**CAMBRIDGE INTERNATIONAL EXAMINATIONS**

**Cambridge International Advanced Subsidiary and Advanced Level**

# MARK SCHEME for the October/November 2014 series

## 9700 BIOLOGY

**9700/42** Paper 4 (A2 Structured Questions), maximum raw mark 100

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)** 1 (ideal characteristics) selected by humans / AW ;

2 one example of features ; e.g. calm temperament / obedient / intelligent

3 allowed to mate / bred together ;

4 offspring with ideal characteristics chosen to mate ;

5 over (many) generations ;

6 allele frequency (for ideal characteristics) increases ;

7 directional selection ; [max 4]

**(b)** **(i)** *jackal*
behavioural / reproductive / AW ;

*dingo*
geographical / AW ; [2]

**(ii)** *one species*
all breeds form fertile offspring with (domestic) dog ;

*separate species*
*idea of* different types of jackal do not interbreed (to produce fertile offspring) ; [2]

**[Total: 8]**

**2** **(a)** *prevents*
1 growth of new blood vessels (to tumour) ;

2 supply of (more), oxygen / nutrient ; **A** named nutrient

3 more routes for metastasis / AW ; [max 2]

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

**(ii)** cell formed by fusion of a plasma cell **and** a cancer cell ;
**A** B-lymphocyte, B cell, splenocyte **and** myeloma cell [1]

**(c)** 1 does not act as foreign antigen / AW ;

2 (so) does not cause, immune response / rejection ;

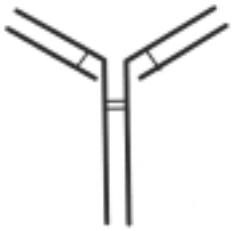
3 avoids, allergic reactions / side effects / anaphylactic shock ;

4 allows more than one treatment ;

5 remains in body for longer (so more effective) ; [max 3]

**(d)** *drawing IgG*
*ignore labels*

four polypeptide chains shown ; *in correct positions*
(disulfide) bridges shown to link chains ;



[2]

**[Total: 9]**

**3 (a) (i)** *reverse transcriptase*: produces (c)DNA from mRNA ;

*DNA polymerase*: produces double stranded DNA from, single stranded (DNA) / cDNA ;

*restriction enzyme*: cuts, DNA / plasmid ;

*DNA ligase*: joins (gaps in) the sugar-phosphate backbone (of DNA) ; [4]

**(ii)** 1 causes blood glucose <u>concentration</u>, to decrease / return to normal (from high) ;

2 (target cells are) liver / muscle ;

3 increased, absorption of glucose (from blood) / permeability of cell surface membrane to glucose ;

4 increased (rate of) respiration of <u>glucose</u> ;

5 *idea of* increased conversion of glucose to glycogen ;

6 inhibits secretion of glucagon / decreased gluconeogenesis ; [max 3]

**(ii)** 1 identical to that produced by body ;
2 activity the same / fast response / no immune response ;

3 no need for animal insulin / AW ;
4 for religious reasons / for ethical reasons / for e.g. vegetarian ;

5 uncontaminated / pure ;
6 so no risk of disease ;

7 production very efficient / always available ;
8 extraction from animals, costly / complex / limited by supply of animals ; [max 2]

**(b) (i)** *insulin **X** **ora** throughout for human insulin*

1 greater initial increase in activity / AW ;

2 time of maximum activity / peak, earlier ; [1.9h v. 3h]

3 maximum activity / peak, greater ; [9.4 v 5.4 (a.u.)]

4 rate of decrease greater ;

5 activity always higher ;

6 comparative figures ; [see above] [max 4]

**(ii)** 1 changes, tertiary / 3D structure ;

2 affects binding to receptor (on cell surface membrane) ;

3 (this) affects production of second messenger ;

4 hydrophilic / hydrophobic, bonds different ;

5 AVP ; e.g. may affect, solubility in blood / transport in blood / rate at which broken down [max 2]

**[Total: 15]**

**4 (a)** 1 maintains biodiversity ;

2 maintain, genetic diversity / genetic variation / gene pool ;

3 (loss of a species) may affect food, chains / webs ;

4 use by humans ; e.g. medical use / building materials / food

5 (eco)tourism ;

6 ethical / moral / aesthetic, reasons ; [max 3]

**(b) (i)** *assume answer refers to the botanic garden population unless otherwise stated*

statement about position relative to **A**, **B** or **C** ; e.g. closest to **B** / lower than **A** and **B** / higher than **C**

use of comparative figures ; e.g. 30.74 plus one other [2]

**(ii)** 1 small number / (only) 10, sampled ;

2 some, variants / alleles, were not included in the sample ;

3 **C** may be smaller than the other populations ;

4 **C** may have developed from only a small number of original plants ;

5 (so) only a small number of, alleles / variants, (present in the original population) ; **A** small gene pool / less genetic diversity [max 2]

**(iii)** 1 *idea of* better chance of survival in changing conditions ;

2 example of change ; e.g. climatic / increased competition / new disease / new pest

3 less chance of, two harmful recessive alleles coming together / inbreeding depression ; [max 2]

**(iv)** 1 (environmental) conditions similar to those in the, wild / natural habitat ;

2 within pollination distance / AW ;

3 *ref. to* possible reintroduction of plants to the wild ; [max 2]

**(c) (i)** *assume answer refers to the seeds unless otherwise stated*

1 *idea that* seeds are small **and** easier to store ;

2 seeds can be stored for a long time ;

3 little maintenance required ;

4 less prone to, disease / being eaten ;

5 seeds can be stored anywhere in the world ; [max 2]

**(ii)** 1 to check that seeds are still, viable / able to germinate ;

2 to produce new plants from which fresh seeds can be collected ;

3 to, find / verify, conditions for breaking seed dormancy (should plants be needed) ; [max 2]

**[Total: 15]**

**5 (a)** contains ribose (not deoxyribose) ;

has three phosphate groups (not one) ; [2]

**(b) (i)** *anaerobic – accept **ora** for aerobic*

1 *idea that* glucose not completely, broken down / oxidised
**or**
only glycolysis occurs **;**

2 pyruvate / lactate / ethanol, still contains energy **;**

3 ETC stops **;**

4 (because) no oxygen to act as (final) electron acceptor **;**

5 (so) no, Krebs cycle / link reaction / oxidative phosphorylation / chemiosmosis **;** [max 3]

**(ii)** 1 lipid contains (relatively) more, hydrogen atoms / C-H **;**

2 detail **;** e.g. molecular formula of glucose <u>and</u> a lipid given

3 more reduced, NAD / FAD, produced **;**

4 more electrons passed along ETC **;**

5 more hydrogen ions pumped across inner mitochondrial membrane / more hydrogen ions pumped into intermembrane space / steeper proton gradient **;** [max 3]

**[Total: 8]**

**6 (a)**

| statement | letter |
| --- | --- |
| is myelinated | **B** |
| may form a synapse with an intermediate neurone | **B** |
| cell body lies within the CNS | **M** |
| dendron is usually longer than axon | **S** |
| cell body lies within spinal nerve | **S** |
| has many dendrites | **B** |

;;;

*all correct = 3 marks*
*3/4 correct = 2 marks*
*1/2 correct = 1 mark* [3]

**(b)** 1 $Ca^{(2+)}$ channels open (in presynaptic membrane / presynaptic knob) ;

2 $Ca^{2+}$ enter (pre)synaptic knob ;

3 vesicles contain, neurotransmitter / ACh ;

4 (vesicles) move towards / fuse with, presynaptic membrane ;

5 (ACh / neurotransmitter) released / exocytosis ;

6 (ACh / neurotransmitter) diffuses (across cleft) ;

7 binds to receptors on postsynaptic membrane ;

8 $Na^{(+)}$ channels open ;

9 $Na^{+}$ enters post-synaptic neurone ;

*penalise lack of mention of ions in mp2 and 9* ***once*** *only* [max 5]

**(c)** hydrolyses / breaks down, ACh ;

stops continuous production of action potentials (in post-synaptic neurone) ; [2]

**[Total: 10]**

**7** **(a)** *recessive*
only expressed in homozygote / two copies of the allele needed to be expressed /
not expressed in heterozygote / not expressed in presence of dominant allele ;

*mutation*
change in the structure of, DNA / gene / allele
**or**
change in, base / nucleotide, sequence ; [2]

**(b)** suitable symbols and key ; e.g. A = allele for normal (non PKU)
a = allele for PKU

correct parental genotypes **plus** correct gametes ;

offspring phenotypes linked to correct offspring genotypes ; [3]

**(c)** 1 fewer amino acids ;

2 change in primary structure ; **A** different amino acid sequence

3 different, tertiary structure / 3D shape ;

4 *ref. to* active site of, PAH / enzyme, changed / absent ;

5 PAH / enzyme / protein, non-functional / AW ; **A** different function [max 3]

**[Total: 8]**

**8 (a) (i)** **A** – RuBP / ribulose bisphosphate ;

**B** – fatty acid ;

**C** – nitrates ; **A** suitable nitrogenous substance e.g. ammonium ions
**I** nitrogen / ammonia [3]

**(ii)** non-cyclic photophosphorylation ; [1]

**(iii)** condensation / polymerisation ; **A** anabolic

glycosidic ; [2]

**(iv)** 1 enters via stoma(ta) ;

2 by diffusion / down a concentration gradient ;

3 passes through air spaces ;

4 dissolves in film of water (on cell surface) ;

5 (diffuses) through cell, wall / surface membrane (of palisade cells) ; [max 3]

**(b)** 1 excited electrons leave, chlorophyll a / photosystem ;

2 pass along ETC ;

3 protons present from photolysis ;

4 protons (pumped) into intermembrane space ;

5 rubisco is in stroma ;

6 *idea that* protons leaving stroma raises pH ; [max 3]

**[Total: 12]**

**9** **(a)** 1 high, carbohydrate / starch, content ; **A** 70–80%

2 source of, energy / ATP ;

3 protein provides amino acids ;

4 for growth ;

5 low in fat ; **A** 2–4%

6 contains essential fatty acids ;

7 source of, vitamin B / vitamin E ;

8 deficient in, vitamin A / vitamin D / vitamin C ;

9 *ref. to* Golden Rice and vitamin A ; **A** *ref. to* other valid examples

10 wide range / AW, of minerals ;

11 named mineral plus use in human body ; e.g. calcium for bone development

12 high in fibre ;

13 for peristalsis / prevents constipation ;

14 easily, dried / stored ;

15 AVP ; e.g. staple diet for much of the world / named staple crop and location

16 AVP ; e.g. different parts of grain have different nutrients / *ref. to* processing grain [max 8]

**(b)** 1 seed is, dormant / metabolically inactive ;

2 water enters seed ;

3 embryo, produces / releases, gibberellin ;

4 gibberellin stimulates aleurone layer ;

5 (by) affecting, gene coding / transcription of mRNA, for amylase ;

6 to produce amylase ;

7 amylase <u>hydrolyses</u> starch ;

8 in endosperm ;

9 to, maltose / glucose ;

10 embryo uses sugars for respiration ;

11 energy / ATP, used for growth ; [max 7]

**[Total: 15]**

**10 (a)** 1 FSH / LH, released by anterior pituitary ;

2 Graafian / ovarian, follicle develops / AW ;

3 oestrogen produced by follicle (cells) ;

4 oestrogen conc rises for first 12 days ;

5 causes, endometrium to thicken ; **A** detail such as increase in blood vessels

6 (around day 14) surge in LH / AW ;

7 stimulates ovulation / AW ;

8 corpus luteum develops ;

9 produces progesterone ;

10 causes, further development of endometrium ;

11 if no fertilisation, secretion of FSH / LH inhibited ;

12 corpus luteum, degenerates / AW ;

13 progesterone conc falls ;

14 endometrium breaks down / menstruation occurs ;

15 negative feedback in correct context ; [max 9]

**(b)** 1 (homeostasis is) maintenance of, constant / stable, internal environment ;

2 irrespective of changes in external environment ;

3 negative feedback ;

4 *ref. to* input / stimulus ;

5 receptor detects change in parameter ;

6 action taken by effector / response / AW ;

7 restoration of, norm / set point / AW ;

8 *ref. to* fluctuation around the norm ;

9 example of homeostasis ; [max 6]

**[Total: 15]**