

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

Specimen for 2007

GCE A LEVEL

MARK SCHEME

MAXIMUM MARK: 100

SYLLABUS/COMPONENT: 9700/04

**BIOLOGY
STRUCTURED QUESTIONS**

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- 1 (a) RQ = volume of carbon dioxide given off;
volume of oxygen taken up
R amount A moles
[1]
- (b) (i) $18\text{H}_2\text{O}$;
 18CO_2 ;
[2]
- (ii) $18/26$;
 $= 0.69 - 0.70$;
allow 2 marks for correct answer [2]
- (c) depends on substrate;
greater than 1 some anaerobic respiration/ref. to an anaerobic respiration;
carbohydrate 1/protein 0.9/fat 0.7 ;; *2 out of 3* [2 max]
ref. to other metabolic processes using oxygen/produce carbon dioxide;
- (d) time/allowed to equilibrate;
record level of fluid in manometer;
change in known time/ref. time;
repeat;
open clip and reset level;
ref. units;
ref. to boiled seeds as a control;
as soda lime absorbs carbon dioxide given off;
ref. to calculation; [4 max]
- (e) remove soda lime;
repeat experiment/ref. to comparison;
ref. to whether manometer rose or fell;
ref. to calculation; [2 max]
- (f) ref. effect of temperature on enzymes in respiration;
ref. named effect of temperature e.g. increased collisions/kinetic energy/more substrate
molecules with activation energy;
ref. to $Q_{10} = 2$ [2 max]
- Total: 15**
- 2 (a) stroma of chloroplast; [1]
- (b) combines with (5C compound) RuBP;
to form unstable 6C compound/forms 2 molecules of (3C) GP;
ref. enzyme/rubisco; [2 max]
- (c) reduced NADP and ATP;
(ATP is) source of energy;
(reduced NADP is for) reduction of GP(PGA) to triose phosphate (TP);
ref. use of ATP in regeneration of RuBP;
ref. to source of phosphate/phosphorylation; [3 max]
- (d) RuBP, accumulates/goes up;
due to reduced combination with CO_2/AW ; *in either RuBP or GP, not both*
GP, goes down/not as much being formed;
due to conversion to TP; [2 max]
- Total: 8**

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- 3 (a) Either
If genetic diagram used

Penalise once for incorrect symbols

orange dominant to black (for converse);

orange scallop

parents	$S^o S^o$	$S^o S^b$	X	$S^o S^o$	$S^o S^b$
gametes	S^o	S^b		S^o	S^b
genotype	$S^o S^o$	$S^o S^b$		$S^o S^b$	$S^b S^b$
phenotype		orange			black
black scallop		$S^b S^b$	X	$S^b S^b$	
parent					
gametes		(S^b	S^b)
genotype			$S^b S^b$		
phenotype			black		

Or
If text explanation given

orange dominant to black (or converse);
orange are heterozygous;
(because) ref. 3:1 ratio;
link data to ratio;
black are homozygous;
because all offspring are black;

[6]

- (b) separate orange scallops produced from first cross/test cross orange with black;
some will produce only orange offspring;
these will be homozygous for orange allele/pure breeding;

[2max]

Total: 8

- 4 (a) Fungi; (accept fungus)
Protoctista; (accept Protista)
Animalia; (accept animal)
Prokaryotae; (accept Prokaryote, bacteria)
Plantae; (accept plant)

[5]

- (b) *advantages*
IDEA of simplicity;
easy to classify most organisms into the correct kingdom;
consistent with the traditional literature / AW;

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disadvantages

plant kingdom, is artificial / contains unrelated organisms / organisms that are not fundamentally similar;

ref. to prokaryotes and eukaryotes in the same kingdom;

ref. to other valid example of very differently organised organisms in the same kingdom;

problem of what to do with protoctists / AW;

detail of difficulty with protoctists (e.g. Euglena is motile (animal-like) but autotrophic (plant-like));

[4 max]

- (c) (i) IDEA that biodiversity is about the variety of different kinds of organisms; BUT there are far more than hundreds of sorts of organisms / there are millions of species; AND biodiversity is all kinds of organisms / not just animals; (independent points)

ii) maintaining biodiversity is important because
 IDEA of extinction is forever / once they are gone they are gone;
 Any two from it is, a source of genes for future use / medicines not yet known / foods not yet known / the means of retaining stability of ecosystems;;

iii) argues that protected species can be successfully protected in artificial environments / zoos / botanic gardens / seed banks;
 argues that species can be successfully protected in controlled natural environments / conserved areas / national parks / AW;
 a specific, named, example of successful conservation (e.g. golden lion tamarins in zoos);

Mark straight through

[6 max]

Total: 15

- 5 (a) restriction (endonuclease) enzyme;
 named example; e.g. EcoR1
 specific, sequence of bases/point;
 ref. to sticky ends/exposed bases;

[3 max]

- (b) sticky ends added to insulin gene;
 ref. to complimentary base pairing/C and G bases pair up;
 ref. H bonds;
 (DNA) ligase;
 formation of phosphodiester bond/seals sugar phosphate backbone;

[3 max]

- (c) identical to human insulin (ref. to bovine/porcine insulin used previously);
 ref. to reduced immune response/side effects;
 cheaper to produce;
 more rapid response;
 pure/uncontaminated;
 regular production not dependent on livestock;
 ethical issues;
 AVP; e.g. tolerance

[2 max]

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Total: 8

- 6 (a) anaerobic / in absence of oxygen;
glycolysis;
IDEA OF because if it was aerobic, no ethanol / only carbon dioxide and water, would be produced;
sugar(s) / named sugar is respiratory substrate;
ethanol produced;
carbon dioxide produced; [3 max]

- (b) (i) end product not contaminated;
enzyme, more stable/less likely to be denatured;
enzyme recovery easier;
idea of enzyme being reused;
AVP; e.g. cost [3 max]

- (ii) α amylase;
more maltose produce;
use of figures; [2 max]

Total: 8

- 7 (a) no petals;
no nectaries;
no scent produced;
large stigma;
feathery stigma;
to trap pollen;
stamens hang outside flowers;
flowers held on tall inflorescences;
pollen light and smooth; [4 max]

- (b) *self pollination*
reliable;
if plants widely scattered;
effective in harsh environments;
e.g. high mountains max 2

- cross pollination*
genetic variation;
ref. outbreeding;
genes shuffled every generation;
species more likely to survive environmental change; max 2 [4 max]

Total: 8

- 8 (a) (i) anterior pituitary gland;
(ii) follicles in ovary; (*both required*)
(iii) corpus luteum (in ovary);
pituitary + ovary + ovary = 1 [3]

- (b) (i) FSH is an oestrogen agonist / AW;

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FSH stimulates follicles to develop (in ovary);
as follicles grow they contain more (granulosa) cells;
(granulosa) cells secrete oestrogen;
oestrogen inhibits FSH production;
peak in oestrogen stimulates LH release;
LH triggers ovulation;
ref. hormones circulate / reach target organs, in blood;

[4 max]

- (ii) rise / peak in oestrogen (before ovulation);
causes proliferation / growth of uterus lining;
rise / peak in progesterone (after ovulation);
maintains uterus lining;
IDEA OF transforms uterus lining from proliferative to secretory;
Drop in progesterone, causes uterus lining to break down / initiates menstruation;
correct ref. figures e.g. oestrogen peak at 10 days / progesterone peak at 21 days;
ref. endometrium;

[4 max]

(c) (i) $\frac{4.0 - 2.2 \text{ cm}^3}{4y} = 0.45; \text{ cm}^3 \text{ per year};$ (accept 1.8 cm^3 per 4 years for 1 mark) [2]

(ii) $\frac{0.45}{2.2} = 0.20 \text{ or } 0.2; ;$ (accept errors carried forward) [2]

Total: 15

9 (a) Explain how a synapse functions. [9]

(b) Describe the role of glucagon in regulating blood glucose. [6]

- (a)
- 1 depolarisation/action potential;
 - 2 of presynaptic membrane/synaptic knob;
 - 3 opening calcium ion channels;
 - 4 calcium ions in;
 - 5 vesicles containing transmitter/acetylcholine;
 - 6 fuse with membrane;
 - 7 contents emptied into synaptic cleft/exocytosis;
 - 8 transmitter/acetylcholine diffuses across synaptic cleft;
 - 9 transmitter/acetylcholine binds to receptor; R protein channel
 - 10 on post synaptic membrane;
 - 11 Na^+ channels open/ Na^+ enters;
 - 12 depolarises post synaptic membrane;
 - 13 action potential set up/impulse transmitted
 - 14 breakdown/hydrolysis of transmitter/acetylcholine by enzyme/cholinesterase; [9 max]

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- (b) 15 when blood glucose levels low;
16 glucagon released from alpha cells (in pancreas);
17 (acts on) liver (cells);
18 breakdown of glycogen to glucose;
19 use of fatty acids in respiration; **R fats**
20 production of glucose from other compounds/fats/amino acids/gluconeogenesis;
21 liver releases glucose into blood;
22 glucose levels rise/return to normal;
23 switching off glucagon secretion;
24 antagonistic to insulin;

[6 max]

Total: 15

- 10 (a) 1 ref. continuous/discontinuous variation;
2 genetic/inherited variation;
3 variation in phenotype/characteristics/AW;
4 (can be due to) interaction of genotype and environment;
5 e.g. of characteristic that influences survival;
6 ref. intraspecific competition/struggle for existence;
7 those with favourable characteristics survive/AW;
8 pass on favourable characteristics to offspring;
9 those with disadvantageous characteristics die;

[6 max]

- (b) 10 ref. to definition of species;
11 ref. allopatric;
12 geographical isolation;
13 ref. to examples e.g. islands/lakes/mountain chains/idea of barrier;
14 ref. to example organism;
15 ref. to populations prevented from interbreeding;
16 isolated populations subjected to different selection pressures/conditions;
17 over time sufficient differences to prevent interbreeding;
18 ref. sympatric;
19 ref. to reproductive isolation;
20 ref. behavioural barriers (within a population);
21 e.g. day active/night active;
22 correct ref. to gene pool;
23 change to allele frequencies;

[9 max]

Total: 15