UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

International General Certificate of Secondary Education

MARK SCHEME for the May/June 2009 question paper

for the guidance of teachers

0610 BIOLOGY

0610/31 Paper 31 (Extended Theory), maximum raw mark 80

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.

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

1 *one mark per row, treat blank spaces and crossed ticks as crosses*

if ticks and crosses and blanks in the same row, treat as incorrect

allow 'yes' and 'no' for ticks and crosses

feature	fish	amphibian	reptiles	birds	mammals
mammary glands	×	×	×	×	✓
fur / hair	×	×	×	×	✓ ;
scales / scaly skin	✓	×	✓	✓ **A** × (except feet/legs)	× ;
external ears	×	×	×	×	✓ ;
feathers	×	×	×	✓	× ;

[4]

[Total: 4]

2 **(a)** **(i)** gut / alimentary canal / oesophagus / small intestine / ileum / duodenum / large (**A** big) intestine / colon / rectum / intestine / AW ; **R** stomach **[1]**

(ii) hepatic portal vein ; **A** hephatic **R** HPV **[1]**

(b) **(i)** *answers may be in space below question*
A – nucleus ;
B – cell / plasma, membrane ; **A** plasmalemma
C – cytoplasm ; **[3]**

(ii) *award two marks if correct answer (between 1983 – 2017) is given, ignore units*
award one mark if incorrect measurement is divided by 0.06
allow +/- 1 mm in reading the line

120 (mm) / 0.06 (mm) 12 (cm) / 0.006 (cm)
2000 ;; **A** 1983 – 2017 **[2]**

(c) *award in either section*

1 ref to enzymes (within liver cells) ;
2 ref to negative feedback / homeostasis ;
A 'concentration returns to normal' / 'reduces glucose level' / AW

penalise once if insulin / glucagon are described as acting like enzymes – MP5/7
ignore incorrect source of hormone(s)
penalise once if starch is given instead of glycogen and if glycogen is misspelt

blood glucose concentration is higher than normal

3 insulin ;
4 glucose, enters / diffuses into / goes into / absorbed (by liver / cells) ;
5 (liver cells) store glucose as glycogen / convert glucose to glycogen ;
A increase respiration / increase metabolism of glucose / storage of fat / AW

blood glucose concentration is lower than normal

6 glucagon ;
7 (liver cells) convert / break down, glycogen to form glucose ;
8 glucose, goes out of cells / enters the blood ; **[5 max]**

(d) **1** makes (named) protein / protein synthesis / forms peptide bonds / are assimilated ;
2 (excess are) broken down / deaminated ;
3 removal of, amino group / $-NH_2$ / nitrogen-containing part ; **R** nitrogen unqualified
4 (to form) ammonia ;
5 converted to urea ;**A** amino acids are, broken down / converted, to urea
6 rest of molecule (**A** carbohydrate), is respired / used to provide energy / stored ;
7 transamination / described ; **[3 max]**

[Total: 15]

3 **(a)** *description required not an explanation, so ignore collisions / denaturation*
MP3 may be awarded for comments within the range 50 °C to 90 °C

1 no activity, at / below, 10 °C ;
2 increased activity between 10 °C and 90 °C ;
3 steep(est) increase / exponential increase, between 50 *or* 60 °C and 90 °C ;
4 optimum / peak / maximum, at 90 °C ; **A** 'works best at' / most active at
5 above 90 °C activity decreases ; **[3 max]**

(b) *ignore details of genetically modified bacteria*

1 (bacteria grown in) fermenter / bioreactor / vat ; **R** tanks
2 (bacteria provided with) substrate / feedstock / food substances / glucose / sugars / starch / minerals / whey / waste substances / nutrients / amino acids / AW ;
R food / raw materials
3 oxygen / aerobic conditions ; **A** air bubbled through / aerated
4 optimum conditions / 26 °C / pH 5–6 / sterile ;
5 stirred to, prevent settling / mix bacteria with nutrients ;
6 (bacteria) grow / reproduce / divide / multiply, rapidly ;
7 (extracellular) enzymes, secreted / released / AW ; **R** production
8 enzymes, extracted / harvested / separated / collected / removed (from, bacteria / mixture) ;
A ref to filtration / crushing bacteria **R** crushing enzymes **[4 max]**

(c) *enzymes must be in the correct context*
do not award MP9 if there are no other points made

1 protein digested to, amino acids / (poly)peptides ; **A** broken down / hydrolysed
2 (by) protease(s) ;
3 fats digested to fatty acids (and glycerol) ;
4 (by) lipase(s) ; **R** ligase
5 (by) amylase ;
6 starch to, sugar, maltose, glucose ;
7 (by) cellulase ;
8 breaksdown cellulose (fibres) to release stains ; **A** reduces pilling
9 *idea that* products are, soluble / washed away (in the water) ; **[4 max]**

(d) **1** thrombin / protease ;
2 fibrinogen converted to fibrin ;
3 soluble (protein) converted to insoluble (protein) ;
4 fibrin, traps blood cells / forms mesh / forms 'nets' ; **[3 max]**

[Total: 14]

4 **(a)** osmosis ;
water, diffuses / moves, down water potential gradient ; **A** high to low water potential
R high water potential gradient to a low water potential gradient
through partially permeable membrane ; **A** selectively / semi-
salts / sugars / solutes, in root hair cell (to lower water potential) ; **[3 max]**

(b) 20.0 ; **A** 20 *accept if not in table* **[1]**

(c) (rate of water) uptake increases / AW ;
positive correlation / exponential / not linear / AW ; **R** directionally proportional
comparative use of figures with units ;
e.g. 0.4 mm min^{-1} at 0 m s^{-1} / no wind, 20 mm min^{-1} at 8 m s^{-1} **A** increase by ×50 **[2 max]**

(d) temperature ; **R** heat
humidity ;
light intensity ; **R** amount / levels, of light **[2 max]**

(e)
1 (raw material for) photosynthesis / forming glucose *or* carbohydrate ;
2 turgidity / support ;
3 transport of, solutes / named solute / food substances ;
4 forming vacuoles / growth / (cell) expansion ;
5 taking part in chemical reaction(s) ; e.g. hydrolysis / breaking down food substance
6 medium for chemical reactions / AW ;
7 AVP ; e.g. activating enzymes

R 'to keep hydrated' / solvent unqualified **[2 max]**

(f)
1 loss of water (vapour) through stomata (in leaves) ;
2 evaporation, from surfaces of (mesophyll) cells / into air spaces (in leaf) ;
3 loss of water from leaf (cells) lowers water potential ;
4 water moves into leaf (from xylem) ;
5 (this) pulls on / creates tension (in water column in xylem) ;
6 cohesion of water molecules / AW ; **A** 'stick together', ref to polar

R root pressure / adhesion / capillarity **[4 max]**

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(g) *note question says* ***structural*** *adaptations*

leaves, small / reduced to spines / are needles ; **A** small surface area
no leaves ;
curled / rolled, leaves ;
hairs on the, leaves / stems ;
thick (waxy) cuticle ; **R** 'skin' / waxy cuticle unqualified
sunken stomata / AW ;
few stomata ;
fleshy / succulent, leaves / stems ; **A** described as reserves / stores of water
small surface area: volume ratio ;
deep roots ;
long / extensive, shallow roots ; **A** long roots near the surface

AVP ; e.g. photosynthesis in stems
AVP ;

ignore stomata close during the day **[3 max]**

[Total: 17]

5 **(a)** (length of) DNA / part of chromosome / on a chromosome ,
that codes for a protein *or* polypeptide *or* enzyme / controls a characteristic ; **[1]**

(b) H^NH^S x H^NH^S ; *accept N and S*

H^N, H^S + H^N, H^S ; gametes must be clear *accept on dotted line or in Punnett square*

H^SH^S ; *ecf from correct gametes if wrong parental genotype* **[3]**

(c) *check http://www.sicklecellsociety.org/education/healthpr.htm for AVPs*

1 red (blood) cells become, sickle shaped / distorted / AW ; **R** abnormal unqualified
2 in areas of low oxygen concentrations / in tissues ;
3 fewer / less elastic / less flexible / short-lived, red blood cells ; *ora*
4 less haemoglobin ;
5 blood / haemoglobin, less efficient at transporting oxygen ; **R** no oxygen
6 less respiration ; **R** no respiration
7 less energy / fatigued / exhaustion / less active / feeling faint *or* tired / breathless ;
8 capillaries are blocked ;
9 pain ;
10 death of tissues linked to blood supply ;
11 'sickle cell crisis' ; **A** 'attacks needing oxygen'
12 slow / poor, growth ;
13 susceptible to infections ;
14 reduced life span ;
15 AVP ;
16 AVP ; **[4 max]**

(d) **1** *idea that* areas with high percentage of sickle cell (allele) are places with malaria **;**

2 H^SH^S / homozygous recessive, reduced life span because of sickle cell anaemia **;**

3 H^NH^N / homozygous dominant / without H^S , susceptible to malaria / AW **;**

4 H^NH^S / heterozygous / carrier/ with H^S, resistant / not affected / less susceptible **;**
A H^SH^S **R** immune / immunity

5 H^NH^S (carrier) survive and have children / H^NH^N *or* H^SH^S do not **;**

6 H^NH^S / carrier, pass on the allele / H^S **;**

7 (if H^NH^S x H^NH^S) 1 in 4 chance of, H^SH^S / homozygous recessive **;**

8 2 in 4 / 50% / ½ , have advantage of resistance to malaria **;** **[5 max]**

(e) **1** *idea that* distinct groups / categories **;** ref to bar chart

2 *either* sickle cell anaemia (H^SH^S), sickle cell trait (H^NH^S), normal (H^NH^N) / *or* normal, anaemic **;** **A** 'some people have disease, some do not'
A 'some people have the allele, some do not'

3 no intermediates / no continuous scale of anaemia / AW **;**

4 genetic condition / environment has no effect (or its expression) **;**
A ref to small number of, genes / alleles, involved **[3 max]**

[Total: 16]

6 **(a)** **(i)** nitrogen, fixation / fixing **;** **[1]**

(ii) decomposition / decay / putrefaction / rotting **;**
deamination / ammonification **;**
nitrification **;** **A** nitrifying , oxidation of, ammonia / nitrite **[2]**

(b) *award two marks for correct answer (24), if answer incorrect or no answer award one mark for correct working, look out for x 100*

28.8 / 120 x 100 **;**
24 (%) **;** **[2]**

(c) proteins ;
enzymes ;
hormones ;
nucleic acid / DNA / RNA ;
membranes ;
muscle ;
growth / new cells / new tissues ;
repair / replacement ;
respiration / release energy ;
AVP ;
AVP ; **[2 max]**

(d) *in animals*
1 deamination ;
2 ammonia ;
3 urea ;
4 lost in urine / excreted ;
5 lost in faeces / egested / not absorbed;

in field
6 recycled / nitrification, to nitrate (ions) ;

7 nitrate, taken up / absorbed, by plants ;

8 denitrification / nitrate to nitrogen (gas) *or* N_2 ;

9 leached / run-off (from field), into, rivers / streams / lakes / freshwater ;
10 taken up / absorbed, by aquatic plants / algal bloom ; **[5 max]**

(e) **1** increase in (human) population / demand for energy ;
2 combustion of, fossil fuels / named fossil fuel / wood ;
3 industrialisation / factories / power stations ;
4 transport ;
5 intensive farming ;

6 deforestation ;
7 burning of forests ;

8 less plant life to absorb carbon dioxide from the atmosphere ;
9 ref to photosynthesis ;
10 AVP ;

R increase in CO_2 because of respiration of humans **[2 max]**

[Total: 14]