UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary Level and GCE Advanced Level

MARK SCHEME for the October/November 2011 question paper for the guidance of teachers

9700 BIOLOGY

9700/22 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.

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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) (i) cilia ; **R** cilla **R** ciliated epithelium *mark first on line* [1]

(ii) transport / exchange / AW, oxygen / carbon dioxide ; **R** air [1]

(b) *mark first feature on line if more than one feature given unless nothing written on other line*

smooth / AW, muscle; **A** smooth muscle cells
cartilage ;
connective tissue ; **A** elastic, fibres / tissue **A** collagen fibres
A collagen and elastic fibres **A** elastin and collagen fibres
mucous gland ; **A** mucus-secreting cells **R** goblet cells [max 2]

(c) emphysema ; [1]

(d) **1** no / few / damaged / destroyed / AW, cilia / **A** ; **R** killed / dead
*allow ecf from **(a)(i)***
2 scar tissue ;
3 fewer / damaged / AW, (columnar) epithelial cells / epithelium ;
A ciliated cells *epithelial cells replaced by scar tissue = 2 marks*
4 goblet cells, enlarged / AW ;
5 enlarged mucous glands ;
6 more (smooth) muscle ;
7 large numbers of white blood cells ; **A** macrophages, phagocytes
8 inflammation ; **A** swelling *in context of inflammatory response* [max 4]

(e) **1** pathogens / AW, enter from, inhalation / external atmosphere / AW ; **R** germs
2 (sticky) mucus traps pathogens ; AW
3 mucus, accumulates / not swept away (because cilia destroyed) ;
4 pathogens / AW, remain / multiply (in gas exchange system) ;
5 increased time leads to increased opportunity to gain entry into cells / AW ; [max 2]

[Total: 11]

2 (a) *'cell' is not required as it is in the stem of the question*

(i) macrophage **;** **A** antigen-presenting cell **R** mycrophage [1]

(ii) neutrophil **;** **A** PMN / polymorphonuclear leucocyte [1]

(iii) T-killer / T_K / T-cytotoxic / T_C, lymphocyte **;** **A** cell for lymphocyte [1]

(iv) memory B- lymphocyte **;** A cell for lymphocyte [1]

(b) (i) ill-health / absence of well-being / abnormal condition / AW, (affecting an organism) **;**
reduced effectiveness of, functions / named function **;** AW
(illness with a set of) symptoms **;** AW **A** signs
poor / AW, physical, mental or social, well-being **;** **A** *two out of the three*
absence of well-being for two of the three = 2 marks [max 2]

(ii)
1 stable virus / virus did not mutate (frequently) **;**
2 same vaccine could be used all the time **;**
3 cheap to produce / ease of production **;**
4 used a, vaccinia / harmless, virus (so people could not get smallpox) **;**
5 able to use a 'live' virus (for stronger immune response) **;** **A** live vaccine
6 vaccine, thermostable / AW **;** **A** no requirement for keeping in cold
7 vaccine easy to administer **;** **A** no need for boosters [max 2]

(iii) *cholera up to max 4*
1 transmission cycle is difficult to break**;** **A** described with example(s)
2 ref. difficulty in administering e.g. refugee camp, displaced, disaster **;**
3 poor diet, lowered immune response **;**
4 more than one strain (needs more than one type of vaccine) **;** **A** more than one type (that causes cholera) **R** constantly mutating
5 vaccine, only gives short-term protection / requiring boosters **;**
6 antigenic concealment **;**
7 qualified **;** e.g. organism in intestines, difficult for antibodies to reach
8 ref. (older or newer oral) vaccine, not successful for everyone / variable (60–65% up to 90% depending on population group) protection **;**
9 no requirement by health authorities (for vaccine) / vaccine not used by health authorities **;** AW

sickle cell
1 no vaccine available **;** **A** cannot vaccinate against sickle cell
2 not caused by pathogen / non-infectious / non-transmissible / non-communicable **;**
3 genetic / inherited, disease / AW **;** **A** caused by a mutation
4 affects all red blood cells so vaccine would lead to their destruction **;** [max 5]

[Total: 13]

3 (a) (i) active, transport / uptake **;**

max 2
movement, against the concentration gradient / from low to high concentration **;** **A** diffusion gradient
requires energy (from ATP) **;**
specificity / specific binding site **;** **A** complementary shape
conformational change / change in 3-D shape **;** **A** ref. to, 'flip-flop' / 'kissing gate' mechanism [max 3]

(ii) (70S) ribosomes **;** *ignore size* [1]

(iii) ammonia / ammonium / ammonium ions **;** **A** NH_3 / NH_4^+ [1]

(b) (i) *two marks for correct answer*
35(%) **;;**

1 mark if correct working but not to whole number
90 / 255 × 100 = 35.29 / 35.3 [2]

(ii) idea that nitrogen removed is replaced by nitrogen added **;**
denitrification / denitrifying bacteria **;** **A** named bacteria e.g. *Pseudomonas aeruginosa / Thiobacillus denitrificans*
convert / AW, nitrate / nitrite (to nitrogen gas) **;**
AVP **;** e.g. occurs, when oxygen depleted / waterlogged soils
volcanic action adds nitrogen [max 2]

(c) 1 increase / maintain, nitrogen content of soil **;** **A** add, ammonium / nitrates, to soil
2 increase / maintain, soil fertility **;**
3 uptake / absorption, of, ammonium ions / nitrates /fixed nitrogen (by plants) **;**
4 (plants use) for, amino acid / protein, production **;**
5 increased, growth / yield, of (crop) plants **;**
6 ref. feeding, livestock / human populations **;**
7 reduced need for fertilisers **;**
8 example of environmental benefit of reduced fertilisers **;**
9 cost saving from reduced use of fertilisers **;**
10 qualified ref. to, *Rhizobium* / legumes **;** [max 3]

[Total: 12]

4 **(a)** *allow points on annotated diagram*
if only diagram drawn, max 1 mark if not annotated
if written response given, only use diagram (if correct) to confirm mark points

1 6 carbons **;** (v. 5 carbons) **A** 1 more
2 6 oxygens **;** (v 4) **A** 2 more
3 12 hydrogens **;** (v10) **A** 2 more
4 5 OH groups v 3 OH groups **;**
A more *if correct diagram drawn*
5 6-membered ring / pyranose **;** (v. 5-membered ring / furanose)
6 carbon 2, OH (pointing down) / has O **;** (v. H pointing down / no O) AW
7 H and OH other way round on carbon 1 **;** AW
8 H and OH other way round on carbon 3 **;** AW [max 3]

(b)

type of bond(s)	biological macromolecule
β,1-4 glycosidic	cellulose **;**
α,1-4 and α,1-6 glycosidic	amylopectin **;**
phosphodiester	mRNA **;**
peptide	protein **;**

R if more than one molecule in box [4]

(c) condensation / polymerisation / esterification **;** [1]

(d)

	replication	*transcription*
1	DNA polymerase	RNA polymerase **;**
2	(free activated) DNA nucleotides	RNA nucleotides **;**
3	(complementary) base pairing A-T	base pairing A-U **;**
4	both strands, involved / act as template / AW	one strand involved **;**
5	all / AW, the DNA molecule, is copied / unzips / AW	part / gene(s), copied **;**
6	(two) DNA molecules produced **A** DNA produced	messenger RNA / mRNA / pre-mRNA , produced **;**
7	molecule(s) produced are double-stranded	single-stranded molecule produced **;**
8	occurs, in late interphase / S-phase / prior to mitosis	occurs throughout interphase / AW **;**
9	important in, mitosis / meiosis **A** cell / nuclear, division	important in, protein / polypeptide, synthesis **;**
10	AVP **;** e.g. Okazaki fragments / breaking and joining (of DNA) required	mRNA produced as continuous molecule

[max 4]

[Total: 12]

5 **(a)** (smokers smoking) 25 and above (g day^{-1}) **;** *must be in correct context* [1]

(b) **1** epidemiological (evidence) **;**
2 increase in tobacco smoked increased death rate in, coronary thrombosis / lung cancer **;**
3 use of data to show increasing death rate (with increased tobacco smoked) **;**
4 non-smoker lower death rate than smoker for, coronary thrombosis / lung cancer **;**
5 use of numerical data for non-smoker versus smoker for coronary thrombosis / lung cancer **;**
6 no clear link between smoking and cardiovascular disease / AW **;**
7 comment on disease of other diseases of gas exchange system, 25g and above **;**
8 (mp 6 / 7) use of data e.g. non-smokers, higher death rate / 2.23, than, 1–14g / 2.07 or 15–24g / 1.58, smokers **;**
9 no females included in the survey **;**
10 other aspects of smoking tobacco not included **;**
11 lack of information e.g. on deaths as a proportion of the sample **;**
12 AVP **;** [max 4]

[Total: 5]

6 **(a)** line to nucleolus labelled **C ;**
line to Golgi apparatus labelled **D ;** **R** to vesicle
line to mitochondrion labelled **E ;** [3]

(b) **1** hydrogen ion / H^+, pumped / AW, out of companion cell **;** **R** if to sieve tube element
2 active / using ATP / energy requiring **;**
3 against the concentration gradient **;**
4 hydrogen ion gradient build-up **;** AW
5 hydrogen ions, co-transport / with / AW, sucrose **;** *in context of <u>into</u> companion cells*
6 <u>diffusion / facilitated diffusion</u> (of hydrogen ions and sucrose) through co-transporter (membrane protein) **;** **A** through membrane protein *if 'cotransport' already used*
7 <u>diffusion</u> of sucrose into (phloem) sieve tube (cell) **;**
8 via plasmodesmata **;** [max 4]

[Total: 7]