

MARKSCHEME

May 2000

BIOLOGY

Standard Level

Paper 2

SECTION A

1. (a) X endoplasmic reticulum; [1]
Y mitochondria; [1]
- (b) nuclear membrane clearly labelled; [1]
- (c) ATP as mitochondria present;
carbon dioxide as mitochondria present;
protein as rough ER present; [2 max]
- (d) normal level / level at start and finish is lower in I than II;
level in I is always below renal threshold but above it in II;
level increases less after ingestion of glucose in I than II;
level takes less time to return to normal in I than II; [2 max]
- (e) person I because the glucose level remained below the renal threshold;
person I because the glucose level was brought back down more quickly; [2 max]
- (f) glycogen granules; [1]
2. (a) $C^r C^r$, $C^w C^w$ **and** $C^r C^w$ [1]
- (b) in peas red allele is dominant but in *Mirabilis jalapa* red and white are co-dominant; [1]
- (c) both sets of gametes shown as C^r and C^w ;
all four genotypes shown correctly;
phenotype shown correctly for each genotype; [3]
3. (a) algae → fish → seals → vultures; [1]
producer → primary consumer → secondary consumer → tertiary consumer; [1]
(allow herbivore for fish, first level carnivore for seals and second level or top carnivore for vultures; [1])
- (b) shortage of fish to eat / shortage of space for breeding; [1]
- (c) overfishing by tourists (affecting seal food supply);
injury / infection / death of seals as a result of lost fishing tackle;
pollution from the boats / hotel / tourists;
noise from boats / disturbance from swimmers / visitors to beach / island; [2 max]

SECTION B

(Remember, up to TWO 'quality of construction' marks per essay)

4. (a) passive movement;
movement of water / solvent;
across a semipermeable / selectively permeable membrane;
from lower to higher solute concentration / higher to lower water concentration; **[4 max]**
- (b) excretion;
removal of toxic waste products (of metabolism from the body);
waste products removed from blood and put into urine;
urea / other named example of a waste product;
osmoregulation;
control of osmotic / water potential;
prevents the blood / body fluids from becoming too concentrated / dilute **[5 max]**
- (c) good solvent / most substance dissolve in it;
many substances dissolved / many reactions take place in **cytoplasm**;
- high specific heat capacity / *(words to that effect)*;
water heats up and cools down slowly;
easier to maintain constant body temperature;
water is a habitat for many organisms;
temperature of ponds / rivers / sea is (relatively) stable;
- high latent heat of vaporisation / *(words to that effect)*;
water used as a coolant in sweating / transpiration;
- water is liquid at most temperatures on Earth;
can be used as a transport medium as in blood / xylem / phloem;
- water molecules form hydrogen bonds with each other;
water molecules are cohesive;
xylem transport / transpiration stream based on cohesion;
surface tension of water;
possible for organisms to live on the surface of water (despite being denser);
- water is transparent;
light passes through the leaf to the chloroplasts / the eye to reach the retina;
- water is incompressible;
used in hydrostatic skeletons / amniotic fluid / turgid plant cells; **[9 max]**

(Remember, up to TWO 'quality of construction' marks per essay)

5. (a) trachea shown with cartilage rings and labelled;
bronchi **and** bronchioles shown and labelled;
two lungs shown and at least one of them labelled;
diaphragm shown with a dome shape and labelled;
ribs **and** intercostal muscles shown and labelled;
pharynx mouth and nasal passages shown (labels not needed); **[5 max]**
- (b) gas exchange is carried out in the alveoli;
wall of the alveolus is very thin / one cell thick;
blood capillaries run over the surface of the alveoli;
gas exchange is carried out using diffusion;
concentration gradients between the air in the alveolus and blood in the capillary;
oxygen from air / alveolus to blood and carbon dioxide from the blood to air / alveolus;
role of moist lining of alveolus in dissolving gases; **[5 max]**
- (c) the larger the size the smaller the surface area to volume relationship;
example of surface areas and volumes for cubes / other shapes of different sizes;
if a cell becomes too large it cannot absorb oxygen / CO₂ (in plants) fast enough;
if a cell becomes too large it cannot absorb foods / nutrients fast enough;
if a cell becomes too large it cannot excrete waste products / CO₂ fast enough;
diffusion in the cell becomes too slow;
centre of the cell is too far from the membrane;
nucleus cannot control a cell above a certain size;
heat not lost quickly enough;
not enough mRNA / proteins / enzymes produced;
large cells may be structurally weak;
cell wall / membrane provides support;
larger blood cells would not fit through capillaries;
sperm / large cells might not move quickly enough;
having many small cells allows differentiation; **[8 max]**

(Remember, up to TWO 'quality of construction' marks per essay)

6. (a) to identify all the genes in the human genome;
to find the base sequences of all the human genes;
to help understand genetic diseases;
to help develop tests for genetic diseases;
to study the variation between humans;
to help us understand ourselves more fully;
to help develop pharmaceuticals based on DNA sequences; **[3 max]**
- (b) base substitution is changing one base to another in a gene;
a new allele of the gene is produced;
mRNA transcribed from the gene will have one base substitution;
one polypeptide / protein may have one amino acid substitution;
the polypeptide / protein may function differently;
the phenotype of the individual may be different;
sickle cell anaemia / other example;
GTG to GAG / other;
valine to glutamic acid / other;
structure of haemoglobin affected;
haemoglobin molecules link together (at low oxygen levels);
red blood cells become distorted / sickle shape / anaemia;
malaria resistance in heterozygotes; **[9 max]**
- (c) faulty gene replaced by correct / working version;
correct protein / enzyme can then be made;
only works if faulty version is recessive;
SCID / cystic fibrosis / other named example where gene therapy could help;
correct / working version of the gene needs to be obtained (from another person);
many copies of the correct / working version must be made;
introduction to cells using viral vector / liposome;
must be done in many cells affected in child / adult to be effective;
if done at gamete / zygote / early embryo stage all cells might inherit the working version; **[6 max]**
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