CAMBRIDGE INTERNATIONAL EXAMINATIONS

Cambridge International Advanced Subsidiary and Advanced Level

MARK SCHEME for the October/November 2014 series

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

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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 accepted)
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
AVP	alternative valid point (examples given)

1 **(a)** cell wall(s) **;**
vacuoles **;**
regular shape of cells / fixed shape / description of shape / AW **;**
I 'no centrioles', 'thicker' as in 'thicker cell walls' [max 1]

(b) **(i)** **B ;** [1]

(ii) **C ;** [1]

(c) chromosomes / chromatin / chromatids, condense / coil up / thicken / AW **;**
A chromosomes / chromatids, become visible / shorten
spindle formation / spindle fibres made / assembly of microtubles / AW **;**
nucleolus disappears **;**
nuclear envelope, breaks down / disintegrates / disassembles / AW **;**
A nuclear membrane
I *ref. to* centrioles and centromeres [max 2]

(d) **(i)** producing (more) cells **;**

genetically identical / no genetic variation **;**
same, number / type, of chromosomes **; A** 'remain diploid'
I 'set of chromosomes'
repair / replacement (of root tip / tissue) **; R** 'repair of cells'

idea that mitosis makes cells for, different tissues / for differentiation **;**
e.g. use of examples, xylem / phloem / root hair / epidermis

I *ref. to* elongation [max 2]

(ii) change in DNA, nucleotide / base, sequence **;**

substitution, deletion, insertion, inversion, frameshift
change in, DNA / (m)RNA, codons / triplets
change in, amino acid sequence / primary structure, protein / polypeptide **;** [2]

(e) *acceptable range for measuring line 14 mm to 16 mm*
if the answer is between 700 and 800 allow 2 marks

if measurement of 14–16 mm is incorrectly converted allow one mark for correct measurement and correct formula – scale length divided by 20

15 000 / 20

750 **;;** [2]

2 **(a)** produces / synthesises, (named) organic compounds from inorganic (named) compounds **;** **A** substances / materials / molecules
using, light / chemical, energy **;**
A photosynthesis / converts light energy to chemical energy / chemosynthesis [2]

(b) primary consumer / feeds on diatoms **;**
provides, energy / food / nutrients / biomass, to, secondary consumers / pondskater / next (named) trophic level / next level in food chain **;**
A 'pondskater eats it' [2]

(c) *idea of* less energy available to (population of) heron(s) **;**
energy 'lost', between / at, each trophic level **;**
any example – respiration / excretion / egestion / movement / to decomposers / heat / not all organisms are eaten / AW **;**
ref. to sizes of individuals **;** [max 2]

(d) **1** *pond skater*
can stand on water / use surface for habitat, because of surface tension **;**
A strong surface because of, hydrogen bonding / cohesion between water molecules
I adhesion

2 *ref. to* its food comprising animals that fall onto water **;**
pike – to max 3

3 solvent, provides (dissolved) oxygen **;**

4 solvent for, carbon dioxide / excreta / ammonia **;**

5 water, has high density / is a medium that, provides support / buoyancy **;**

6 liquid so pike can move **;**

7 transparent, so pike can see **;**

8 high specific heat capacity (of water), provide stable temperature / environment **;**

9 ice less dense than water / ice floats, so can survive (when water freezes) **;**
A idea of life beneath the ice / insulation

10 AVP **;** e.g. high latent heat of fusion, water does not freeze easily [max 4]

(e) *ignore nitrogen fixation, formulae must be correct if names are not used*

1 decomposers / saprotrophs / bacteria / fungi **;**
I microorganisms / microbes

2 protein broken down to amino acids **; A** *ref. to* proteases

3 urea / amino acids / protein, converted to, ammonia / ammonium (ions) / NH_3 / NH_4^+ **;**
A deamination produces ammonia / ammonification from urea etc.

4 ammonia / ammonium ions, to, nitrite / NO_2^- **;**

5 nitrite / NO_2^- , to, nitrate / NO_3^- **;**

6 oxidation / nitrification (in correct context) / nitrifying bacteria **;**

7 *Nitrosomonas* and *Nitrobacter* in correct contexts **;**
if ammonia to nitrate or *ammonia to nitrite and nitrate* = 1 mark
*ammonia to nitrite and **then** nitrate* = 2 marks [max 4]

3 (a) 1 vaccine / attenuated virus, has antigen which stimulates immune response **;**
A AW for stimulates **A** description of immune response

2 macrophages, take up virus (by phagocytosis), and, present antigens / act as antigen presenting cells **; A** APCs
A antigen presentation by B cells

3 *ref. to* T, lymphocytes / cells **; A** helper T cells / killer T cells

4 B / T, lymphocytes, bind to APC / are recognised / undergo clonal selection / have appropriate receptor **;**

5 (lymphocytes) divide (repeatedly) by mitosis / undergo clonal expansion / clone rapidly / proliferate **;**

6 *ref. to* specificity **;**

7 memory cells formed **;**

8 idea that booster used, to further stimulate memory cell formation / in case first dose did not work / to increase strength **;**

9 on infection by virus, fast(er) response / higher levels of antibody formed / no symptoms **;**

[max 5]

(b) *accept use of data to make these 5 points*

1980 – 1990
percentage vaccinated increased **;**
number of cases decreased (steeply) **;**

1990 – 2002
percentage vaccinated, levels off / remains constant **;**
number of cases decreases (less steeply than earlier) **and** levels off **;**

in either section
number of cases / percentage vaccinated, fluctuates with an example **;**
e.g. number of cases in year 1981
e.g. number cases in year 2000 increases from 1999
e.g. percentage vaccinated decreases, after 2000 / in 2001 [max 4]

(c) **1** CD–46 is a receptor **;**

2 tertiary structures / (3D) shapes, of MV–8 and CD–46 (may be implied) **;**
(shapes are) <u>complementary</u> **;**

3 *ref. to* interaction of, R-groups / amino acid side chains **;**
A formation of hydrogen bonds / ionic bonds **R** disulfide / peptide

I 'active site'

'shape of MV–8 is complementary to shape of CD–46' = mp2 and mp3 [max 2]

4 (a) 1 glucose / substrate, is not complementary / is partially complementary, to active site **;**

2 enzyme / active site, changes shape / moulds around / fits around, when substrate, enters / binds **; R** if substrate / glucose changes

3 stronger binding of substrate to active site **;**

4 further detail **;** e.g. becomes complementary to / fits more tightly to, glucose / substrate
interaction of, functional groups / R–groups / side-chains
formation of (named) bond but not disulfide *or* peptide bond [max 3]

(b) 1 (competitive) inhibitor has, same / similar, <u>shape</u> to substrate **;**

2 inhibitor does not induce the same change in, 3D shape / tertiary structure / active site (as the substrate) **;**

3 (so inhibitor) less likely to bind (successfully) in active site **;**

4 *idea that* because it does not have same functional groups (in same positions) / AW **;**

5 in lock and key the inhibitor, fits directly into / is complementary to / binds to, active site **;** [max 2]

(c) enzymes / hexokinase, denatured **;**
all enzymes molecules are partially denatured / some enzyme molecules are denatured **;**

changes / disrupts / loss of (specific shape / structure) active site **;**
A no longer complementary to, glucose / substrate
breakage of, ionic / hydrogen, bonds **; R** disulfide / peptide bonds

idea that loss of structure makes E–S complex formation more difficult / fewer E–S complexes are formed / substrate does not fit into active site **;** [max 3]

(d) (i) *accept* ***ora***
active transport requires, ATP / energy (whereas facilitated diffusion does not) **;**
active transport moves substances against the concentration gradient (whereas facilitated diffusion moves substances down the concentration gradient) **;**
active transport uses only carrier proteins (whereas facilitated diffusion uses both carrier and channel proteins) **;**
A active transport can involve cotransport but facilitated diffusion does not [max 2]

(ii) too large / too big **; R** 'it is a big molecule' unqualified

polar / charged, so cannot pass through hydrophobic region of membrane **;**
A fatty acid tails for hydrophobic
no, specific / AW, protein, in membrane / carrier / channel **;**
e.g. AW = no protein for G–6–P
AVP **;** e.g. gated channels are closed [max 2]

5 (a) (i) alveoli **; A** alveolus / aveoli [1]

(ii) emphysema **; A** emphasema etc. [1]

(b) damage / paralyse / destroy / inhibit, cilia / ciliated epithelium **;**
goblet cells, enlarge / produce more mucus **;**
mucus, accumulates / not swept away (by cilia) **;**
bacteria / pathogens, can multiply in mucus / AW **; A** grow in mucus
I mitosis
bacteria / pathogens, not removed **;**
increased time available to infect cells **;**
AVP **;** e.g. increased permeability of alveolar walls to pathogens depressed antigen-presenting ability of lung macrophages [max 3]

(c) CO, binds to / combines with / joins with, haemoglobin **;**
A forms carboxyhaemoglobin
I carbaminohaemoglobin

binding is irreversible / carboxyhaemoglobin is stable / AW **;**
R carbaminohaemoglobin is stable

haemoglobin, cannot become fully saturated with oxygen / has a lower affinity for oxygen / carries less oxygen / AW **; A ora**
R 'carries no oxygen' [max 2]

6 (a) *(xylem row 1)* no / dead cells +
(xylem row 2) water and, (named) minerals / ions / salts **;**
I nutrients

(phloem row 3) bidirectional / in both (or any) directions / in one direction / described / source to sink **;**
R sink to source

(phloem row 4) yes / (freely / fully) permeable **;**
R partially / semi / differentially, permeable

(xylem row 5) cellulose **and** lignin
(phloem row 5) cellulose **;** [4]

(b) (synthesis of) <u>chlorophyll</u> **;**
light, absorption / capture (for photosynthesis) **;**
prevents chlorosis **;**

enzyme, cofactor / activator / decribed **;**
required, for enzyme catalysis / DNA polymerase **;**
stabilises, cell wall / proteins / nucleic acid / membranes **;**
important in, energy transfers / ATP synthesis **;**
A *ref. to* ATP synthase
binds to ATP **;**
DNA, synthesis / replication **;**
involved in translation / joining large and small ribosome subunits / as part of ribosome **;**
AVP **;** [max 1]