UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary Level and GCE Advanced Level

MARK SCHEME for the October/November 2008 question paper

9700 BIOLOGY

9700/04 Paper 4 (Theory 2), 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.

All Examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes must be read in conjunction with the question papers and the report on the examination.

- CIE will not enter into discussions or correspondence in connection with these mark schemes.

CIE is publishing the mark schemes for the October/November 2008 question papers for most IGCSE, GCE Advanced Level and Advanced Subsidiary Level syllabuses and some Ordinary Level syllabuses.

UNIVERSITY of CAMBRIDGE
International Examinations

Question **Expected Answers** **Marks**

1 (a)

eukaryotic		prokaryotic
1. linear / strands	**or**	circular ;
2. in nucleus	**or**	(free) in cytoplasm ;
3. associated with, proteins or histones	**or**	naked ;
4. in chromosomes	**or**	not in chromosomes ;

assume eukaryotic if not stated [2 max]

(b) 1 habitat destruction / deforestation ;

2 disease ;

3 fall in prey numbers / difficulty in finding food ;

4 increased competition (with other carnivores) ;

5/6 ref. named human activities ; ; e.g. killing / agriculture / logging
R pollution [3 max]

(c) 1 national parks ;

2 zoos ;

3 captive breeding programmes ;

4 AVP ; e.g. banning hunting / gamete banks / education qualified [2 max]

[Total:7]

2 (a) (i) acts as chloride channel ; **A** Cl^- **R** chlorine

Cl^- moves out (of cell) ;

active transport / binding site for ATP ; [2 max]

(ii) **E** on diagram / upper face, because this is where, oligosaccharides / glycocalyx / carbohydrate chains, are present ;
A glycoprotein **R** glycolipid [1]

(b) **(i)** form / variety / version, of a gene **;**

only affects phenotype when dominant allele not present / AW **;** [2]

(ii) 1. thick / sticky / dehydrated, mucus produced **;**

2. mucus not moved effectively by cilia / mucus accumulates **;**

3. reduced gaseous exchange / longer diffusion pathway **;**

4. difficulty in breathing **;**

5. more infections / (mucus) traps bacteria **;**

6. lungs are scarred **;** [3 max]

(c) viral DNA carries normal (CFTR), allele / gene **;**
R RNA **A** recombinant DNA

virus binds (with lung cells) **;**

viral DNA put into, (lung) cells / host DNA **;** [2 max]

(d) **(i)** 1. <u>translation</u> will not occur normally **;**

2. no amino acid added to chain when stop codon reached **;**

3. protein chain not completed / protein only partially made **;**

[2 max]

(ii)

PTC124		gene therapy
1. can be taken orally	**or**	delivered (by vector) into respiratory tract **;**
2. self administered	**or**	requires medical treatment **;**
3. is readily taken up by cells	**or**	poor take up by cells **;**
4. no vectors needed / fewer or no side effects	**or**	possibilty of side effects (from vectors) / named side effect **;**
5. only needs to enter cytoplasm	**or**	difficulty in inserting gene into host DNA **;**
6. no need to switch on gene	**or**	difficulty in switching on gene **;**

[3 max]

[Total:15]

3 (a) 1 very extensive root system / roots go very deep ;

2 small surface area of leaves ; **R** narrow leaves

3 leaves roll / presence of hinge cells ; **A** bulliform

4 leaves / stalks, have waxy covering / thick cuticle ;

5 high silica content ;

6 stomata, reduced in number / in sunken pits ;

7 idea of supporting tissue ; e.g. sclerenchyma [max 2]

(b) (i) 1. (ABA concentration) increases from day 3 / 4 to day 7 then decreases (to day 8 / 9 /10) **or** peaks at day 7 ;

2. comparative figs (2 ABA concentrations at 2 days) ; *ignore units* e.g.1 at day 4 and 10 at day 7

3. as water potential decreases concentration of ABA increases / ora ;

4. no response until water potential drops below -600 to -800 kPa ; [max 3]

(ii) fall in water potential causes, stomatal resistance to increase / closure of stomata ; **A** ora

increase in ABA concentration causes, stomatal resistance to increase / closure of stomata ; **A** ora

detail of mechanism ; e.g. turgor of guard cells / proton pump / flow of K^+ [max 2]

(c) stomatal closure reduces water loss ; **R** stops / prevents

by transpiration / (by diffusion of) water vapour from leaves ; [2]

[Total: 9]

4 (a) 1 (mouse) injected with antigen ; **A** protein / red cells

2 spleen / plasma / B, cell ;

3 with ability to make antibody ; *linked to 2*

4 fused with, tumour / myeloma / cancerous, cell ;

5 cells cultured ;

6 cells checked for antibody production ;

7 cells cloned ; [4 max]

(b) **(i)** 1. Herceptin / X-ray, induces (slightly) more cell death than control **;**
A more effective

2. X-rays induce more cell death than Herceptin **;** **A** more effective

3. comparative figures supporting 1 or 2 **;** e.g. 0.6 or 0.75 v 0.5

4. Herceptin and X-rays induce much more cell death (than either treatment alone) **;** **A** highest / most / greatest, effect

5. comparative figures supporting 4 **;** e.g. 2.0 v 0.6 or 0.75 [3 max]

(ii) $\frac{2.0 - 0.6}{0.6} \times 100\ \%$

= 233 % **;;** *award 2 marks for correct answer* *ignore decimal places*

allow 1 mark for valid working if answer incorrect [2]

(c) **(i)** 1. increase in dose of X-ray causes, decrease in % cells surviving / more cell death **;**

2. increase in X-ray dose plus Herceptin causes greater, decrease in % cells surviving / cell death **;**

3. difference greatest above 2 (J kg^{-1}) **;** **R** ref to time or rate [3]

(ii) identifies cancer cells **;**
immune response triggered **;**

enters cancer cell **;**
kills it **;**

Herceptin enhances effect of X-ray **;** [2 max]

[Total: 14]

5 (a) *FSH:*

1 anterior pituitary gland ;

2 follicle ;

3 stimulates, growth of follicle / follicle to secrete oestrogen ;

progesterone:

4 corpus luteum ; **A** some from follicle cells **A** yellow body

5 endometrium (uterine epithelium) / anterior pituitary ; **A** lining **R** wall

6 stimulates glandular activity in endometrium **or** maintains / increases, thickness of endometrium **or** inhibits FSH secretion **or** inhibits LH secretion ; [6]

(b) 1 (effect on) hypothalamus / anterior pituitary ;

2 (both) inhibit secretion of, FSH / LH ;

3 (hence) no ovulation ; **R** ref. to eggs

4 ref. negative feedback ;

5 makes cervical mucus hostile to sperm / thickens mucus therefore stops sperm ;

6 prevents implantation ; [3 max]

[Total: 9]

6 (a) (i) adenine ;

(ii) ribose ; **R** pentose [2]

(b) 1 energy is released when it is hydrolysed ; **A** equation **A** joules for energy

2 easily hydrolysed ;

3 (energy) used in, processes / reactions ; **A** named process

4 rapid turnover ;

5 links catabolic and anabolic reactions / AW ;

6 found in, most cells / all organisms ;

7 soluble so easily moved (within cell) ;

8 ATP produced from variety of reactions ; **A** named reactions [4 max]

(c) 1 ETC / inner mitochondrial membrane / crista / stalked particles ;

2 grana / thylakoids / inner chloroplast membrane ;

3 cytoplasm / cytosol ;

4 mitochondrial matrix ; [2 max]

[Total: 8]

7 (a) **G** to cells in centre ;

R to surrounding white area ; [2]

(b) ADH ; [1]

(c) **(i)** (too) large / MM > 68 000 ;

to pass through basement membrane ; **R** gaps / wall [2]

(ii) reabsorbed ;

in proximal convoluted tubule ; [2]

(iii) 1. more urea in urine than in filtrate / ora ; **A** comparative figs

2. water is reabsorbed ;

3. in, distal convoluted tubule / collecting duct ;

4. most urea stays in urine ; **R** all urea stays

5. other substances are reabsorbed ; [2 max]

[Total:9]

8 1 CC^a Bb X C^hC^a Bb ;

2 CB Cb C^aB C^ab x C^hB C^hb C^aB C^ab ;

3 offspring phenotypes:
full black : full red : himalayan black : himalayan red : albino black : albino red ;

4 phenotype ratio:
6 : 2 : 3 : 1 : 3 : 1 ;

5/6 offspring genotypes in Punnett square ;; [6]

ecf
if incorrect symbols penalise the parent genotypes (pt 1) and mark rest of cross up to max 4

ecf
if one gene only used then mark to max 2

[Total: 6]

9 **(a)** **(i)** ribulose ; [1]

(ii) ribulose bisphosphate carboxylase / rubisco ; [1]

(iii) stroma ; **R** stoma [1]

(iv) ATP / reduced NADP ; **R** reduced NAD [1]

(b) 1 light independent reaction / Calvin cycle, continues ;

2 RuBP (still) converted to GP ;

3 until used up ; *link to 2*

4 light dependent reaction stops ;

5 no, ATP / reduced NADP, produced ;

6 RuBP not regenerated ;

7 GP, coverted to TP / used to make hexose ; [4 max]

[Total: 8]

10 (a) *most of these points can be taken from an annotated diagram*

1 nucleus in cell body ;

2 (short), dendrites / dendrons ;

3 axon ;

4 (axon) much longer than, dendrite / dendrons ;
must be stated / not on diagram

5 cell body contains, mitochondria / RER / golgi / groups of ribosomes ;

6 many mitochondria at, synaptic knob / terminal branch ;

7 synaptic vesicles ;

8 neurotransmitter / named neurotransmitter ; *linked to 7*

9 Schwann cells / myelin sheath ;

10 nucleus in Schwann cell ; **R** nucleus in myelin sheath

11 node of Ranvier ;

12 AVP ; e.g. motor end plate / (dendrites) have receptors (for neurotransmitters) [7 max]

(b) 13 Na^+ channels open ; **A** sodium channels

14 Na^+ enter cell ; **R** enter membrane

15 inside becomes, less negative / positive / +40mV / depolarised ;

16 Na^+ channels close ; **A** sodium channels

17 K^+ channels open ; **A** potassium channels

18 K^+ move out (of cell) ; **R** of membrane

19 inside becomes, negative / repolarised ; **A** negative figure [5 max]

20 local circuits / description ;

21 (myelin sheath / Schwann cells) insulate axon / does not allow movement of ions ;

22 action potential / depolarisation, only at nodes (of Ranvier) / gaps ;

23 saltatory conduction / AW ;

24 one-way transmission ;

25 AVP ; e.g. hyperpolarisation / refractory period *related to 24* [3 max]

[Total: 15]

11 (a) 1 allopatric speciation ;

2 geographical isolation / spatial separation ;

3 e.g. of barrier ;

4 e.g. of organism ; *must relate to 3*

5 sympatric speciation ;

6 example ;

7 meiosis problems ;

8 polyploidy ;

9 behavioural / temporal / ecological / structural, isolation ;

10 (isolated) populations, prevented from interbreeding / can only breed amongst themselves ;

11 no, gene flow / gene mixing, (between populations) ;

12 different selection pressures operate ;

13 natural selection ;

14 change in allele frequencies ;

15 different gene pool ;

16 over time (differences prevent interbreeding) ;

17 reproductively isolated ; [8 max]

(b) 18 humans ; *must be linked to, choosing / selecting / mating etc*

19 parents with desirable feature ;

20 e.g. organism **and** feature ;

21 bred / crossed ;

22 select offspring with desirable feature ;

23 repeat over many generations ;

24 increase in frequency of desired allele(s) / decrease in frequency of undesired allele(s) ;

25 background genes ;

26 loss of hybrid vigour / increase in homozygosity / ref. inbreeding depression ;

27 AVP ; e.g. detail of breeding techniques [7 max]

[Total: 15]