

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

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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)
<u>underline</u>	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)

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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

(x) 2778/2780/2800 ; ; (for 25 mm) A \pm 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

(25000/9.0) ;

[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]

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- 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, receptors ;
 receptors, complementary to / specific shape 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
only, target / bone marrow, cells, have receptors, for EPO / specific to EPO ;
 or
 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, and 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]

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(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) to $15.3\ g\ kg^{-1}$ (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]

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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]

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- (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]

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- (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, shape/tertiary structure, 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 ;
chronic bronchitis ;

[2]

[Total: 4]