

**MARK SCHEME for the October/November 2010 question paper  
for the guidance of teachers**

**9700 BIOLOGY**

**9700/23**

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

- CIE will not enter into discussions or correspondence in connection with 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 guidance on the mark scheme)
- AW** alternative wording (where responses may vary more than usual)
- underline** actual word given must be used by the candidate (grammatical variants excepted)
- max** indicates the maximum number of marks that can be given
- ora** or reverse argument

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1 (a) (i) **A** phospholipid ; (1)  
**B** protein ; *ignore protein descriptions* **R** glycoprotein **R** lipoprotein (1) [2]

(ii) polar / hydrophilic, head / group ;  
attracted to / AW, water / aqueous environment ; **A** water-loving  
ref. hydrogen bonding (polar head to water) ;

non-polar / hydrophobic / hydrocarbon / fatty acid, tails / chains / groups ;  
repelled by / away from, water / aqueous environment ; AW **R** water-hating [max 3]

(b) **C** *any one of*  
(channel) allows, ions / water / polar molecules / water-soluble molecules /  
hydrophilic molecules, to, pass through membrane / enter cell / leave cell ;  
**R** transport, without qualification e.g. across, through  
facilitated diffusion ;  
active transport ; (max 1)

**D** *any one relevant e.g.*  
cellular recognition  
cell identification  
antigen  
cell signalling  
receptor  
binding site  
ref to hydrogen bonding with water / forms bond with water to stabilise membrane  
cell adhesion (max 1) [2]

(c) 1764 ;;

*if correct working (588 × 3) is shown, but no answer or incorrect answer, award one mark* [2]

**[Total: 9]**

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2 (a) *Mycobacterium tuberculosis* / *Mycobacterium bovis* ; (1)

(infected person) coughs / sneezes / spits / exhales / breathes out / aerosol (infection) / droplet (infection) / moist air (containing the pathogen) ;  
(uninfected person) inhales / breathes in / inspires ;  
*ignore ref. to cattle*  
*treat ref. to virus etc as neutral* (2)

[3]

- (b) 1 ref. patient does not complete course / takes inadequate dose / stops taking when feels better ;  
2 problems with continuing supply (of antibiotics) ;  
3 not all bacteria killed ;  
4 ref. mutation to become resistant ; **R** immune  
5 likelihood of resistance increases if only one antibiotic used ;  
6 ref. to changes in bacterium to enable resistance ;  
7 ref. to changes in host cell (membrane structure) ;  
8 AVP ; e.g. repeated exposure to different drug regimes (because of mp. 1)  
exposure to bacteria with different resistance

[max 2]

- (c) 1 ref. to, worldwide incidence of TB / TB found worldwide ; AW  
2 highest, incidence / AW, (sub-Saharan) Africa / LEDC / developing countries ;  
3 problem with, vaccine / BCG, qualified ; e.g. doesn't work well, everywhere / in Africa / in Far East  
doesn't work well for all ethnic groups  
less efficient with age  
ref. cold chain / needs to be kept cold  
knowing when enough people vaccinated  
ref. to cost  
**R** vaccine doesn't work  
4 difficult to identify infected people / ref. symptomless carriers / AW ;  
5 difficulty with, contact tracing / described ;  
6 difficult to diagnose / time to diagnose (can infect others) ;  
7 ref. to transmission from animals to humans ;  
8 weakened immune systems / link with HIV/AIDS / TB is opportunistic ;  
9 ref. social factor ; e.g. overcrowded living conditions, poor diet, remote areas  
10 coordination of, vaccine / treatment ;  
11 ref. to difficulty of administering, drugs / DOTS ;  
12 lack / availability, of trained personnel ;  
13 ref. to political problems ; e.g. war , unstable regimes, refugees, migration  
14 cost, qualified with additional relevant point ;  
15 AVP ; e.g. ref. to countries (e.g. Russia) with large area / low population density,  
16 AVP ;ref. to quarantine problems, travel qualified, other social factor

[max 5]

[Total: 10]

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- 3 (a) (i) glucose and fructose ; *ignore monosaccharides* [1]
- (ii) 1 active site, gives specificity ; **A** specific active site  
*ignore ref to specific substrate*
- 2 substrate binds with active site or enzyme-substrate / E-S, complex forms ;
- 3 complementary (shape) / substrate fits into active site ; **A** 'lock and key'  
**A** matching shape  
**R** 'same shape'
- 4 induced fit / described ;
- 5 further detail of substrate and active site ; e.g. binding by hydrogen bonding,  
e.g. transfer of electrons
- 6 lowers activation energy / described e.g. causes strain in substrate / AW ;  
**A** Ea
- 7 breaks glycosidic bond ;
- 8 glucose and fructose / products, no longer fit / AW ; [max 4]
- (iii) non-competitive (inhibition) ;  
irreversible (inhibition) ; [max 1]
- (b) (i) idea of, hydrolysis / product formation / further metabolism, lowering sucrose  
concentration (in, companion cells / sink cells) ;  
maintains, concentration / diffusion, gradient (between phloem sieve tubes and,  
companion cells / sink cells) ;  
to remove sucrose from the phloem (sieve tubes) ;  
AVP ; e.g.ref. easier transport of, glucose / fructose, through membranes ; [max 2]
- (ii) ref. facilitated diffusion out / may be lost from cells ;  
products / glucose / fructose, are soluble / AW ;  
(so) will lower the water potential / water potential becomes more negative ;  
causes water to move into cells by osmosis ; **A** osmotic, problems / stress  
reactive / easily metabolised, qualified ; e.g. so interferes with, other metabolic  
processes / cell chemistry **A** more reactive than starch [max 3]

[Total: 11]

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**4 (a) R** if mark points are in context of secondary response

sensitised / activated / AW, by (foreign) antigen / epitope ; *accept once only*  
 correct ref. specificity ; *accept once only*  
 production of memory cells ; *accept once only*

*T lymphocytes*

(T-helper / Th) secrete, cytokines / lymphokines ;  
 (T-helper / Th) stimulate, B cells to divide ; **A** stimulate humoral response  
 (T-killer / Tk / T-cytotoxic / Tc) secrete, perforin / hydrogen peroxide / AW ;  
**A** toxins  
**R** hormones  
 (T-killer / Tk / T-cytotoxic / Tc) kill / destroy / AW, non-self cells / pathogens / infected cells ;  
 (T-surpressor / Ts) ref., surpresses / reduces, response (on recovery) ;

*B lymphocytes*

formation of plasma cells ;  
 antibody production ;

[max 4]

**(b)** no more antigen / AW ;

(remaining) antibodies, removed from the blood / broken down (in the liver) ;  
**R** excreted

plasma cells, are short-lived / begin to die / are not replaced ;  
 no more antibody produced ;

AVP ; e.g. detail of removal / macrophage engulfs, digested, peptide bonds broken [max 3]

**(c)** line drawn continuous with that provided ;

and rising more steeply before day 55 ; *should start to rise from day 40 / should rise more steeply initially /should not remain as a plateau from day 40*

reaches higher than primary response between day 45-55 and, peaks / plateaus ;  
*must not go below the day 40 antibody concentration*

[3]

**[Total: 10]**

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- 5 (a) 1 thin (alveolar) walls / one cell thick / thin epithelium / squamous epithelium ;  
**A** pavement epithelium  
**R** thin cell wall  
**R** thin layer
- 2 short diffusion distance (between air and blood) ;
- 3 elastin / elastic fibres ;
- 4 stretch to increase surface area / increase surface area on inspiration / recoil to expel air ;
- 5 ref. to maintaining, diffusion / concentration, gradient ; *linked to marking points above*
- 6 large surface area for, diffusion / AW ;
- 7 some cells secrete surfactant ;
- 8 prevent collapse ; [max 3]
- (b) (i) (cigarette / tobacco) smoking ;  
infection ;  
inflammation / detail of inflammation ;  
(excessive) coughing ; [max 1]
- (ii) *max 1 for structure*  
fewer alveoli ; **A** alveolar walls broken down / fewer air sacs / alveoli burst / alveoli destroyed / reduced surface area **R** elastin broken down  
*or*  
fewer capillaries ;
- effect*  
less gas exchange / less uptake oxygen / less removal carbon dioxide ; [2]
- (c) *look for symptoms*
- shortness of breath / breathlessness / AW ; **A** breathing difficulty  
wheezing (on inspiration) ;  
rapid breathing rate / hyperventilation / decreased ability to hold breath ;  
**R** heavy breathing  
chest, tightness / pain ;  
cyanosis / bluish appearance to the skin / AW ; **A** pale  
fatigue / tiredness / lethargy / weakness / dizziness / reduced mobility / AW ;  
coughing / coughing up blood ;  
lots of / AW, mucus produced / much phlegm ;  
expanded / barrel, chest ;  
**R** refs to oxygen concentration of the blood  
**R** small vital capacity [max 3]

[Total: 9]

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- 6 (a) (i) (for) chlorophyll (structure / synthesis) ;  
(for) ATP functioning ;  
(for) enzyme functioning / enzyme cofactor ;  
signalling ion / regulates carbon fixation ;  
(for) DNA / RNA, synthesis ;  
stabilises, DNA / RNA, structure ; **A** required in translation  
(matrix of) bone ; [max 1]
- (ii) mutualistic association / AW ; **A** ref. to mycorrhiza  
qualified; e.g. further detail of relationship, named nutrients
- arrow from plant to fungi*  
ref. (some) fungi are, parasitic / pathogenic (on plants) ; **A** pathogens  
leakage (from plants) of assimilates ;
- arrow from fungi to plant*  
plants absorb nutrients, excreted by fungi / from decomposition by fungi ; [2]
- (b) (i) 5th / 6th ; **A** top carnivore [1]
- (ii) idea of little energy available, at / towards, top / end, of food chain ;  
too few organisms in level below ;  
expend much energy catching animals in trophic level below ;  
to obtain, a wider range of / varied, nutrients ;  
reduced competition ; [max 2]
- (c) (i) *community*  
all, populations of all species / organisms, living in a particular area, at one time /  
AW ; (1)
- habitat*  
place / location / environment / AW, where, a population / an organism, lives ;  
**A** community (1) [2]
- (ii) soil is source of nutrients for, plants / producers ;  
plants / producers, provide energy for ecosystems ;  
ref. recycling nutrients (by soil organisms) ;  
ref. to importance of, carbon / nitrogen, in, organic / complex molecules ;  
AVP ; e.g. detail of nutrient cycling, maintains balance of nitrogen in air [max 3]

[Total: 11]