance);
herbicide is selective agent;
resistants survive to pass on, mutation/resistance, to offspring;
natural selection; **max 3**

**(b)** **(i)** code for one a. acid changed to that for another;
ref. mRNA;
by, substitution/inversion/change of one base for another; **max 2**

**(ii)** change in, shape/3° structure;
herbicide no longer, binds to/prevents normal function of, protein; **2**

**(c)** meristematic/undifferentiated/totipotent, cells;
placed in sterile nutrient medium;
p.g. substances/hormones, to stimulate cell division;
ref. mitosis/cytokinins; **max 3**

**(d)** **(i)** N - to show that adding the normal tubulin gene did not produce resistance;
to show that genetic engineering itself did not, produce resistance/have an effect;

C - to show that 'normal' maize cells did not show resistance;

[ *A 'both are controls' for max. 1 mark*] **max 2**

**(ii)** mutated tubulin gene gives resistance;
two copies of mutant gene (M2) gives resistance at all concentrations used;
one copy of mutant gene (M1) gives same resistance as two copies at 0.05mg $dm^{-3}$;
but decreasing resistance to higher concentrations/ref. suitable figures;
same growth as, N/C, at 1.0 mg $dm^{-3}$; **max 3**

**Total: 15**

2 **(a)** autosomal/not sex-linked/chromosome 7;
recessive allele;
sufferers homozygous recessive;
heterozygotes, carriers/ unaffected;
appropriate statement inheritance (e.g. 1 in 4 chance from two carrier parents); **max 3**

**(b)** **(i)** Q lacks, C-T-T triplet/3 bases; ( *A triplet reversed: T-T-C*) **1**

**(ii)** (protein) minus, one a. acid/glutamic acid; **1**

**(iii)** test is for a particular, mutation/deletion;
many different mutations result in CF;
P may have a (different) mutation in another part of the gene; **max 2**

**(c)** frequency increased;
because of, selective advantage/heterozygote advantage; **2**

**(d)** mutant allele reduces uptake of all three strains;
comment *re* not reduced to 0;
ref. comparative figures;;
ref. large difference/log scale; **max 3**

**(e)** ref. CFTR/transmembrane protein/ion channel/ion pore;
membrane less easily penetrated than normal by bacteria;
excess mucus hinders bacterial uptake;
A.V.P. (e.g. binding to c-s-membrane encourages uptake) **max 3**

**Total: 15**

3 (a) *Explain the roles in selective breeding of*

(i) *progeny testing*; [6]

(ii) *artificial insemination (AI)*; [7]

(iii) *embryo transplantation*; [7]

.....

(i) PT is test of value of genotype from performance of offspring;
measure of breeding value of parent;
especially when trait is polygenic;
ref. reason needed for polygenic trait;
used in both plants and animals;
of most use in animals;
particularly males;
used for sex-limited (NB not sex-linked) traits; ( *R sex-linked*)
e.g. of such a trait; (milk production/egg laying)
parent mated with range of partners;
trait measured in offspring;
allows selection for, banking/keeping at stud; **max 6**

(ii) saves, cost/problems, of keeping male;
saves, cost/problems, of animals travelling for mating;
less stressful than mating;
quickly available;
sperm from one superior male can be used for many females;
reduces inbreeding if different sperm used;
one ejaculate can be divided between several females;
sperm genetically tested;
sperm sexed;
speeds up progeny testing;
speeds up, selective breeding/artificial selection;
allows international mating; **max 7**

(iii) reproductive rate of superior female increased;
large number of, oocytes/embryos, can be harvested;
desirable, herd/flock/etc., quicker;
superior female not put at risk by pregnancy;
by use of surrogates;
surrogates can be, inferior quality/even different species; (e.g. guanaco/goat)
cloning embryos further increases number of desirable offspring;
embryos can be sexed;
embryos can be genetically tested;
embryos can be inserted in intermediate portmanteau animal;
smaller so easier to transport;
embryos can be frozen for storage; **max 7**

**Total: 20**

.....

3 (b) *Explain*

(i) *what is meant by the terms linkage and crossing over;* **[7]**

(ii) *the effect of crossing over on the inheritance of two linked genes;* **[6]**

(iii) *the effect of linkage in the major histocompatibility (HLA) system on the availability of transplants.* **[7]**

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(i) linked, genes/loci, are on the same chromosome;
do not assort independently/are inherited together;
number of linkage groups = number of haploid chromosomes;
reduces the number of phenotypic classes resulting from a cross/reduces variation;
linkage is broken by crossing over;
crossing over occurs in prophase I of meiosis;
during synapsis/when homologues pair;
chromatids of a bivalent break and join to non-sister chromatids (A/W);
exchange of alleles between, maternal and paternal chromosomes/homologues;
diagram showing exchange;
visible as a chiasma;
**max 7**

(ii) in total linkage parental phenotypes only are produced;
dihybrid cross behaves as monohybrid cross;
3:1 instead of 9:3:3:1 in $F_2$/1:1 instead of 1:1:1:1 in test cross;
e.g. total linkage; (*HLA, banded snails, etc.*)
recombinant offspring produced by crossing over;
smaller numbers than parental phenotypes;
1:1 large numbers parentals and 1:1 small numbers recombinants in test cross;
e.g. showing this;
chance of a cross over between two loci is proportional to their distance apart;
percentage of recombinants gives cross over value;
measure of distance apart of loci;
**max 6**

(iii) 4 (6) loci/A, B, C and D (P, Q, R);
on chromosome 6;
tightly linked/no crossing over;
detail (A,B,C very close D further away)
inherited as a unit;
haplotype;
must inherit one haplotype from each parent;
loci code for tissue typing antigens;
donor tissue rejected if not matched;
probability of finding a matching donor in general population very small;
ref. large number of alleles at each locus;
probability of finding matching donor in family much greater;
1 in 4 chance of two siblings having same haplotypes;
1 in 2 chance of two siblings sharing one haplotype;
identical twins have same haplotypes;
not all loci of same importance in rejection;
matching only those that matter most improves chance of match;
**max 7**

**Total: 20**

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## OPTION 4 - GROWTH, DEVELOPMENT & REPRODUCTION

1 (a) (i) A germinal epithelium ]
B stroma/cortex ] *Half marks rounded up*
C corona radiata/cumulus ]
D zona pellucida ] **2**

(ii) 0.1mm/100μm → 0.15mm/150μm
( *A any figure in this range*) **1**

(iii) oocyte haploid v. A diploid;
as a result of, meiosis I/prophase I;
oocyte has 23 chromosomes v. A 46 chromosomes;
oocyte has new combinations of alleles;
as a result of, crossing over/independent assortment; **max 2**

(b) acts with FSH to cause follicle growth;
stimulates, steroid/oestrogen, production;
by the theca;
causes ovulation (on day 14);
causes, development/maintenance, of corpus luteum;
stimulates progesterone production; **max 3**

(c) (i) 0.27μg; **1**

(ii) both rise initially;
hCG peaks in early pregnancy, progesterone peaks in late pregnancy
small initial peak of progesterone;
low level/small peak, of hCG in late pregnancy;
supporting figures; (*blood concentration and time figure for <u>both</u> hormones*) **max 3**

(d) *sites of production*
*hCG* fertilised egg/zygote/blastocyst/chorion/embryo;
*progesterone* corpus luteum/placenta;

*functions*
*hCG* maintains corpus luteum;
up to three months;

*progesterone* maintains uterus, lining/complexity;
relaxes uterine muscle;
inhibits FSH;
inhibits prolactin;
stimulates milk gland development; **max 3**

**Total: 15**

2 (a) *vegetative propagation*
asexual reproduction involving a piece of, tissue/leaf/stem/root/plant;

*axillary bud*
lateral bud/bud between stem and leaf/bud between stem and petiole; **2**

(b) (i) *warm summers* reserves formed in bulb;

(ii) *cold winters* ref. to bulb triggered to flower in right season; **2**

(c) (i) 0.6 - 0.73 g per week; **1**

(ii) reserves from old bulb;
broken down/hydrolysed/digested/mobilised;
transferred to growing leaf;
synthesis of leaf tissues;
fall in old bulb mass mirrors growth of leaf; **max 2**

(iii) respiration;
production of carbon dioxide;
accounts for loss in mass as reserves used;
increase in mass related to photosynthesis;
ref. to (rate of) photosynthesis greater than respiration; **max 4**

(d) stem height increases with density increase;
mass of new bulbs decreases with density increase;
leaf area, unaffected by density; ( *A not significant/trivial*)

competition for light;
water;
nutrients;

leaves overlap;
more energy used in growing taller (stems); **max 4**

**Total: 15**

3 (a) (i) *Describe the structures of a stamen and a pollen grain, including reference to their microscopic organisation.* **[10]**

(ii) *Describe the development of pollen grains and the male gametes of the flowering plant.* **[6]**

(iii) *Suggest the benefits of knowing when pollen release occurs from plants.* **[4]**

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(i) *stamen* consists of anther and filament;
vascular strand/connective/xylem and phloem;
epidermis and fibrous layer;
tapetum/nutritive layer;
four, pollen sacs/microsporangia;
detail of structure related to wind pollination;
detail of structure related to insect pollination;

*pollen* exine with detail;
intine with detail;
vegetative nucleus/tube nucleus;
two, gamete nuclei/male nuclei/sperm cells, *or* generative nucleus;
pits/pores;
detail of wind pollen;
detail of insect pollen; **max 10**

(ii) pollen mother cell undergoes meiosis;
ref. independent assortment;
detail independent assortment;
ref. crossing over;
detail crossing over;
tetrad/four, pollen grains produced;
nucleus divides to produce generative and vegetative nuclei;
by mitosis;
generative nucleus divides;
by mitosis;
haploid, nuclei/sperm cells/gametes, produced; **max 6**

(iii) pollination of crops;
example of an important crop;
timing of insecticide sprays;
greenhouse pollination;
ref. to, allergies/asthma/hay fever;
taking precautionary drugs;
avoiding exposure to atmospheres with high pollen counts;
A.V.P. (e.g. ref. to hybridisation) **max 4**

**Total: 20**

---

3 (b) (i) *Describe how the passage of sperms from the testes to the oviduct is brought about in humans.* **[8]**

(ii) *Explain how fertilisation occurs in humans.* **[8]**

(iii) *Discuss the biological reasons for the use of in vitro fertilisation (IVF).* **[4]**

---

**(i)** sperm in epididymis;
sexual arousal/nervous control of release;
contractions of, vas deferens/urethra;
addition of seminal fluid from named gland;
sugar/fructose, nourishes sperm/for respiration;
tail propels sperm;
sperm deposited, at top of vagina/at cervix;
ref. cervical mucus; (plug/channels)
capacitation of sperm/removal of glycoproteins or plasma proteins;
cooperative action of sperm;
ref. to alkaline secretions protecting sperm;
from, low pH/acidity, of vagina;
muscular contractions of female tract aiding sperm;
action of cilia in oviduct;
ref. prostaglandins;
chemotaxis/chemical attractant released by, oocyte/egg; **max 8**

**(ii)** acrosome fuses with sperm membrane;
digestive/hydrolytic, enzymes released;
ref. protease/acrosin/hyaluronidase;
path through, surrounding cells/corona/zona, made (by enzymes);
sperm binds to receptors;
on zona pellucida;
membranes of sperm and, oocyte/egg, fuse;
cortical reaction occurs/lysosomes released;
male nucleus swells;
ref. contents;
polyspermy prevented/zona pellucida impermeable;
second meiosis occurs;
polar body extruded;
fusion of haploid, (pro)nuclei/gametes, to form diploid zygote;
ref. to calcium release; **max 8**

**(iii)** damaged/blocked, oviducts;
failure ovulate regularly/polycystic ovaries;
cervical mucus inhibits sperm;
low sperm count;
poor sperm motility;
sterilised women;
immunity between female and sperm;
allows screening of embryo for defects;
donated oocytes; **max 4**

**Total: 20**

---

## OPTION 5 - HUMAN HEALTH & DISEASE

1 **(a)** **(i)** *similarity* rise in number of cases of AIDS;
S-shaped curve;
both peak in 1990; **max 1**

*difference* earlier rise for homosexuals/bisexuals;
earlier levelling off in number of new cases for homo/bisexuals;
fewer cases in drug users; **max 1**

**(ii)** (*earlier rise for homosexuals/bisexuals*) because gay community first infected;
(*earlier levelling off in new cases for homo/bisexuals*) because more aware of need for/more able to take preventative measures;
( *A converse trends for injecting drug users*)
(*fewer cases in drug* users) because A.V.P.; **max 1**

**(iii)** use of clean, needles/syringes/reduced sharing of contaminated, needles/syringes;
provided free (by, local authorities/Government);
availability of more effective drug treatments;
education/advertising campaigns;
( *R 'safe sex'*) **max 3**

**(b)** *component* surface glycoprotein; **1**

*reason* glycoproteins often, antigenic/epitopic;
stimulate response from immune system;
proteins exposed on surface of, virus/infected cell, easy to attack for antibodies;
**max 1**

**(c)** prevents conversion of RNA of virus into DNA in host;
DNA enters host cell nucleus and integrates with host DNA;
this necessary before virus can replicate; **max 2**

**(d)** antibiotics interfere with metabolic processes;
e.g. metabolic process; (*e.g. cell wall synthesis/protein synthesis/cell membrane function/enzyme action*)
viruses do not have, metabolism/relevant metabolic process; **max 2**

**(e)** HIV destroys, T helper cells/lymphocytes;
T helper cells needed for correct functioning of, immune system/T & B cells;
T cells eliminate viral infection/B cells make antibodies;
opportunistic infections therefore occur/no resistance to common pathogens;
cancers not recognised and eliminated;
example; (*e.g. TB, fungal pathogens such as candidiasis/oral thrush, secondary cancers, Kaposi's sarcoma, skin cancer, herpes, Pneumocytis/rare form of, pneumonia, food poisoning, toxoplasmosis, brain lesions, cryptosporidiosis, diarrhoea.*)
**max 3**

**Total: 15**

2 **(a)** literally 'bad nutrition'/not having correct food in correct proportions;
applied to both under- and over-nutrition; ( *R undernutrition only*)
A.V.P.; **max 2**

**(b)** BMI = $m/h^2 = 70/1.7^2 = 70/2.89$; (*one mark for correct method of calculation*)
= 24.22; ($kgm^{-2}$) (*units not needed for BMI*) **2**

**(c)** **(i)** age ranges variable (between countries);
years variable (between countries);
sample size unknown;
do not know whether equal numbers of men and women;
A.V.P.; (e.g. occupations/life styles) **max 2**

**(ii)** obesity is a bigger problem in the USA (than in Europe);
(slightly) more among women (than men);
more in Germany than England;
difference between USA and Europe not genetic/environmental factors important;
A.V.P.; **max 2**

**(iii)** *working: (One mark only)*
7% increase in 14 years;
0.5% increase per year;
5% increase in 10 years; **max 1**

*answer:* 17%/18%; **1**

**(d)** mean energy expenditure of obese women greater than lean women;
suggests obesity due to obese people taking in more energy than lean people;
not due to obese people, using less energy/having lower metabolic rate, than lean;
**3**

**(e)** obese people find it difficult to do enough exercise to lose significant amounts of energy;
energy of excess food intake far exceeds energy lost in exercise;
basic problem is eating too much;
exercise makes one hungry; **max 2**
( *R arguments about not wanting to do exercise since question assumes the obese person takes the advice to do exercise*)

**Total: 15**

3 (a) (i) *Explain why the use of alcohol and tobacco can lead to dependence.* **[6]**
(ii) *Describe the possible effects of alcohol on the liver.* **[8]**
(iii) *Explain how smoking tobacco can lead to damage of blood vessels.* **[6]**

---

(i) alcohol and tobacco cause both physical and psychological dependence; (*statement*)
both become involved in metabolism and body comes to depend on their presence;
= physical dependence; (*N.B. linked to previous point*)
nicotine is active ingredient in tobacco;
nicotine, causes physical dependence/is addictive;
nicotine mimics acetylcholine;
both cause, drug tolerance/progressive decrease in body's response to drug/need more to get same effect;
tolerance leads to dependence because effects of withdrawal heighten, desire/need for drug;
both stimulate, pleasure/dopamine, pathways in brain/both alter, mood/emotions/ both reduce, anxiety/stress/brain activity;
this leads to psychological dependence; (*N.B. linked to previous point*)
A.V.P.; (e.g. alcohol makes neurones more sensitive to GABA which is sedative) **max 6**

(ii) fat/plasma protein, builds up in liver (cells);
liver becomes swollen (as a result);
can disrupt normal functioning of cells;
liver adapts to presence of aclohol by increasing production of enzymes that metabolise it;
microsome ethanol oxidising system/MEOS, stimulated;
ethanol → ethanal;
(ethanal) toxic/affects proteins;
example; (interferes with, enzyme/membrane protein/other protein, activity)
changed proteins often attacked by antibodies;
cells cannot excrete bile pigments so leads to jaundice;
hepatitis;
cirrhosis/cells die and replaced by fibrous tissue;
hardens;
blood flow into liver obstructed; **max 8**

(iii) increases atherosclerosis;
cholesterol/fatty streaks, in walls of arteries;
other constituent of plaque; (e.g. fibrous tissue/platelets/extra smooth muscle fibres/phagocytes/foam cells)
damages endothelium of blood vessels;
ref. coronary artery;
nicotine, increases blood pressure/causes hypertension;
decreases, antioxidants/vit. C/vit. E, in blood leading to increased damage of artery walls by free radicals;
A.V.P.; (e.g. Peripheral vascular disease) **max 6**
( *R thrombosis and strokes, changes to blood*)

**Total: 20**

---

3 (b) (i) *Explain why, on average, the death rate from cholera is higher in developing countries than developed countries.* **[7]**

(ii) *Describe the response that would be mounted by the B cells (B lymphocytes) of the body on their first exposure to cholera bacteria.* **[7]**

(iii) *Explain with examples, the advantages of using monoclonal antibodies.* **[6]**

.....

(i) cholera spread by faecal contamination;
in water;
untreated sewage;
no purification of water used for, drinking/washing;
cannot afford the treatment plants;
cannot afford vaccination programmes;
cannot afford, treatment of disease/oral rehydration therapy;
malnutrition reduces resistance;
more flies to spread disease;
unhygienic handling of food;
low levels of education re, hygiene/etc.;
many symptomless carriers;
A.V.P.; **max 7**

(ii) cholera, bacterium/vibrio, has antigens on its surface;
immune response triggered;
B cells responsible for humoral immunity;
B cells with receptor which matches antigen are activated;
clone themselves/divide by mitosis;
become, plasma cells/effector cells/memory cells;
(plasma/effector, cells) produce antibody molecules;
in blood, tissue fluid and lymph;
live only a few days;
memory cells long-lived and enable rapid, response to subsequent infection/2° response; **max 7**

(iii) MCAs are, pure antibodies/specific to one antigen;
allergic response minimised;
*suitable examples of diagnosis:*
diagnosis of *Chlamydia*;
results in 15 - 20 minutes;
diagnosis of gonorrhoea;
results in 15 - 20 minutes;
immediate/rapid, diagnosis of streptococcal throat infections;
allows immediate treatment;
distinguish between herpes viruses;
important to distinguish because treatments different;
early detection and treatment of cancers;
example; (e.g.leukaemia/lymphoma)
pregnancy testing;
detects hCG in mother's urine;
blood typing;
detail;
*suitable examples of treatment (few available)*
use as 'magic bullets'/seek out and attach to specific targets;
example; (e.g. cancer cells/bacteria/viruses)
attach, toxic drug/radioactive isotope, to destroy target; **max 6**

**Total: 20**

OCR

RECOGNISING ACHIEVEMENT



# Markscheme 9264/2
# June 2000

## Multiple Choice

| Question No. | Correct Answer |
|---|---|
| 1 | B |
| 2 | D |
| 3 | A |
| 4 | B |
| 5 | C |
| 6 | C |
| 7 | B |
| 8 | A |
| 9 | B |
| 10 | A |
| 11 | A |
| 12 | B |
| 13 | D |
| 14 | B |
| 15 | B |
| 16 | D |
| 17 | B |
| 18 | D |
| 19 | D |
| 20 | C |
| 21 | C |
| 22 | C |
| 23 | D |
| 24 | A |
| 25 | B |
| 26 | A |
| 27 | B |
| 28 | C |
| 29 | B |
| 30 | B |
| 31 | A |
| 32 | D |
| 33 | B |
| 34 | A |
| 35 | D |
| 36 | C |
| 37 | A |
| 38 | C |
| 39 | A |
| 40 | C |

OCR

RECOGNISING ACHIEVEMENT



# Markscheme 9264/3
# June 2000

MARK SCHEME
Question 1
**SECTION A**

(a) A capillary / glomerulus ;
B Bowman's capsule / corpuscle / Malpighian body / corpuscle ;
C PCT ;
**3**

(b) X in area of glomerulus ;
**1**

(c) brush border / microvilli ;
large surface area (for reabsorption) ;

(many) mitochondria ;
for active transport ;

tight junctions (between cells) ;
ref. to polarity of cells / prevent leakage between cells ;

carrier / channel proteins ;
co-transport / facilitated diffusion / active transport ;

proximity of (peritubular) capillaries ;
efficient transfer to blood ;
**4**

(d) (i) only waste products / urea / excess salts pass dialysis membrane ;
no reabsorption in dialysis ;
ref. to composition of dialysing fluid / same as plasma no urea ;
ref.. to (hydrostatic) pressure differences in kidney vs. diffusion in dialysis ;
ref. to periodic vs. all the time in kidney ;
**3 max**

(ii) permanent / long term;
reduce time spent for treatment ;
allow better lifestyle qualified eg. eat and drink normally ;
ref. to less chance of infection ;
ref. to long term cost ;
ref. to hepatitis / HIV ;
ref. to damage to blood vessels ;
**2 max**

**Total : 13**

MARK SCHEME
Question 2

**(a)** *fluid* - phospholipids free to move / not laterally bonded / proteins free to move ;
*mosaic* - ref. to pattern / arrangement of proteins ; **2**

**(b)** hydrophilic / polar channel ;
hydrophobic / non polar outer surface ;
ref. to distribution of hydrophilic / hydrophobic R groups ; **2 max**

**(c)** ions / carry charge ;
ref. hydration shell ;
only soluble in water / not lipid soluble ;
hydrophobic / non polar region within membrane ; **2 max**

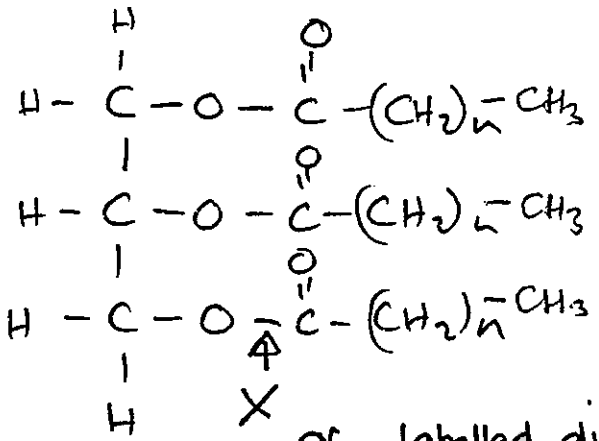
**(d)** *cholesterol* ref. regulates membrane fluidity / permeability / stability ;

*glycolipids* cell (to cell) interactions / adhesion / binding / recognition ; **2**

**Total : 8**

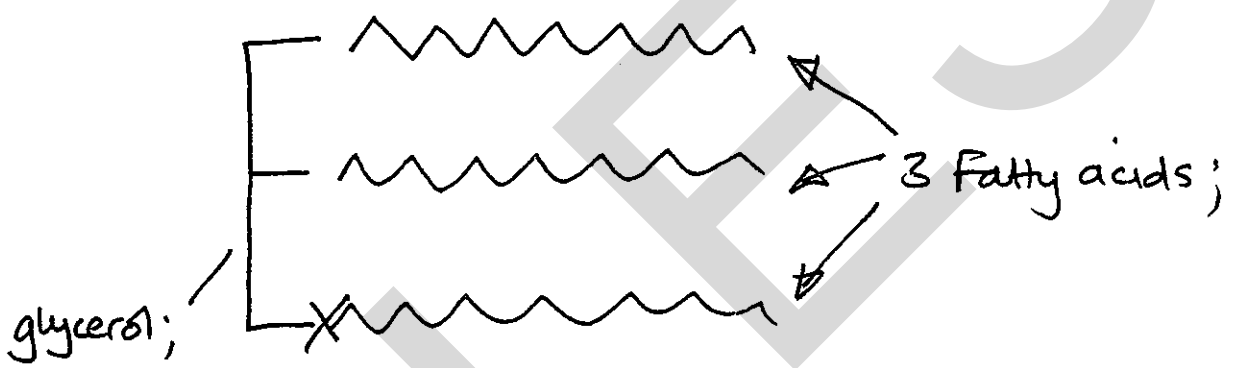
MARK SCHEME
Question 3

(a) (i)



correct Molecular Structure shown ;;
deduct one mark for each mistake

or labelled diagram




**2**

(ii) See above.

**1**

(b) triglyceride non polar / insoluble (in water) / lipid soluble ;
products / fatty acids and glycerol water soluble / polar / insoluble in lipid ;
*penalise once only if no mention of water*
ref. to -OH / hydroxyl / -COOH / carboxyl groups ;
groups responsible for solubility(in water) become exposed ; **3 max**

(c) more hydrogen to oxidise ;
more carbon - hydrogen bonds ;
less oxygen ;
ref. to greater ratio of H to O ; **2 max**

**Total : 8**

MARK SCHEME
Question 4

**(a)**

| *transcription* | *translation* |
|---|---|
| in nucleus | in cytoplasm / ribosome ; |
| DNA to RNA / ref. synthesis of RNA | mRNA to protein / ref. synthesis of protein ; |
| RNA polymerase | ref. to other enzymes / qualified; |
| phosphodiester bonds formed | peptide bonds formed ; |
| nucleotides joined | amino acids joined ; |

*must state both points to gain mark*

**3 max**

**(b)**

**A** large / 50 S subunit ;
**B** mRNA ;
**C** protein / polypeptide ; **3**

**(c)** tRNAase / amino acyl tRNA synthetase / description of enzyme joining amino acid to tRNA ;
ATP ;
amino acids ;
protease / peptidase / description of enzyme forming peptide bond ; **2 max**

**(d)** anticodon ;
(complimentary) base pairing with codon / triplet of baseson mRNA ;
amino acid binding site ;
amino acid corresponding / specific (to anticodon) ; **2 max**

**Total : 10**

MARK SCHEME
Question 5

**(a)** **(i)** levels off at 1500 $CO_2$ uptake ($\mu$mol $h^{-1}$ $dm^{-2}$ )
idea of light no longer a limiting factor ;
some other factor limiting / qualified / other factor specified eg. carbon dioxide / temp ;
**2 max**

**(ii)** compensation point reached at lower light intensity for plants grown in low illumination;
ref. steeper gradient / faster rate for plants grown in high illumination ;
ref. to initial starting points / quote figures –200 ($\mu$mol $h^{-1}$ $dm^{-2}$ ) for high illumination plants compared to –100 ($\mu$mol $h^{-1}$ $dm^{-2}$ )for low illumination plants / lower rate of respiration in low illumination plants ; **2 max**

**(b)** compensation point reached at a low light intensity ;
ref. to gain in dry mass (at low light intensities) ;
AVP ; ; eg. ref. to greater leaf area
ref. to lower respiratory rate
ref. to more chlorophyll
**2 max**

**Total : 6**

MARK SCHEME
Question 6

**(a)** yellow and round are dominant ;
correct ref. to cross 4 and / or cross 2 ; **2**

**(b)**

| | | |
|---|---|---|
| 1 | YyRr ; | yyrr ; |
| 2 | YyRr ; | YyRR ; |
| or | YyRR ; | YyRr : |
| or | YyRR ; | YyRR : |
| 3 | YyRr ; | Yyrr ; |
| 4 | yyRR ; | YYrr ; |

(Do not (P) in (b) for incorrect answer in (a))

*if two heterozygous genotypes in 2 only one mark*

**8 max**

**Total: 10**

JUNE 2000

MARK SCHEME
Question 7
**SECTION B**

*(a) Describe the main components of mammalian blood.[6]*
*(b) Explain how both oxygen and carbon dioxide are transported by the blood.[10]*

---

**(a)**

1 plasma ref. water ;
2 (dissolved) solutes qualified / named ions / nutrients / hormones ;
3 plasma proteins / albumin / fibrinogen / globulin / prothrombin ;
4 red blood cells / erythrocytes ;
5 size 7 – 8$\mu$m / ref. to shape of rbc ;
6 no nucleus ;
7 white blood cells / leucocytes / named white blood cell ;
8 ref. fewer / larger than rbc ;
9 nucleus ;
10 platelets / thrombocytes ;

**6 max**

**(b)**

11 oxygen carried as oxyhaemoglobin ;
12 four molecules of oxygen per molecule of haemoglobin / four subunits of Hb ;
13 ref. to haem / iron / Fe ;
14 ref. allosteric effect / co-operative binding ;
15 reversible binding ;
16 ref. to dissociation curve / S shaped ; *allow on graph with axes labelled*
17 ref. Bohr effect ;
18 carbon dioxide dissolves in water to form carbonic acid ;
19 ref. carbonic anhydrase (in rbc) ;
20 which dissociates into hydrogen ions and hydrogencarbonate ions ;
21 ref. haemoglobonic acid / HHb and release of oxygen ;
22 hydrogencarbonate passes out of rbc / in plasma ;
23 ref. chloride shift ;
24 some carbon dioxide dissolved in plasma ;
25 ref. carbamino-haemoglobin ;

**10 max**

| | |
|---|---|
| **Content:** | **16** |
| **Quality:** | **4** |
| **Total:** | **20** |

---

MARK SCHEME

Question 8

*(a) Describe the behaviour of chromosomes during meiosis.[10]*

*(b) Explain the similarities and differences between homologous chromosomes.[6]*

---

**(a)**

1 ref. replication of DNA ;
2 each chromosome consists of two (identical) chromatids ;
3 chromosomes shorten / thicken / coil up / condense ;
4 pairing of homologous chromosomes / formation of bivalent / ref. synapsis ;
5 chiasmata / crossing over ;
6 exchange of, (same) length of chromatid / alleles / genetic material / DNA ;
7 orientation of bivalents / homologous chromosomes on equator (at metaphase I) ;
8 ref. random / independent assortment ;
9 ref. to number of possible chromosome combinations / $2^n$ ;
10 idea of whole chromosomes pulled apart ;
11 ref. to role of microtubules / spindle / spindle fibres ;
12 chromosome line up separately (in metaphase II);
13 centromeres divide ;
14 sister chromatids move to opposite poles ;
15 chromatids become chromosomes ; **10 max**

**(b)**

*similarities*
16 have the same genes ;
17 code for the same characteristics ;
18 same loci / genes in the same position ;
19 position of centromeres the same ;
20 same length / size ;
21 look the same / indistinguishable (under microscope) ;

*differences*
22 may have different alleles ;
23 they have different sequence of bases / nucleotides ;
24 each has come from different parent ; **6 max**

**Content: 16**
**Quality: 4**
**Total: 20**

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JUNE 2000

MARK SCHEME

Question 9

*(a) Describe the structure and function of a sensory neuron and a motor neuron in a reflex arc.[8]*

*(b) Explain how a nerve impulse is transmitted across a synapse.[8]*

---

**(a)** *sensory*

1 (single) long dendron ;
2 axon shorter / similar length ;
3 cell body not at end of cell / towards centre of the cell ;
4 in dorsal root ganglion ;
5 impulses / action potentials from receptor / named ;
6 impulses / action potentials to CNS / brain / spinal cord ; } (P) once

*allow following points on diagram if suitably labelled*

*motor*

7 short dendrons / dendrites ;
8 long axon ;
9 cell body at end of cell
10 cell body in the CNS / brain / spinal cord ;
11 impulses / action potentials to muscle / gland / effector ;
12 impulses / action potentials from CNS / brain / spinal cord ; } (P) once.
13 ref. via intermediate / relay / interneuncial neuron ;
14 qualified ref.to synapses ;
15 ref. to myelin sheath / nodes of Ranvier linked to speed of conduction ; **8 max**

**(b)** 16 depolarisation of synaptic knob / presynaptic membrane ;
17 diffusion / movement in of $Ca^{2+}$ / calcium ions into synaptic knob ;
18 vesicles of transmitter / acetylcholine ;
19 fuse with presynaptic membrane ;
20 empty contents into synaptic cleft ;
21 exocytosis ;
22 diffuses ;
23 across synaptic cleft ;
24 (transmitter / acetylcholine) binds to receptor ;
25 on post synaptic membrane ;
26 $Na^+$ / sodium channels opened ;
27 $Na^+$ / sodium ions diffuse / move in ;
28 depolarises post synaptic membrane ;
29 action potential set up / impulse transmitted ; **8 max**

| | |
|---|---|
| **Content:** | **16** |
| **Quality:** | **4** |
| **Total:** | **20** |

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OCR

RECOGNISING ACHIEVEMENT



# Markscheme 9264/5
# June 2000

# MARK SCHEME
## Summer 2000 4815/1, 9264/5

1 **(a)** Tube A: yellow;
opaque; (*acc.* cloudy, turbid, *rej.* ppt, milky, murky, dense)
Tube B: yellow-green; (if same colours are given in A and B allow once)
clear/clearer; (*acc* translucent)
Tube C and D: both blue;
both opaque; (*acc* less opaque in D, clearer in D)

**6**

**(b)** decrease in pH in A (but not in C);
due to production of fatty acids;
by action of lipase;

**3**

**(c)** more acid produced / lower pH in A;
due to greater amount of fat in K1; (*acc* ref to full fat/ skimmed milk)
Or:
decrease in opacity in B;
due to lower initial fat content in K2;

**2**

**(d)** C and D act as controls; (*rej.* fair test)
to show that the change in colour in A and B is due to lipase (enzyme) action;
allows comparison of fat content:

**max 2**

**(e)** K1 rises;

**1**

**(f)** (i) K2 sinks;
drop spreads out less;

**2**

**(f)** (ii) K1 is less dense than K2; (*rej.* lighter/heavier)
due to greater fat content;

**2**

**(g)** (i) correct procedure for Benedict's;;(appropriate volumes: boiled)
and biuret; (approp. volumes and correct order)
two validity points;; (volumes; heating time standardised)
(ii) format of table; (separate results and conclusions, headings)
accurate results in both for sugar;(ppt/sediment/ cloudy)
accurate results in both for for protein;
correct conclusions: sugar similar; (*acc* slight differences either way)
more protein in K2;

**max 7**

**Total: 25**

2 (a) *Drawing:* accurate representation of zone behind cap;
two regions shown behind that;
*Annotations ( in appropriate regions/positions):*
*Behind tip:* small cells;
square;
non-vacuolated;
most frequent mitoses;
*Next:* square cells;
vacuolated;
bigger than those at tip;
few mitoses;
*Furthest from tip:*
rectangular cells;
vacuolated;
largest/longest present;
no mitoses;
*Drawing 2, plus any 5 annotations* **7**

(b) (i) *Drawing:*
four cells, square outlines;
same scale;
two accurate features in each drawing;;;;;;;;
(see examples provided) **9 max**

(ii) correct sequence;; **2**

(c) (i ) cells contain chromosomes;
at different stages of meiosis/cell division;
presence of diads or tetrads; **max 2**

(ii) arrow in correct position; **1**

(iii) genetically identical in K3, different in K4;
diploid in K3, haploid in K4; **2**

**Total: 23**

For Examiner's Use

**Question 2** [50 minutes]

**K3** is a stained longitudinal section of a young root tip.

Examine **K3** carefully using low and high power objectives of your microscope. Note the occurrence and distribution of different kinds of cells in this section.

(a) Make a plan drawing of the entire section, within the outline drawn in Fig. 2.1, to show the different **regions.** These regions result from differences in the *shapes, sizes* and *structure* of the cells as well as in the frequency with which stages of *mitosis* are visible.

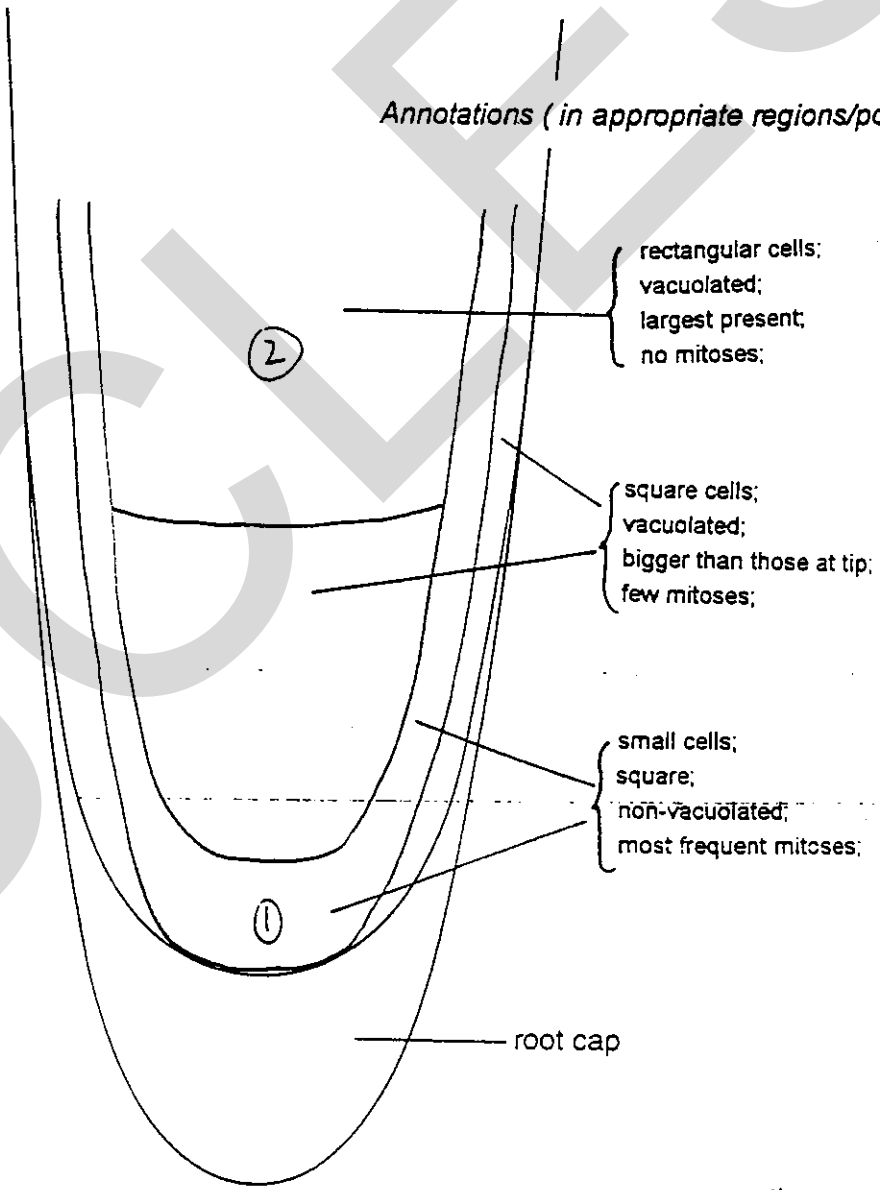
**Do not draw individual cells. Ignore the cells that make up the root cap region.**

**Annotate** your drawing as fully as possible to **describe** the features of the cells in each region that you map.

*Drawing:*

zone (1)shown at apex with some backward extension from it;
area (2) indicated by a line;

*Annotations ( in appropriate regions/positions):*



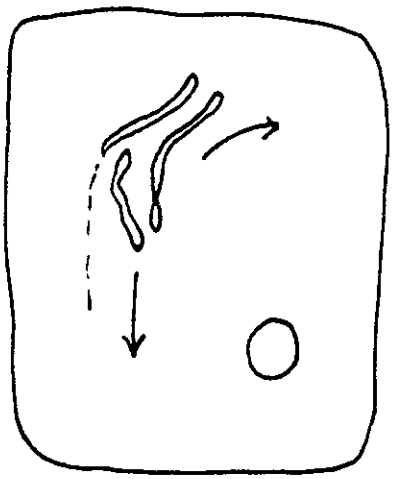

*Drawing 2. plus any 5 annotations*

[7]

Fig. 2.1

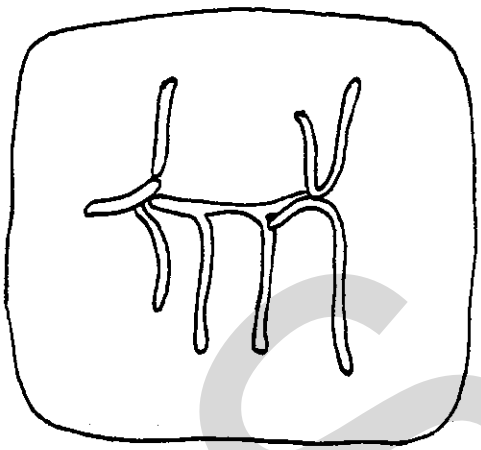
Q2(b)(i) Drawing points: any 2 on each of the following:

1



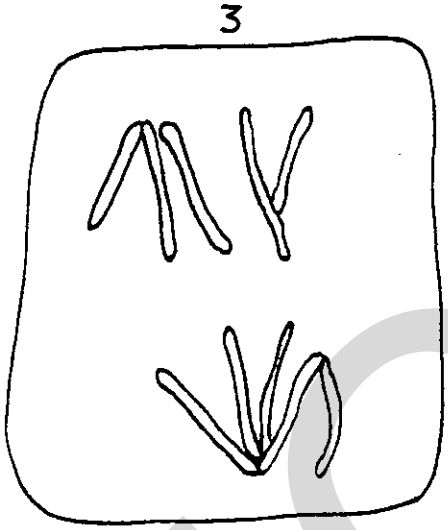
circular group not enclosed by membrane;
random arrangement of threads;
presence of one or two nucleoli;

2



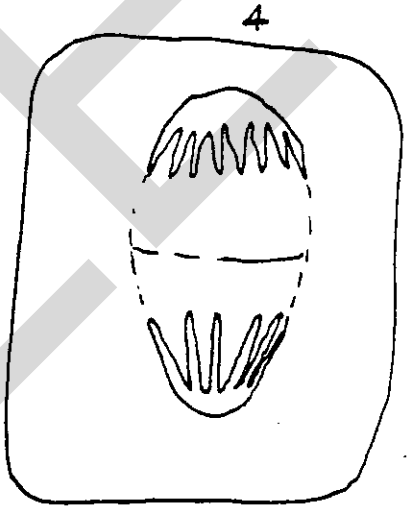
some chromosomes shown as V's or U's;
points towards centre;
connected as a mass;
centromere shown;

3



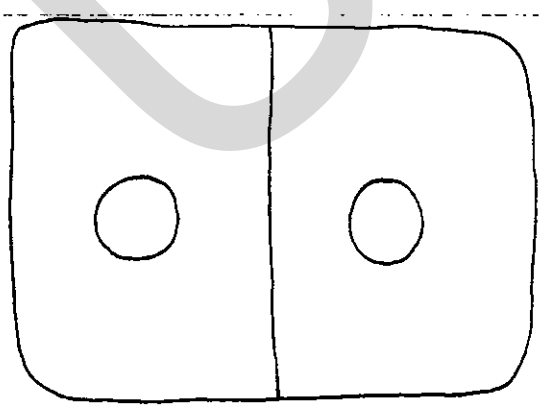
fan-like arrangement;
symmetry between groups;
variation in chromosome length;

4



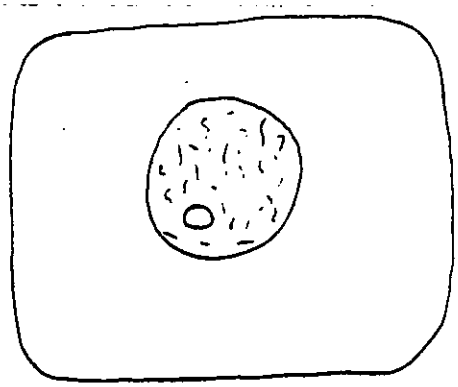
solid mass with arms;
some evidence of a spindle;
and middle lamella;

5



two small nuclei widely separated;
new cell wall;

OR 6



presence of nuclear membrane and nucleolus;
nucleus detail;
(granular/thread appearance);

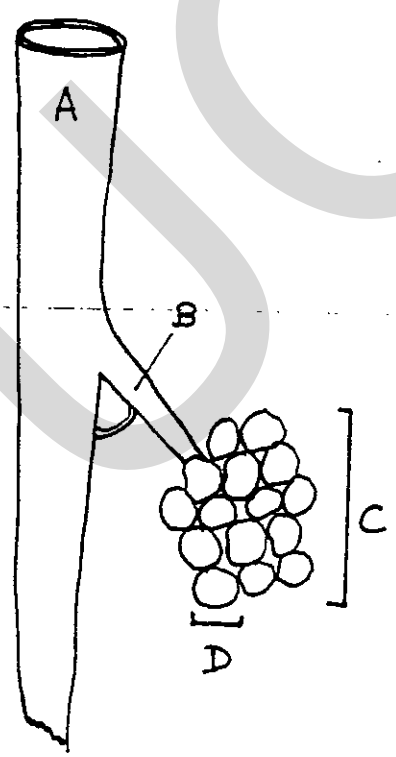
3 (a) *Drawing:* presence of a substantial airway;
shown as a solid structure;
from which a branch (branches) arises;
at an acute angle;
and which is much finer than the main branch (1/2 to 1/4);
blobs shown as a group from a fine branch;
blobs shown to be <u>solid</u> rather than sections: *Any 6*
*Labels:* alveoli (air sacs);
bronchiole; **8**

(b) <u>extensive</u> (*acc* many, network) system of blood capillaries ( vessels);
<u>thin</u> alveolar walls; (*rej.* one cell thick) **2**

(c) three dimensional structure/shape of the alveoli;
<u>number</u> of alveoli connected to a bronchiole;
branching pattern of bronchioles;
aggregation of alveoli into clusters; **max 2**

**Total: 12**

Q3(a)




A – airway
shown as drawing ;

branch;
acute angle;

B – finer than A (1:3);
blobs shown (C) as group;
each as <u>solid</u> (D)

Any 6