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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

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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]

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(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]

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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]

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(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]

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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]

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(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]

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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]

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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]

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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]

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(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]

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