UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary Level and GCE Advanced Level

MARK SCHEME for the May/June 2011 question paper

for the guidance of teachers

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.

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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
AVP	Alternative valid point (examples given as guidance)

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1 **(a)** 1. pools drying up **;**
2. pools, affected by the sea / more salty **;**
3. disease / parasite, (causing high death rate) **;**
4. changes to sand dunes **;** e.g. by humans or natural causes
5. increase in predators **;**
6. decrease in food **;**
7. named pollution **;** e.g. acid rain affecting pH of pools
8. named human activity **;** e.g. taking toads / road kill / food for humans
9. increased competition **;** [3 max]

(b) 616 or 617 **;;**
allow one mark for working if incorrect answer [2]

(c) **(i)** idea of feeding on other organisms **;**
to obtain organic compounds **;** [2]

(ii) animalia **and** fungi **;** [1]

(d) people more interested in vertebrates
or
vertebrates, larger / more visible **;** [1]

[Total: 9]

2 **(a)** 1. (solutions of) alginate and enzyme mixed **;**
2. droplets (of mixture) into calcium chloride (solution) **;**
3. to produce beads **;** [2 max]

(b) 1. idea of easier purification of product **;**
2. enzyme, can be reused / is not lost / has longer shelf life **;**
3. allows continuous culture **;**
4. cheaper **;** 2 max

(c) *description*
1. immobilised papain more active / papain in solution less active, at higher temperatures **;**
2. idea of difference above 30°C **;**
3. comparative figs **;** e.g. values of activity for **both** at any **one** temperature above 30°C

explanation
4. (inert support) protects enzyme **;** **A** beads
5. tertiary structure / 3D structure / active site, (of the enzyme) is stabilised **;**
6. less denaturation **;**
7. <u>H bonds</u>, vibrate less / less easily broken **;**

accept ora for mp4–mp7 [4 max]

[Total: 8]

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3 (a) **A** – germinal epithelium ;
B – theca / wall of follicle ;
C – follicle cells / granulosa cells / corona radiata ;
D – oocyte ; **R** ovum / egg [4]

(b) 1. (progesterone / oestrogen), reduce the production of, FSH / LH ;
2. negative feedback ;
3. to, hypothalamus / anterior pituitary ;
4. idea of lack of FSH prevents maturation of follicle ;
5. lack of LH prevents ovulation ;
6. cervical mucus, thick / hostile to sperm ;
7. thin uterine lining prevents implantation ; [4 max]

(c) (i) 1. blocking gene means no, ZP3 / receptor (for sperm) ;
2. because no, transcription / translation / protein synthesis ;
3. sperm (head) has complementary shape to, ZP3 / receptor ;
4. fertilisation cannot occur ;
5. because sperm cannot bind (to oocyte) ; [3 max]

(ii) 1. idea of giving unwanted side effects ;
2. example ; *any one from*
nausea
mood swings
high blood pressure
risk of blood clots
headaches
weight gain
increased risk of breast cancer
3. to maintain natural hormone balance
or
because pill may reduce subsequent fertility ; [2 max]

(iii) 1. only oocytes affected / no other cells affected ;
2. ref. unknown / undesirable, effects elsewhere in the body ; [2]

[Total:15]

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4 (a) (i)
1. hybrid vigour ;
2. increased heterozygosity / decreased homozygosity ;
3. increases gene pool / AW ;
4. harmful recessive alleles less likely to be expressed / reduces inbreeding depression ;
5. increased yield ;
6. other named useful characteristic ; e.g. disease resistance / more nutritious [3 max]

(ii) high cost (of seed) / farmers must buy new seed each year ; [1]

(b) (i)
1. stomata closed ;
2. to reduce transpiration / to avoid too much loss of water ;
3. so carbon dioxide cannot enter the leaf ;
4. so carbon dioxide concentration (in leaf / in chloroplast) becomes very low ; [3 max]

(ii)
1. RuBP / rubisco / Calvin cycle, present in bundle sheath cells ;
2. which are tightly packed ;
3. which are not in contact with air (spaces) ;
4. so are not exposed to oxygen ;
5. CO_2 / malate, delivered to bundle sheath cells ;
6. from mesophyll (cells) ;
7. (so) CO_2 concentration in bundle sheath cells always high ; [4 max]

(c) (i)
1. CO_2 concentration (in bundle sheath cells) is always high ;
2. CO_2 not limiting ;
3. another factor / light intensity / temperature, limiting ;
4. no photorespiration ; [2 max]

(ii)
1. idea of change in temperature ;
2. affects, light independent / light dependent, stage (of photosynthesis) ;

or

3. idea of change in light intensity ;
4. affects light dependent stage (of photosynthesis) ; [2]

[Total: 15]

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5 **(a)** 1. higher yields / more crop survives **;**
2. less need to use pesticides / crop pest-resistant **;**
3. (reduced pesticide use) may benefit other organisms in the same environment **;**
4. less risk of harm to humans, from spray drift / from pesticide residues on food **;**
ignore refs to cost [2 max]

(b) (eating Bt maize) reduces growth rate **;**
0.6 compared to 0.7 / difference of 0.1 **;** [2]

(c) 1. experiments done in laboratory and not in the ecosystem / AW **;**
2. predicts what could happen if Bt toxin conc. increases in the future **;**
3. may not (normally) feed on pollen **;** [2 max]

(d) 1. such results likely to have a negative effect on public perception (of GM crops) / AW **;**
2. might reduce work for researchers in this area **;**
3. might reduce income of companies (producing GM crops) **;**
4. increased use of pesticides **;** [1 max]

6 **(a)** **(i)** decarboxylation **;** [1]

(ii) dehydrogenation / oxidation **;** [1]

(iii) substrate level phosphorylation **;** [1]

(b) **K** – reduced NAD **;** **A** NADH etc.
L – oxaloacetate **;** [2]

(c) 1. hydrogens split into protons and electrons **;**
2. electrons pass along ETC **;**
3. energy released used to pump protons **;**
4. (from matrix) to intermembrane space **;**
5. inner membrane impermeable to protons **;**
6. proton gradient forms **;**
7. protons move down gradient **;**
8. through ATP, synthase / ATP synthetase **;** **R** ATPase
9. enzyme rotates **;**
10. ATP produced **;** [5 max]

[Total: 10]

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7 (a)

nuclear division	letter of stage
meiosis I	B
	E
	J
	H
	F
	D
meiosis II	G
	I
	C
	A

E J H F all in meiosis I ;
E J H F in correct order ;
G I C A all in meiosis II ;
G I C A in correct order ; [4]

(b) 1. chiasma / crossing over ;
2. between <u>non-sister</u> chromatids ;
3. homologous chromosomes / bivalents ; *in correct context of mp1 or mp8*
4. in prophase I ;
5. exchange of genetic material / AW ;
6. linkage groups broken ;
7. new combination of <u>alleles</u> ;
8. <u>independent</u> assortment ; **R** random assortment
9. in metaphase I ;
10. detail of independent assortment ;
11. AVP ; e.g. possible mutation [5 max]

[Total: 9]

8 reproductive ;
constant / stable / AW ;
variation ;
alleles ;
gene ; [5]

[Total: 5]

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9 (a) *gene mutation*

1. spontaneous / random, change **;**
2. in, base sequence / nucleotide sequence / mRNA code / codon **;**
3. example **;** e.g. addition / insertion / substitution / deletion / inversion

triplet code

4. (sequence of) three (DNA nucleotide) bases **;**
5. complementary to mRNA codon **;**
6. codes for a specific amino acid **;** 4 max

(b)

parental phenotypes	man without HD	woman with HD
parental genotypes	**tt**	**Tt**
gametes	**all t**	**T or t ;**
offspring genotypes	**Tt**	**tt**
offspring phenotypes	**Huntington's disease**	**normal ;**

probability of first child having D **50% / 0.50 / 1 in 2 ;** [3]

[Total: 7]

10 (a)

1. (photosynthetic pigments) arranged in light harvesting clusters **;**
2. primary pigments / chlorophyll a **;**
3. at reaction centre **;**
4. P700 / PI, absorbs light at 700nm **;**
5. accessory pigments / chlorophyll b / carotenoids **;**
6. surround, primary pigment / reaction centre / chlorophyll a **;**
7. absorb light **;**
8. pass energy to, primary pigment / reaction centre / chlorophyll a **;**
9. (light absorbed results in) electron excited / AW **;**
10. emitted from, chlorophyll / primary pigment / reaction centre **;**
11. passes to electron, acceptor / carrier **;**
12. (electron) passes along, chain of electron carriers / ETC **;**
13. ATP (synthesis) **;**
14. electron returns to, P700 / PI **;** [8 max]

(b)

15. photolysis of water **;**
16. releases H^+ **;** **R** H / hydrogen atoms
17. by, P680 / PII **;**
18. e^- released from, P700 / PI **;**
19. e^- (from PI) and H^+ combine with NADP **;**
20. used in Calvin cycle **;**
21. reduces, GP / PGA **;**
22. to TP **;**
23. ATP used (during reduction of GP) **;**
24. NADP, regenerated / oxidised **;** [7 max]

[Total: 15]

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11 (a) *accept ABA for abscisic acid*

1. stress hormone ;
2. plant secretes ABA in, high temperatures / dry conditions ;
3. ABA binds to receptors ;
4. on plasma membranes of guard cells ;
5. inhibits proton pump / H^+ not pumped out of cell ;
6. high H^+ conc / positive charge, inside cell ;
7. K^+ diffuses out of cell ;
8. water potential of cell increases ; **A** increase in solute potential
9. water moves out of cell by <u>osmosis</u> ;
10. volume of guard cells decreases ;
11. guard cells become flaccid ;
12. response very fast ; [8 max]

(b)

13. (barley) seed is, dormant / metabolically inactive ;
14. seed absorbs water ;
15. embryo produces gibberellin ;
16. gibberellin stimulates aleurone layer ;
17. to produce amylase ;
18. amylase hydrolyses starch ;
19. in endosperm ;
20. to maltose / glucose ;
21. embryo uses sugars for respiration ;
22. energy used for growth ;
23. gibberellins affect, gene / transcription of mRNA, coding for amylase ; [7 max]

[Total: 15]

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