

## MARK SCHEME for the October/November 2007 question paper

<b>5090 BIOLOGY</b> 5090/02      Paper 2 (Theory), maximum raw mark 80
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This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began.

All Examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes must be read in conjunction with the question papers and the report on the examination.

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### Section A

- 1 (a) (i) xylem only shaded (A shaded on only one vascular bundle);  
(ii) correctly named (Ignore 'vessel'); [2]
- (b) transpiration/evaporation;  
water/vapour + lost from leaf/stomata/plant;  
pulls/draws/pushes + water/solution  
(R sucks) OR water (from transpiration) must be replaced;  
ref. capillarity/root pressure AW/cohesion AW/adhesion AW; [max. 3]
- (c) diffusion (R if osmosis mentioned with diffusion, ignore active transport);  
ref. concentration gradient;  
through (cellulose) cell walls;  
cell wall permeable;  
(A partially/selectively)  
cell membrane is a p.p.m./allows molecules of dye to pass; [max. 3]  
(R if in osmosis context)
- (d) osmosis/diffusion;  
water leaves cells;  
water loss from plant or from plant part named;  
salt solution more concentrated than cell sap/ref. water potential  
(R refs to quantity of water rather than concentration) gradient;  
plant wilts or described e.g. refs flaccidity/loss of turgor/of support ; [max. 3]  
(A drooping, R withering)
- 2 (a) (i) substrate/s;  
(ii) product/s; [2]
- (b) (i) protein (A casein);  
(ii) protease/pepsin/proteolytic (A rennin if casein given above); mark  
(iii) (poly)peptides/peptones/proteoses (A amino acids); independently [3]  
(this mark not available with casein/rennin option)
- (c) graph rises;  
reaches peak between 35 and 55 °C;  
falls to zero between 50 and 80 °C; [3]  
(A vertical drop, R incurving drop)
- (d) (i) active site/place where substrate fits AW (R lock / key); [1]  
(A region/area) (A place where reaction occurs)
- (ii) lock and key (A words in a description); [1]

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3 (a) Mark the first, one per line, any **three** from:

cleaner, at or near body temperature (A higher temp./warmer),  
more CO<sub>2</sub>, less O<sub>2</sub>, more moisture AW (A saturated);;  
(Ignore pathogens) [3]

(b) (external) intercostal muscles relax;  
diaphragm relaxes;  
ribs / thorax moves down/in;  
diaphragm domes AW;  
decreased volume/increased pressure; [max. 4]

(c) *There are two routes to the two marks in this section*  
*Route 1: respiration ;*

production of carbon dioxide/removal of oxygen (A oxidation)/  
release of energy or heat/release of water  
(R produce/generate etc.)  
(A points on equation in words or symbols – need not be balanced);

*Route 2: named specific cell (e.g. RBC);*

The effect of this cell on a the content of the air in the jar; [2]  
(e.g. collects/carries away AW O<sub>2</sub>) (Ignore refs CO<sub>2</sub> and RBCs)

4 (a) iron/Fe;

(b) *If the column headed 'mammals' is left blank, or if there is a clear, but inaccurate, attempt to describe mammal (as opposed to human) RBCs, then all three marks are available for correct statements re. bird RBCs .*

*All comparisons must be valid pairs (R oval v. biconcave)  
Mark each line separately, (R refs. to haemoglobin/surface area)*

( A longer) ( A shorter)  
Any 3 from: nucleus + no nucleus, larger in size/smaller in size ,  
larger than WBCs +smaller than WBCs, oval/egg-shaped + round isc,  
biconvex/not biconcave + biconcave, ( R spherical);; [3]

(c) (i) capillary,; [1]

Any **two** from: blood cells in single file AW, running between body cells, walls thin/permeable/one cell thick, substances pass through (at C), vessels in the form of a network,;; [2]

(ii) tissue fluid/ECF/lymph/plasma/interstitial fluid ( R blood); [1]

(iii) pulse beat + in arteries/arterioles;  
greater pressure in arteries/lower pressure in veins;  
ref. arteries or D nearer heart/pump/ventricle;  
blood flows smoothly/no pulse + in veins/venules;  
resistance offered by capillary network;  
fluid lost from network; [max 3]

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- 5 (a) ovary (wall)/pericarp/stigma or style remains or scar; [1]  
(A epi-/meso-/endo-)
- (b) 'Mark explanation' column only if stated 'type of reproduction' is correct for that plant  
sexual for bean **and** maize;  
(fruits or seeds) develop from flowers/ovaries/ref. fertilisation/pollination/ref. gametes or  
meiosis;  
(A with ref. either bean or maize)  
asexual for potato;  
(A no meiosis)  
tubers develop from stems or buds (A roots)/only mitosis/no fusion/fertilisation/pollination/  
gametes/not from flowers; [4]
- (c) bacteria or named;  
in root nodules;  
N<sub>2</sub> fixing (or process described);  
part of nitrogen cycle;  
(increases) nitrates in soil;  
needed to make proteins/amino acids;  
for plant growth; [max. 4]

[Maximum for Section A = 50]

### Section B

(Marks allowed anywhere on annotated diagrams)

- 6 (a) (i) remove urea/nitrogenous waste/uric acid (R urine);  
salts/minerals/ions/toxins/hormones;  
excretion;  
water + in excess/ref. osmoregulation;  
(filtration) from blood;
- (ii) carries urine;  
from bladder + to outside;  
seminal fluid/sperms; [max. 5]
- (b) connected to patients circulatory system/blood through machine;  
(along)  
blood + passed through partially (etc.) permeable/dialysing tube;  
(R if blood is passing through the wall of the tube – Ignore named membrane)  
diffusion/differential conc. solutes in bathing fluid/fluid renewed;  
of excretory/waste products/urea [see list for (a)(i)];  
salts/small molecules [see (a)(i) list];  
from blood;  
large molecules (or named) stay in bloodAW;  
ref bathing/washing/dialysing fluid; [max. 5]

[Total: 10]

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- 7 (a) [A anywhere in (i), (ii), or (iii)]  
 ref impulses;  
 (all linked via) synapses;
- (i) (sensory) from receptor/sense organ or named (A skin);  
 (A nerve endings) (R finger)  
 to CNS/brain/spinal cord;
- (ii) (motor) from CNS/brain/spinal cord;  
 to effector or named;
- (iii) in the grey matter/within CNS or specified part;  
 from sensory to motor; [max. 6]
- (b) (reflex actions) (external) stimulus or named e.g.;  
 protective/always the same response;  
 (A immediate)  
 do not have to be learnt/automatic/instinctive/involuntary AW  
**OR** (for deliberate) controlled/ref. decision/conscious/voluntary;  
 Rapid **OR** slow(er) for deliberate;  
 (deliberate) (always) involves the brain; [max. 4]
- [Total: 10]

- 8 E light\*;  
 trapped AW by chlorophyll;  
 in plant cells/chloroplasts;  
 (for) photosynthesis;  
 converted to chemical energy/energy stored in organic molecule;  
 named\* organic molecule;  
 eaten (by person);  
 organic molecule digested/ref enzyme action;  
 absorbed + from gut/named part of gut;  
 carried in blood ;  
respiration/oxidation;  
in muscle (cells);  
 release of energy\* (R production/manufacture etc.);  
 for (muscle) contraction; [max.10]
- (\* = A on equation – as words, symbols or formulae)
- [Total: 10]

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**8 O** named antibiotic;  
 fungus/bacterium (need not be linked to name);  
 fermenter (or described);  
 sterilised (R cleaned);  
 to prevent contamination AW;  
 substrate/nutrient medium/culture medium (or constituents named);  
 containing carbohydrate (or named) + respiration/ref energy;  
 protein/amino acids + for growth;  
 paddles for stirring or reason for stirring;  
 supply of oxygen/air;  
 sparger/bubbles/large surface area (of O<sub>2</sub>);  
 temperature control (A 25 – 45°C if given);  
 removal of CO<sub>2</sub>/pH control (A pH 5 – 8);  
 maximum/increased rate of growth;  
 extraction/filtration/purification/crystallisation;

[max 10]

**[Total: 10]**