UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

Specimen for 2007

GCE A LEVEL

MARK SCHEME
MAXIMUM MARK: 100
SYLLABUS/COMPONENT: 9700/04 BIOLOGY STRUCTURED QUESTIONS

UNIVERSITY of CAMBRIDGE
International Examinations

1 **(a)** RQ = volume of carbon dioxide given off; **R** amount **A** moles
volume of oxygen taken up **[1]**

(b) **(i)** $18H_2O$;
$18CO_2$; **[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 <u>enzymes in respiration</u>;
ref. <u>named</u> 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

3 (a) **Either**

If genetic diagram used **Penalise once for incorrect symbols**

orange dominant to black (for converse);

orange scallop						
parents		S^oS^b		X	S^oS^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;

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]**

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)** <u>anterior</u> 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;

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

(ii) $\frac{0.45}{2.2}$ = 0.20 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/acetychloine 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]**

(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 acides 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