

MARKSCHEME

November 2000

BIOLOGY

Standard Level

Paper 2

SECTION A

1. (a) both growth hormones cause an increase in thymine absorption;
GF2 has more effect (at all concentrations) / stimulates more thymine absorption than GF1 /
GF2 cells absorb more thymine (at all concentrations) than GF1 cells;
both cause a sharp increase in thymine absorption at low concentrations;
both level off at high concentrations / reach a plateau; *[3 max]*
- (b) thymine is only found in DNA / specific to DNA;
other bases / A / G / C are also found in RNA as well as DNA / nonspecific; *[1 max]*
- (c) similar to a saturation curve for enzymes;
increased concentration of GF leads to binding / filling / saturation of surface proteins;
when the curve reaches a plateau, the binding sites are saturated;
GF2 binds to the cell more than GF1 / GF2 has more binding sites than GF1 / GF1 does not
bind to the cell as well as GF2;
increased binding of surface proteins increases changes in cell / DNA replication;
binding of low concentration of GF may open specific channels for thymine absorption; *[2 max]*
- (d) no kinase labelled at any concentration of GF2;
amount of labelled kinase increases as concentration of GF1 increases; *[2]*
- (e) GF1 binds to a protein in the membrane so activating kinase and stimulating DNA replication;
GF2 binds to a membrane protein and stimulates DNA replication by a different method / an
unknown method; *[2]*

2. (Award [1 mark] for any of the differences below, up to [2 marks] max. and [1 mark] for each corresponding reason, up to [2 marks] max.; total of [4 marks max])

Differences in structure	Reasons
1. arteries with thicker walls / more muscles / more elastic tissues and veins with thinner walls;	arteries withstand high blood pressure from heart and veins low blood pressure;
2. arteries have smaller lumen / cavity (relative to diameter) and veins with larger lumen;	arteries maintain high pressure, veins store / carry blood at low pressure / blood takes longer to flow through vein;
3. arteries with valves only in aorta, pulmonary artery / no valves and veins have valves throughout;	valves prevent back flow of blood;

3. (a) (i) recessive;
reason: condition jumps two generations and then reappears in G IV / not present in all generations / shows when cousins marry in G III / two unaffected parents (GIII 1 & 2) have affected children; [2 max]
- (ii) not sex linked;
reason: affects both males and females (in G IV); [2]
- (b) G II: 2 and 3 and 4 must all be heterozygous / Aa;
G III: 1 and 2 must both be heterozygous / Aa; [2]
(Do not award the first mark if any of the others in generation II are shown heterozygous)
(Do not award the second mark if any of the others in generations III or IV are shown heterozygous)

SECTION B

Remember, up to TWO “quality of construction” marks for the essay.

4. (a) (Award [1 mark] for any of the below if clearly labelled and accurately drawn)
- vagina;
 - uterus / endometrium / myometrium;
 - ovary / ovaries;
 - oviduct / fallopian tubes / funnel / infundibulum;
 - cervix;
 - clitoris / vulva;

[4 max]

- (b) **processes:**

- first stage of birth / labor involves a series of involuntary contraction of the uterus;
- dilation / opening of cervix;
- breaking of waters / amniotic fluids;
- delivery / release of baby through birth canal / vagina;
- cutting of umbilical cord;
- afterbirth / release of placenta from uterus;

hormonal controls:

- drop in oestrogen / progesterone levels;
- stimulates release of oxytocin;
- oxytocin made in posterior pituitary / causes contractions of uterus;
- pressure of baby on cervix stimulates release of more oxytocin / positive feedback;
- prostaglandins increase contractions of uterus / myometrium;

[6 max]

- (c) **variation:**

- two parents with different alleles / genes;
- chromosomes separate randomly (in meiosis) to form gametes / haploid cells;
- $2n$ combinations of chromosomes in gametes (where n = haploid number) / specific example of combinations possible for a given number of chromosomes;
- each gamete with different combinations of alleles / genes / chromosomes;
- random mating;
- each fertilisation with different combinations of alleles from each parent / siblings all different;
- mutations;

advantages of variation:

- potential overpopulation leads to struggle for survival / competition;
- more chance of survival of some offspring and thus the species with variation;
- more survivors reproduce and pass on genes;
- more likely some (offspring) survive under changing conditions;
- natural selection leads to best adapted surviving to breed / survival of species;

[8 max]

Remember, up to TWO “quality of construction” marks for the essay.

5. (a) (Award [1 mark] for any of the below with a maximum of [5 marks] for needs; up to [7 marks max])

needs: light / solar energy;
water;
carbon dioxide;
enzymes;
chlorophyll;
correct light intensity / colour;
correct temperature;

products: oxygen;
carbohydrates / sugars / glucose;
increased biomass;
ATP;

(b) definition of organic compounds / identification of three biochemical groups;
carbohydrates have about the same amount of energy content as proteins;
fats / lipids have twice the energy content of CHO / proteins;
fats and CHO are the usual sources of energy / stored forms for organisms;

[3 max]

(c) valid example of energy conversion *e.g.* light to chemical energy;
food chain obtains energy from light / solar energy;
autotrophs / producers / plants capture / convert solar to chemical energy / organic compounds / biomass;
biomass / chemical energy used for energy of growth / respiration / cell activities by plant;
energy transfer to heterotrophs / herbivores / primary consumers to carnivores / secondary consumers;
energy transfer never 100%;
energy transfer usually 10-20%;
energy loss limits the length of food chains;
energy transfer always involves heat loss;
heat lost in transfer is not recycled / lost from ecosystem;
energy ingested by primary consumers is greater than by secondary consumers, *etc.* / energy pyramid;
wastes from one organism may provide energy for decomposers / detritivores / saprotrophs;

[8 max]

Remember, up to TWO “quality of construction” marks for the essay.

6. (a) (Award [1 mark] for any of the below if clearly represented; up to [5 marks max])

cell (surface) / plasma membrane;
cell wall;
(slime) capsule;
flagellum;
plasmid;
naked nucleic acid / nuclear material / nucleoid region / circular DNA;
cytoplasm;
pili;
mesosome / photosynthetic lamellae;
ribosomes;

(b) isolating plasmids / small circles of DNA from bacteria;
use of (restriction) enzyme to cut the DNA at a given base / nucleotide sequence / target sequence;
DNA fragments / genes isolated from donor organism;
split the DNA fragment of host organism with **same** restriction enzyme;
DNA fragments added to open plasmid;
ligase enzyme used to join together the DNA and plasmid;
recombinant plasmids inserted into host cells / bacteria / yeast / humans / other organism;
identification to determine if new DNA present;
cloning to get many copies;

[5 max]

(c) genetic screening is testing for the presence or absence of a gene / allele;
screening looks for markers associated with a particular gene, false results possible;
used to test for genetic diseases;
used for identification of family relations in immigration disputes;
confirmation of animal pedigrees;
used to produce animals / organisms with precise conditions;
breed out diseases / alleles;
used in prenatal diagnosis;
used to identify the sex of offspring;
ethical issue of use of abortion when problem identified;
ethics of selection of certain organisms *e.g.* euthanasia;
identification of people with certain diseases may lead to being stigmatised for jobs / insurance;
DNA profiling used for very accurate identification of genetic constitution;
identification of disease / property can be followed by gene therapy;
value of knowledge gained from genetic screening depends on whether it is a curable or incurable disease;
example of gene therapy *e.g.* cystic fibrosis, SCID;
other valid statements;

[8 max]
