CAMBRIDGE INTERNATIONAL EXAMINATIONS

Cambridge International Advanced Subsidiary and Advanced Level

MARK SCHEME for the March 2016 series

9700 BIOLOGY

9700/22 Paper 2 (AS Level 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 as guidance)

1 **A** sucrose **;**

B peptide **;** **A** amide

C cellulose **;**

D biuret **;** **A** (dilute) potassium / sodium, hydroxide (solution) and (dilute) copper sulfate (solution)
R Millon's solution

E glycerol **;**

[5]

[Total: 5]

2 **(a)** magnification = $\frac{\text{image length}}{\text{actual length}}$ / AW **;** **A** M = I / A **or** M = O / A

correct calculation or to 2 or 3 significant figures using the correct calculation

(×) 2778 / 2780 / 2800 **; ;** (for 25 mm) **A** ± 1 mm in measurement

one mark if correct measurement stated and divided by actual size but incorrect answer owing to, rounding up error / incorrect conversion factor

(25 000 / 9.0) **;**

[3]

(b) spherical / spheroid / AW **;**

(nuclear) envelope / two (nuclear) membranes / double membrane **;**
(containing) nuclear pores **;**

(contains) chromatin / chromosomes **;**
DNA and, proteins / histones **;**

contains, nucleolus / nucleoli
or
nucleolus is / nucleoli are, dark(er) staining / spherical / defined **;**

AVP **;** e.g. outer membrane continuous with RER
heterochromatin and euchromatin
contains nucleoplasm

[max 3]

[Total: 6]

3 (a) (i) a gene codes for a protein / gene coding for EPO **;**

ref. transcription **;** **A** gene 'switched on'
A increase gene expression

mRNA (required) for, EPO / protein, synthesis
or
mRNA involved in translation **;**

[max 2]

(ii) vesicles move to, cell (surface) / plasma, membrane (via cytoskeleton) **;**

(vesicles) fuse / merge, with cell (surface) membrane **;**

exocytosis (occurs) **;**

(movement of vesicle / exocytosis) requires, energy / ATP **;**
A active (process)
R active transport

[max 2]

(b) (i) EPO, binds to / combines with / AW, <u>receptors</u> **;**

receptors, complementary to / specific <u>shape</u> for, EPO **;**
A EPO fits into receptors

cell signalling / EPO binding leads to (specific) responses within the (target) cells / AW **;**
I cells respond to EPO

<u>only</u>, target / bone marrow, cells, have receptors, for EPO / specific to EPO **;**
ora
A binding triggers responses only within, target / bone marrow, cells

[max 3]

(ii) too large **;**

ref. to shape, cannot pass through **;**

(protein) is, hydrophilic / water soluble, <u>and</u> cannot cross hydrophobic core (of phospholipid bilayer) / AW **;**

no specific membrane transport protein **;**

[max 1]

(c) stem cell **;** **A** haematopoietic stem cell
treat as neutral adult / non-embryonic / multipotent / stromal [max 1]

(d) **max 3** *if all description (***D***) or all explanation (***E***)*
A Hb for haemoglobin and Hb concentration for mean Hb concentration
A g per kg / g kg^{-1}, for g per kg body mass

constant
D Hb concentration, remains constant / of 12.6 g kg^{-1}, for first two weeks (of investigation) / up to start of injections **;**

E idea of regulation **;**
e.g. sufficient oxygen so no requirement for increased EPO

increase then decrease description
D (then) increase in Hb concentration (from week 2) for 5 weeks / AW, then decrease (for last three weeks / to week 10) **;**

D data quote / manipulated data, to support **;**
e.g. increase from 12.6 g kg^{-1} (week 2) to15.3 g kg^{-1} (week 7)
increases by 2.7 g kg^{-1} (to week 7)
decrease from 15.3 g kg^{-1} (week 7) to 13.7 g kg^{-1} (week 10)
decreases by 1.6 g kg^{-1} (to week 10)

increase explanation
E EPO increases production of red blood cells that contain Hb / AW **;**

decrease explanation
E red blood cells, short life span / die **;**
E cell signalling stops / (target / bone marrow) cells no longer stimulated / AW **;**
A EPO, degraded / AW

increase after injections stop
D Hb concentration increases for 1 week after injections have finished **;**

E *idea of*, time delay for red blood cell production to stop / time for immature red blood cells to mature and be released into blood stream **;**

AVP **;** e.g. steady increase as time required for, mitosis / cell proliferation / differentiation into red blood cells / production of haemoglobin
contributory factor for increase may be, accumulation / increased concentration, of EPO with injections

[max 4]

(e) *high altitudes and low oxygen partial pressure so*
less oxygen in inhaled air / less oxygen (would be) transported to tissue / AW **;**

lower oxygen saturation of haemoglobin / haemoglobin has lower oxygen affinity **;**

body requires more red blood cells that contain haemoglobin / AW **;**
A more red blood cells produced so more haemoglobin (to bind oxygen)

idea of compensation **;** **R** *idea of* body getting more oxygen

[max 3]

[Total: 16]

4 (a) *Morbillivirus*
aerosol / droplet, infection **;**
A described, e.g. (from infected person) in, exhaled / airborne, droplets, and inhaled

idea of spread by touching an infected surface and putting fingers into mouth / nose **;**
R contact *without qualification*

HIV
sexual intercourse / passed via semen / passed via vaginal fluids / AW **;**
blood transmission **;** **A** described, e.g. blood transfusion
sharing (contaminated), needles / syringes
accept transmitted in body fluids for one mark *if above two points not gained*

mother to, foetus / baby, transmission **;**
A described, e.g. across placenta / during birth / breastfeeding

AVP **;** e.g. ref. to measles mode of transmission leading to faster spread of disease / ora

[max 4]

(b) antibiotics (only) used against bacteria (and some fungi) **;** **I** used in malaria

idea that antibiotics act at a cell structure not possessed by virus **;**
e.g. viruses, do not have, a cell wall / a cell surface membrane / ribosomes

suggestion that viruses are, inside host cells / not within reach **;**

antibiotics act only on, living / growing, cells (viruses do not grow) **;**

antibiotics do not act on, protein coat / capsid / capsomeres / viral envelope **;**

[max 2]

(c) (i) phospholipid bilayer **;**
proteins / glycoproteins / named **;** **I** cholesterol

[2]

(ii) SLAM acts as a receptor **;**
haemagglutinin / H / (viral) glycoprotein, binds to / fits into / complementary to, SLAM / receptor **;**

fusion protein / F / (viral) glycoprotein, causes fusion (of envelope) to cell surface membrane **;**
A (viral) envelope fuses with cell surface membrane
fusion releases nucleoprotein (and viral polymerase) **;**

[max 3]

(iii) *in context of viral RNA*
replication of RNA / to make copies of genes / AW ;

transcription / production of mRNA ;
detail ; e.g. to make viral proteins ;

AVP ; e.g. *credit suggestion of,* RNA-dependent DNA polymerase / reverse transcriptase, to produce viral DNA

[max 2]

(d) (i) protein ; **A** polypeptide **A** glycoprotein [1]

(ii) immunise / inject / AW, mice / small mammals, with p24 / antigen ;
immune response occurs / leave for a number of weeks ; **A** description
harvest / collect / AW, splenocytes / B-lymphocytes / B-cells / plasma cells ;
fuse with, myeloma cells / cancer cells ; **A** tumour
form hybridoma cells ;
select for (hybridoma) cells secreting antibody against, p24 / antigen ;

[max 3]

[Total: 17]

5 (a) phosphate ;
ribose ;
adenine ;
adenosine ;
covalent bond ;
} *labels pointing to correct components*

[max 3]

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

(ii) **D A C B** ; [1]

(iii) source ; [1]

(c) (i) ref. tRNA role in translation ;
e.g. amino acid carried by tRNA molecule to ribosome
anticodon on tRNA (with specific amino acid) binds to codon on mRNA
tRNAs bring amino acids, adjacent to each other / for peptide bond formation

idea that mRNA (sequence of) codons dictate which amino acids will be added (to polypeptide chain) / AW ;
ref. correct, sequence of amino acids / primary structure (of, polypeptide / protein) ;

[max 2]

(ii) hydrogen / ionic, bonds, break / disrupted **;** **A** electrovalent for ionic
R if other bonds named
charges at the active site may be affected **;**
changes, shape / (tertiary) structure, of active site **;**
A changes, <u>shape</u> / <u>tertiary structure</u>, of enzyme

[max 2]

(iii) substrate enters the active site **;**
active site, (partially) flexible / changes shape slightly **;**
ref. provides a better fit / moulds around **;**
allows interaction of R groups (of active site) with substrate **;**

[max 2]

[Total: 12]

6 **(a)** trachea / windpipe
bronchus / bronchi
bronchiole / bronchioles
alveolus / alveoli
} *all correct two marks* **; ;**

one mark for:
one structure, incorrect / missing, but others in correct order
or
trachea and alveolus correct but bronchus and bronchiole wrong way round

[2]

(b) emphysema **;**
<u>chronic</u> bronchitis **;**

[2]

[Total: 4]