CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary Level and GCE Advanced Level

MARK SCHEME for the October/November 2012 series

9700 BIOLOGY

9700/21 Paper 2 (AS Structured Questions), maximum raw mark 60

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, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge will not enter into discussions about these mark schemes.

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Mark scheme abbreviations:

;	separates marking points
/	alternative answers for the same point
R	reject
A	accept (for answers correctly cued by the question, or by extra guidance)
AW	alternative wording (where responses vary more than usual)
underline	actual word given must be used by candidate (grammatical variants excepted)
max	indicates the maximum number of marks that can be given
ora	or reverse argument
mp	marking point (with relevant number)
ecf	error carried forward
I	ignore

1 (a) *one mark per row*
penalise once for stated ecf and then mark to max 4 [6]

	name of organelle	function
A	*cell surface membrane*	*control of movement of substances into and out of the cell*
B	nucleolus	production of, ribosomes / rRNA / tRNA ;
C	mitochondrion **A** mitochondria	one from ; aerobic respiration ATP synthesis/ production / AW link reaction Krebs cycle oxidative phosphorylation **R** produces energy / ATP energy
D	smooth endoplasmic reticulum **R** SER or smooth ER	lipid / sterol / cholesterol / steroid, synthesis ; *ecf if SER, or Golgi is named organelle*
E	rough endoplasmic reticulum **R** RER or rough ER	one from ; protein / polypeptide, synthesis translation modification of protein / described (e.g. folding, glycosylation) protein transport (to Golgi) *ecf if RER*
F	Golgi (body / complex /apparatus)	one from ; modification of protein glycosylation / described modification of lipid pack(ag)ing (of), protein / lipids production of, (Golgi / secretory) vesicles / lysosomes ***ignore*** synthesis of protein *allow ecf if smooth endoplasmic reticulum*
G	lysosome *or* Golgi / secretory, vesicle	contains /storage of, hydrolytic / digestive, enzymes *or if Golgi vesicle* transfer / transport, of, protein / lipids ;

(b) *max 3 if only structure or only explanations given*

polysaccharide ;

chains of α-glucose (residues) ; *only need α once*
α1–4 glycosidic bonds / links ;

branches ;
(because of) α 1–6 glycosidic bonds ; *only need glycosidic once*

idea that many 'ends' to easily, add / remove, glucose ;
compact / AW ;
insoluble ;
will not affect, water potential / ψ ; AW
AVP ; [max 4]

[Total: 10]

2 (a) (i) 1 diffusion through (freely permeable) cell wall;
2 membrane is partially permeable ; **A** selectively
3 osmosis across membrane (into cell)
4 (only) some water may pass between phospholipids (across membrane);
5 movement across membrane facilitated by aquaporins ;

6 ref. down water potential gradient / from high water potential to low water potential; **A** from a higher / to a lower, water potential *if in context*
7 AVP ; e.g. further detail about aquaporin (hydrophilic channel) [max 3]

(ii) 1 increases permeability of membrane to water ;
2 *idea that* osmosis across bilayer does not supply cell rapidly enough with water (that needs to pass on to surrounding cells) ;
3 *idea that* phospholipids are relatively impermeable to water ;
4 *idea that* water cannot pass / only some water passes, through <u>hydrophobic</u> region of membrane / AW ; [max 1]

(b) pathway via, cells of cortex / cortical cells, and endodermis / endodermal cells ;

symplast pathway, described as
cytoplasm <u>and</u>, plasmodesmata / vacuole(s) ;

(out of cell to) apoplast pathway, described as
cell wall pathway ;

Casparian strip / suberised cell wall, of endodermis, impermeable to water ;
(so) pathway only via, symplast / cytoplasm ;

AVP ; e.g. reference to pericycle
reference to passage cells of endodermis
vacuolar pathway *(unless given in mp 2)* [max 3]

(c) **(i)** stomata are open (to absorb carbon dioxide for photosynthesis) ; ora [1]

(ii) rate of transpiration, (almost) always / AW, higher / higher at night, in A / mutant plants ; ora
A *expressed in terms of water loss*
at night only cuticular transpiration / no stomatal transpiration ;
idea that during day stomatal transpiration same for both ;
(so) differences because of less effective cuticle ;
comparative data quote ; [max 3]

[Total: 11]

3 **(a)** **(i)** **K** – (DNA) replication / synthesis / described ;
L – cytokinesis / cytoplasmic division / cell division ; [2]

(ii) 3 ; [1]

(iii) remain the same / stays constant / stay at 46 / AW ; *ignore description of events occurring before and during mitosis* [1]

(b) transcription (of specific genes) ; **A** reference to gene switching
protein / polypeptide, synthesis ; **A** translation
production of haemoglobin ;
further detail ; e.g. assembly of quaternary structure
(production of) carbonic anhydrase ;
loss of, mitochondria / named organelles ;
loss of nucleus ;
adopts biconcave disc shape ; [max 3]

(c) occurs in both primary and secondary (immune) responses ;
selected / specific / AW ;
lymphocytes / B -cells / T-cells / divide (by mitosis) ;
clonal expansion / described in terms of producing, clone / many cells ;
A *idea that* different types of immune cell can result
reference mitosis in memory cells (for rapid) secondary response ; [max 3]

(d) *T helper / Th,*
secrete, cytokines / interleukins ;
activate B-lymphocytes to, divide / form plasma cells ; **A** idea that leads to enhanced antibody levels
enhances / AW, phagocyte / macrophage, response ; **A** angry macrophages ;

T cytotoxic / Tc / T killer / Tk
attach to / kill / AW, infected cells / damaged cells / tumour cells / cells with non-self antigens / AW;
mechanism of killing ; e.g. perforin

T memory / Tm
already exposed to antigen ;
reference to role in secondary response ;

AVP ; ; e.g. T suppressor cells
function of suppressor cells [max 3]

[Total: 13]

4 (a) *ignore reference to, first / third / fourth, trophic level*

(primary) producer ;
secondary consumer ; **A** second / 2°, consumer
tertiary consumer ; **A** third / 3°, consumer [3]

(b) 1 polar bear is, tertiary / quaternary consumer / top carnivore ; **A** in fourth / fifth, trophic level
2 feeds (only) on ringed seals ;
3 therefore limited, food / energy, supply ;
4 reference to ringed seals competing for food / food for seals shared with, others / named ;
5 reference to energy loss, within / between, trophic levels ; **A** approx 90% loss from one trophic level to the next
6 any two examples of, energy / heat, loss in lower trophic levels ; e.g. heat loss from, respiration / movement / digestion / excretion / egestion / indigestible parts / to decomposers / death but not eaten [max 4]

(c) *decrease in population of Arctic cod so higher trophic levels*
1 less, food / energy, (for consumers of cod / higher consumers) ;
2 more competition for food ;
3 consumers / named consumers, of cod feed on other levels ;
4 starvation / decrease in population / extinction(s) (of other species) ;
5 migration to areas where food is more plentiful ;

lower trophic levels
6 increase in numbers of
either, copepods / AW *or*
arrow worms / AW ;
7 (so) decrease in population of phytoplankton ; *only if mp 4 not scored*
8 (so) increased competition with bivalve molluscs ; *only if mp 2 not scored* [max 3]

[Total: 10]

5 **(a)** *closed* blood travels, inside blood vessels / AW ;
double blood travels through the heart twice during one, complete circuit / circulation of the body ; AW
A pulmonary and systemic, systems / circuits [2]

(b) **P** to right atrium ;
Q to (semilunar) pulmonary or aortic valve ;
R to, vena cava / pulmonary artery ;
S to, septum / wall(s) of ventricles ; [4]

(c) **(i)** 75 (beats per minute) ;;

if incorrect answer or no answer allow one mark for extraction from Fig. 5.2 or for correct working
e.g.10 beats in 8 seconds
10/8 × 60 [2]

(ii) *max 3 if only description or only explanation given*
lowest pressure in aorta, is 10.8 kPa / varies between 10.8-11.2 kPa v in left ventricle is 0 KPa ;
difference between highest and lowest is greater in the ventricle / AW ;
4.8 – 5.2 kPa for aorta, 16.0 kPa in left ventricle ;

reference pressure differences (in left ventricle) as a direct result of ventricular systole and diastole ;
semilunar / aortic, valve prevents backflow from aorta into ventricle ;
(so) no / little, blood in ventricle, when fully contracted / AW ;
elastic recoil of artery maintains (diastolic) blood pressure ;
AVP ; [max 4]

(d) **(i)** coronary arteries ; [1]

(ii) insufficient, glucose / oxygen (to, cardiac / heart, muscle) ;
angina ;
heart attack / myocardial infarction / cardiac arrest ;
description of anaerobic conditions in muscle ; [max 1]

(e) coronary (artery) by-pass (graft) operation ;
R by-pass *unless qualified*
A described
insertion of a (coronary) stent ; **A** described
heart transplant ;
angioplasty ; **A** described
AVP ; e.g. calcium-channel blockers / named
further detail of treatments e.g. anticoagulants after angioplasty [max 2]

[Total: 16]