CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary Level and GCE Advanced Level

MARK SCHEME for the May/June 2013 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.

Cambridge will not enter into discussions about these mark schemes.

Cambridge is publishing the mark schemes for the May/June 2013 series for most IGCSE, GCE Advanced Level and Advanced Subsidiary Level components and some Ordinary Level components.

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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)

1 (a) (i) *in high light intensity*

1. (as temperature increased) the volume of oxygen released / rate of photosynthesis, increased to a peak **and** then fell**;**

in low light intensity

2. (as temperature increased) the volume of oxygen released / rate of photosynthesis, remained constant **and** then fell**;**

3. supporting figures (two oxygen values at two different temperatures plus units)**;** [3]

(ii) 1. light no longer limiting / temperature now limiting**;**

2. enzymes denatured / described**;**

3. so fewer enzyme-substrate complexes / AW**;**

4. so less photolysis (leads to less oxygen produced)**;** [2 max]

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

(ii) P680**; A** (photosystem) II [1]

(iii) respiration uses oxygen**;** [1]

[Total: 8]

2 (a) (i) 1. easier to, identify / screen**;**

2. more economical / time saving / labour saving / harmless**;**

3. resistance gene(s) can be passed to other bacteria**;**

4. idea of antibiotics no longer effective
or
requiring development of new antibiotics**;** [2 max]

(ii) 1. promoter, initiates transcription / switches on gene /causes gene expression / AW**;**

2. ref. binding of, RNA polymerase / transcription factors**;**

3. otherwise gene has to be inserted near an existing promoter**;**

4. this is difficult to do / this may disrupt expression of existing gene**;**

5. in eukaryotes precise position of promoter important**;**

6. idea that you need a coral promoter to switch on a coral gene**;** [3 max]

(b) (i) 1. DNA fragmented by, restriction enzyme(s) / endonuclease(s)**;**

2. loaded (into wells) at, negative end / cathode end, (of gel)**;**

3. ref. buffer / electrolyte**;**

4. phosphate groups of DNA give negative charge**;**

5. (negatively charged) DNA attracted to, anode / positive electrode**;**

6. separation due to, electric field / PD / potential difference**;**

7. short pieces / smaller mass, move further (in unit time) / move faster**; ora**

8. ref. impedance of gel / AW**;** [4 max]

(ii) 1. idea of comparison of position with reference DNA**;**

2. ref. staining / fluorescence in UV**;**

3. by use of DNA probe**;**

4. ref. single-stranded / complementary base pairing**;** [2 max]

(c) 1. allows estimate of numbers of each type;

2. to check success (of release of sterile males);

3. if sterile males wrongly identified as wild;

4. there will be a waste of resources, e.g. pesticides;

5. if wild males wrongly identified as sterile males;

6. a potential infestation may be missed;

7. AVP**;** e.g. to determine which moths to (re)release [2 max]

(d) 1. that DsRed is not toxic to predators of the moth;

2. that DsRed does not persist in the environment;

3. that the gene cannot pass to other organisms;

4. does not alter, food web / ecosystem, (in harmful way); [2 max]

[Total: 15]

3 (a) 1. nutrients added **and** product removed at a steady rate / AW;

2. (so) volume / named condition, kept, constant / at an optimum;

3. organism kept at, exponential / log, phase of growth; [2 max]

(b) (i) 1. at, low / 7.0, (carbon concentration) higher temperature causes increases in, growth / dry mass**;**

2. at, high / 14.0, (carbon concentration) higher temperature causes little or no change in, growth / dry mass**;**

3. comparative figures plus units**;** [3]

(ii) *carbon or nitrogen source*

1. to produce, amino acids / proteins / enzymes**;**

2. to produce, nucleic acids / nucleotides / ATP / purines / pyrimidines / named N-base**;**

3. chitin / building block, for cell wall**;**

carbon only

4. used in respiration;

5. to produce, carbohydrates / sugar / polysaccharide / glycogen / lipids**;** [3 max]

[Total: 8]

4 (a) (i) inner membrane / crista(e); [1]

(ii) 1. (electron comes from) hydrogen (atom); **R** H^+ / H_2

2. (from) reduced NAD / reduced FAD;

3. (from) dehydrogenation / oxidation, reactions;

4. (from substances in) Krebs cycle / link reaction / glycolysis;

5. in, matrix of mitochondrion / cytoplasm; [max 3]

(iii) 1. final electron acceptor / accepts electron from last carrier;

2. so carrier can be reduced again;

3. so electrons can keep flowing (along ETC) / so ETC can continue to work;

4. (oxygen) combines with H^+ to form water; [2 max]

(b) (i) 1. (when pump stops working), resting potential not maintained
or
pump usually maintains the resting potential;

2. (during resting potential) membrane polarised
or
positive charge outside (neurone) / negative charge inside (neurone) / -70mV inside neurone relative to outside / potential difference across membrane;

3. (when pump stops working), ions (only) move by diffusion;

4. Na^+ **into** the neurone;

5. outward diffusion of K^+ is limited / K^+ stay in neurone;

6. ref. non voltage-gated channels;

7. (eventually) inside of the neurone, becomes less negative / contains (relatively) more positive ions
or
there is a reduced potential difference across the membrane; [max 4]

(ii) 1. voltage gated (calcium) channels open;

2. (calcium ions move in) by diffusion / move down their concentration gradient; [2]

(c) (i) 1. Na^+ / K^+, cannot move through membrane;

2. so potential across membrane maintained even when pump stops / so membrane depolarisation does not happen;

3. calcium ions cannot enter cell;

4. so, (destructive) enzymes not activated; [max 2]

(ii) 1. gene (for protein channels), expressed less / switched off;

2. transcription, reduced / stopped;

3. AVP; e.g. reduced aerobic respiration / less ATP, for transcription [max 2]

[Total: 16]

5 (a) correct ref. to woman being given hormones;

ref. to one suitable hormone, e.g. FSH / gonadotrophin / LH / GnRH agonist; [2]

(b) 1. <u>capacitation</u>;

2. able to undergo acrosome reaction;

3. able to swim (more vigorously); [max 2]

(c) (i) 1. fewer IVF cycles needed;

2. no need to transfer more than one embryo to the uterus;

3. so less chance of problems from multiple embryos;

4. less chance of miscarriage; [max 2]

(ii) 1. need to wait (at least 7.8 hours) before transferring embryo to uterus;

2. may be difficult to keep embryos in ideal conditions during this time period;

3. embryos destroyed; [2 max]

[Total: 8]

6 (a) (i) 17.9;;

allow $\frac{125}{700}$ *(× 100) or 17.8 for one mark* [2]

(ii) *fluid can pass through glomerular capillaries because* (max 3)
1. fenestrations in capillary endothelium; **A** hole / pores / gaps
2. basement membrane acts as a filter;
3. no substances >68 000 MM can get through;
4. no cells can get through**;**

fluid can pass through podocytes because
5. have, projections / AW;
6. gaps (between projections); **A** filtration slits [4 max]

(b) (i) microvilli; [1]

(ii) 1. produce ATP / provide energy;
2. for active transport of Na^+;
3. **out** (of cell); [max 2]

(iii) *mark first two answers*
any named ion / mineral ions;

vitamins;

amino acids;

glucose;

some urea; [max 2]

[Total: 11]

7 (a) $\mathbf{W^R}$ = allele for warfarin resistance
$\mathbf{W^S}$ **=** allele for warfarin susceptibility

parental phenotypes	resistant male		resistant female	
parental genotypes	$\mathbf{W^R W^S}$		$\mathbf{W^R W^S}$	
gametes	$\mathbf{W^R}$	$\mathbf{W^S}$	$\mathbf{W^R}$	$\mathbf{W^S}$;
offspring genotypes	$\mathbf{W^R W^R}$	$\mathbf{W^R W^S}$	$\mathbf{W^R W^S}$	$\mathbf{W^S W^S}$;
offspring phenotypes	**resistant**	**resistant**	**resistant**	**susceptible ;**

[3]

(b) not enough Vitamin K found (in the wild) / require too much Vitamin K; [1]

(c) competitive / reversible;

as the concentration of inhibitor increases, the rate of the (inhibited) reaction decreases
or
as dose of warfarin increases, the rate at which blood clots decreases; **ora** [2]

(d) 1. different, codon / triplet;

2. stop codon;

3. different amino acid;

4. different, primary / secondary / tertiary / 3D, structure;

5. shortened, polypeptide / protein;

6. change in function of protein; [3 max]

[Total: 9]

8 (a) 1. allopatric speciation;

2. fish populations isolated;

3. geographical / physical / land, barrier;

4. no, breeding / allele flow / gene flow, between populations;

5. mutations occur;

6. different selection pressures / different (environmental) conditions;

7. advantageous alleles selected for / advantageous alleles passed on**;**

8. change in, allele frequency / gene pool;

9. (can result in) different chromosome numbers;

10. genetic drift;

11. ultimately, reproductively isolated / cannot interbreed; [5 max]

(b) 1. conditions remain the same within the pool;

2. best adapted fish (to conditions in pool) survive;

3. extreme phenotypes, selected against / do not survive; [2 max]

(c) 1. numbers of all species increase initially;

2. due to more, breeding space / food;

3. competition between (four) species**;**

4. (possible) reduction in numbers within, some / all, species;

5. not all species (may) survive;

6. different species, restricted to different areas / occupy different niches;

7. interbreeding / hybridisation;

8. AVP; e.g. ref. new selection pressure [3 max]

[Total: 10]

9 (a) 1. DNA not surrounded by nuclear membrane / no nucleus;

2. (prokaryote) DNA is circular;

3. DNA not associated with histones; **A** naked DNA

4. plasmids (may) be present;

5. no (double) membrane-bound organelles; **A** no, mitochondria / chloroplasts

6. no, ER / Golgi; **A** ribosomes not attached to membranes

7. ribosomes,70S / 18 nm / smaller (than eukaryotic cells);

8. cell wall made of, peptidoglycan / murein / amino sugars / AW;

9. (usually) unicellular;

10. 0.5 to 5.0 μm diameter; **A** any value between 0.5 and 5.0 as long as μm is used

11. AVP; (may) have, flagella / pili / capsule / slime layer [8 max

(b) 12. ores (may) contain metal sulfides;

13. example; e.g. iron / copper / zinc / cobalt / lead

14. insoluble in water so difficult to extract;

15. bacteria oxidise metal sulfide;

16. to soluble sulfate;

17. <u>bioleaching</u>;

18. example of bacteria; e.g. *A.ferrooxidans*

19. bacteria need to survive in acidic conditions;

20. mixture of bacteria required (in bioheap);

21. (in order to) survive a wide range of temperatures / range of bacteria with different temperature optima;

22. advantage;

23 e.g. low grade ores / spoil heaps, can be exploited
can get metal from industrial waste
does not produce sulfur dioxide
can be done in situ
low energy demand
less (heavy) machinery
not labour intensive
relatively cheaper (than other mining methods)

24. AVP; e.g. ref. gold / uranium [7 max]

[Total: 15]

10 (a) *ignore references to function*
accept from diagram

1. 3 – 10 μm (diameter);
2. double membrane;
3. ground substance / stroma;
4. contains enzymes / named enzyme, e.g. rubisco;
5. also, sugars / lipids / starch;
6. 70S / AW, ribosomes;
7. circular DNA;
8. internal membrane system **/** fluid-filled sacs / thylakoids; **A** flattened sacs
9. grana are stacks of thylakoids;
10. (grana) membranes hold, photosynthetic pigments / ATP synthase / ETC; [7 max]

(b) 11. ethene (in plant);
12. stimulates production of gibberellin;
13. gibberellin stimulates, cell division / cell elongation / increase in stem length**;**
14. leaves / flowers, above water;
15. (so) photosynthesis can occur;
16. (so) sexual reproduction / pollination, can occur;
17. aerenchyma / description;
18. assists gas diffusion (within plant);
19. air can be trapped by specialised underwater leaves;
20. (submerged parts of plant) carry out anaerobic respiration;
21. produce ethanol;
22. can tolerate high concentrations of ethanol;
23. produce a lot of ethanol dehydrogenase; [8 max]

[Total: 15]