

**CAMBRIDGE INTERNATIONAL EXAMINATIONS**

Cambridge International Advanced Subsidiary and Advanced Level

**MARK SCHEME for the October/November 2014 series**

**9700 BIOLOGY**

**9700/22**

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

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### Mark scheme abbreviations

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

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- 1 (a) *mp 1 for naming the cell types in the epithelium*  
*cell names not required for mps 2 and 4*
- 1 goblet cells and ciliated epithelial cells ; **A** ciliated cells  
*goblet cells*
- 2 produce / **AW**, mucus ; **R** ciliated cells produce mucus
- 3 mucus, traps / **AW**, pathogens / **AW** ;  
*treat, dust / particles, as neutral unless qualified*  
*e.g. allergens / asbestos dust can be credited*
- ciliated (epithelial) cells*
- 4 cilia / ciliated cells waft / move mucus to back of throat / away from lungs / to be swallowed ;  
**A** away from alveoli / gas exchange system  
**R** goblet cells waft  
**R** *idea that cilia present all the way to the stomach*  
**R** *idea that whole ciliated cells move* [max 3]
- (b) *in context of smooth / involuntary muscle*  
need a large supply of / **AW**, ATP / energy ;  
so able to synthesise large supply of ATP ; **R** energy  
energy / ATP, for muscle / contraction ; [max 1]
- (c) bronchi / bronchus, and trachea ; [1]
- [Total: 5]**
- 2 (a) **X** = transpiration ; **A** evaporation  
**Y** = nitrification ; **A** oxidation [2]
- (b) *Nitrosomonas / Nitrobacter / Nitrococcus / Nitrosococcus* ; [max 1]
- (c) *stomata, open / are open*  
stomata open for, gas exchange / entry of CO<sub>2</sub> ;  
inevitable consequence of gas exchange ;  
water potential gradient between (inside) leaf and atmosphere ;  
diffusion of water vapour out (of leaf) from high to low water potential ;
- occurs even if stomata closed*  
water is lost through, cuticles / lenticels ;
- balance between disadvantage and plant requirements*  
*idea of maintains transpiration pull, qualified ; e.g. to bring ions / for water for*  
*photosynthesis / to replace water lost / to maintain turgidity*
- I** cooling effect [max 1]

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(d) *treat as neutral smaller leaves/less SA*  
*any two from*

sunken ;  
 in pits / in grooves / in crypts ;  
 fewer (per square unit of area) ;  
 only on the lower surface / underside ; **ora**  
 closed during the day ;

} stomata

curled / rolled / folded inwards ;  
 needle-like ; **I** spines / thorns

} leaves

thick cuticle ;  
 trichomes / hairs ;  
 epidermis / hypodermis, has layers ;  
 thick walled epidermal cells ;  
**AVP** ; e.g. secretion of resins

} other

[max 2]

(e) 1 active transport / uptake ; **A** description  
**A** facilitated diffusion (*may occur in initial stages*)

2 carrier protein ; **A** for active transport and facilitated diffusion  
 transmembrane / integral / intrinsic / transport  
**A** protein pump *only with active transport*  
**A** channel protein *only with facilitated diffusion*

3 specific membrane protein / binding site ;

4 hydrophobic core / fatty acid tails / phospholipid bilayer prevents entry ; [max 2]

(f) **I** *descriptions across the root, e.g. symplastic and apoplastic route*  
**I** *ref. to hydrostatic pressure*

1 nitrates dissolved in water ;

2 in an apoplastic / a non-cytoplasmic route (in xylem) ;  
 3 passive (transport) / does not require energy ;  
 4 transpiration pull / idea of column of water pulled up ;

} describe

5 movement of water out of xylem creates tension ; **A** negative pressure

6 cohesion of water molecules / explanation in terms of  
 hydrogen bonding ;

} explain

7 adhesion of water molecules to cellulose / lining ; **I** lignin

8 **AVP** ; e.g. water potential gradient root to leaf  
 mass flow caused by evaporation [max 4]

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- (g) in bases / adenine / cytosine / guanine / uracil ; **R** thymine  
**A** A, U, C, G  
**A** purines / pyrimidines [1]

[Total: 13]

- 3 (a) blood is in vessels / blood is in heart, arteries, veins, capillaries ;  
*any three*  
 pulmonary and systemic circulations / described  
**or**  
 blood passes through heart twice for one circuit round the body / **AW** ; [2]

- (b) 1 globular (shape) ; **A** rounded / spherical **R** circular  
 2 hydrophilic, amino acids / R-groups, face cytosol  
**or**  
 hydrophobic, amino acids / R-groups, to the interior ; **AW**  
 3 (so) soluble **or** dissolved in cytoplasm / cytosol ;  
 4 *ref. to* haem / prosthetic (group) / porphyrin (ring) /  $Fe^{2+}$  ferrous ion / iron (ion), binding oxygen ; **R** forms bonds with  
 5 four polypeptides / haems / **AW**, so 4 oxygen molecules / 8 oxygen atoms ;  
**A** four polypeptides, each carrying an oxygen molecule /  $O_2$   
 6 cooperative binding / allostery / described ;  
 7 **AVP** ; e.g. tertiary structure allows association of prosthetic group [max 4]

- (c) 13–15% ;;  
*one mark for correct data extraction*  
 96 / 97% at sea level and 82 / 83% at altitude [2]

- (d) 1 more haemoglobin (molecules) / Hb ;  
 2 *idea of* compensation ; e.g. for decreased saturation of haemoglobin as less oxygen available so more can be taken up / transported so tissues receive same / sufficient concentration of oxygen [2]

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- (e)
- 1 reduces (rate of enzyme activity) ;
  - 2 binds at a site on the enzyme other than at the active site/allosteric site ;
  - 3 change in tertiary structure ;
  - 4 change in shape/conformation/configuration of active site ;
  - 5 substrate unable to bind/product unable to form/ES complexes do not form/fewer ESC ;
  - 6 **AVP** ; e.g.  $V_{\max}$  not reached/increasing substrate concentration no effect [max 3]

(f) *accept Hb for haemoglobin throughout*

- 1 carbon monoxide binds to Hb/Hb has higher affinity for CO than O<sub>2</sub> ;  
**A** carboxyhaemoglobin forms (heavy smoker)
- 2 (with CO) Hb reaches lower % saturation/lower percentage saturation (after 3.6–, 4.0–4.2 kPa) ;  
**A** correct figures quoted  
**R** lower saturation at all partial pressures of oxygen
- 3 less oxygen taken up, in lungs/at higher partial pressures  
**or**  
reduces the volume of oxygen transported ; **AW**
- 4 below 3.6–4.2 kPa (with CO), curve shifts to left/Hb has (relatively) higher saturation ;
- 5 less oxygen unloaded at lower partial pressures/in tissues ;
- 6 heart rate increases to deliver sufficient oxygen ;
- 7 *ref. to* insufficient oxygen to heart muscle and effect on people with CHD ; [max 3]

**[Total: 16]**

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4 (a) (i) *neutral points = poor diet / poor living conditions*

*look for comparative statements*

***A** points if both sides are compared even without ref. to high or low economic country  
if not comparative, **A** if stated as low (or high if **ora**) economic status country  
max 1 if no points stated as low or high but all points themed as low or high*

*points below are for low economic status countries – **ora** for high*

poor sanitation ;

*water*

no / poor water treatment

**or**

*ref. to unable / do not know to boil water ;*

no bottled water

**or**

have to drink contaminated / unsafe / unclean water ;

*sewage*

inadequate / poor treatment of sewage

**or**

sewage contamination of crops ;

*medical*

no / poor access to (oral) rehydration therapy ;

vaccines not available / effective (because poor diet) ;

**I** vaccination programmes in Canada

antibiotics / drugs / medication not available ;

*other*

greater number of refugee camps / squats ;

less able to cope after natural disasters ;

less education about disease prevention / transmission ;

poor hygiene / described ; e.g. not washing hands after defecating

[max 3]

(ii) 1 Angola/Cameroon, comparative data to show decrease in cases over time

or

comparative data, Cameroon fewer than Angola for 2006/2008 ;

2		2006		2008		2010
	Angola	67257 (66335) ↓	(of 56746)	10511	(of 9027)	1484
		→ decrease (of 65773) →				
	Cameroon	922	decrease	0		

3 explanations for decrease in cases (Angola/Cameroon)/fewer cases in Cameroon (than Angola) ;; *examples in context of cholera*

4 control methods prevent transmission/spread ; **AW ora**

5 pool of infected people reduced, reducing transmission ; **AW ora**

6		2006		2008		2010
	Cameroon			0	increase	10759

Cameroon, steep/ **AW** increase, 2008–2010

or

cases increase in Cameroon from 0 to 10759 ;

7 explanation for steep increase in/high number of cases ;

e.g. war

natural disaster

refugee camps

breakdown of infrastructure (due to population increase)

influx of immigrants with cholera

*can be credited if linked to high number of cases in Angola in 2006*

[max 4]



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(b) (i) look for **AW** throughout

- 1 required percentage cover not reached/high percentage cover required/not enough people vaccinated ;
- 2 some do not respond successfully to vaccine ;
- 3 poor diet/lack of vitamin A ;
- 4 poor storage of non-thermostable vaccine ;
- 5 vaccine not cost-free to population ;
- 6 inaccessible vaccination stations for some of the population ;
- 7 *ref.to* difficulty in giving boosters ;
- 8 *ref.to* reluctance to have children vaccinated ;
- 9 lack of advertising/campaigns/education to encourage vaccination ;
- 10 different strain (to the one used in vaccine)/antigens changing ;  
**R** *ref.to* resistance [max 2]

(ii) 1 *ref. to* secondary (immune) response ;

- 2 memory (B), lymphocytes/cells ;
- 3 recognition of/binding to antigens ; **A** clonal selection  
**A** proteins/glycoproteins (on *Morbillivirus*)
- 4 clonal expansion/described ;
- 5 plasma cells secrete antibodies ;
- 6 *idea of* faster production/higher levels of antibody ;
- 7 *ref. to* T (helper)-lymphocytes, release cytokines/stimulate humoral response ;

[max 3]

**[Total: 12]**

5 (a)	event	three marks	two marks	one mark
	impulses pass down septum through conducting fibres known as the bundle of His	4	any four/five correct ;;	any two/three correct ;
	atrioventricular node sends out impulses	3		
	impulses travels across atrial walls	2		
	impulses reach base of ventricles (apex of heart)	5		
	impulses pass up through Purkyne fibres in ventricle walls	6		
	sinoatrial node sends out impulses	1		

[3]

(b) following ventricular systole/contraction

or

when ventricles in diastole/relaxation ;

when pressure in arteries higher than that of ventricles

or

when pressure in ventricles lower than in arteries ;

**A** aorta/pulmonary artery

[2]

(c) *in blood*

*idea that* red blood cells too large to leave capillaries ;

*idea that* (some plasma) proteins too large to leave capillaries ;

higher concentration of oxygen, qualified ;

e.g. from lungs

not yet unloaded (from haemoglobin)

not yet diffused out (from red blood cell)

not yet forced out of capillary (in plasma)

(higher concentration of) glucose/nutrients/named nutrient, qualified ;

e.g. to be delivered to cells/from absorption

*tissue fluid contains*

*ref. to* products excreted by cells (yet to enter blood) ;

e.g. waste products/(more) carbon dioxide/lactate

[2]

[Total: 7]

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- 6 (a) 1 proteins produced (for growth) ;  
 2 DNA replication ;  
 3 organelles/ named organelles synthesised ; **A** more organelles  
 4 uncontrolled mitosis/ **AW**  
**or** continuous cell cycle  
**or** cell cycle checkpoints not controlled ;  
 5 (new cells) do not differentiate ; **A** do not become specialised  
 6 loss of function (of tissue) ; **A** changed function/new cells do not function as tissue of origin  
 7 (abnormal) mass of cells formed ;  
 8 **AVP** ; e.g. no programmed cell death/apoptosis/cells immortal / cells grow independently of normal programming/no contact inhibition [max 4]

- (b) travels in phloem/phloem sap/translocation ; **R** in xylem  
 from cell to cell via plasmodesmata ;  
 in symplast pathway ;  
 in apoplast pathway ; **R** in xylem  
 ref. to bacterial motility, e.g. flagella ; [max 1]

- (c) 1.1–1.13 (µm) ;; **OR** 1.2–1.22 (µm) ;;  

$$\left[ \frac{13 \text{ mm}/13000 \mu\text{m}}{11500} \right]$$

$$\left[ \frac{14 \text{ mm}/14000 \mu\text{m}}{11500} \right]$$

*one mark only for*

correct formula and measurement (13/14 mm) but incorrect conversion  
**or** for correct formula used with a measurement of 12 or 15 mm

2

[Total: 7]