Location Entry Codes

As part of CIE's continual commitment to maintaining best practice in assessment, CIE has begun to use different variants of some question papers for our most popular assessments with extremely large and widespread candidature, The question papers are closely related and the relationships between them have been thoroughly established using our assessment expertise. All versions of the paper give assessment of equal standard.

The content assessed by the examination papers and the type of questions are unchanged.

This change means that for this component there are now two variant Question Papers, Mark Schemes and Principal Examiner's Reports where previously there was only one. For any individual country, it is intended that only one variant is used. This document contains both variants which will give all Centres access to even more past examination material than is usually the case.

The diagram shows the relationship between the Question Papers, Mark Schemes and Principal Examiner's Reports.

Question Paper	Mark Scheme	Principal Examiner's Report
Introduction	Introduction	Introduction
First variant Question Paper	First variant Mark Scheme	First variant Principal Examiner's Report
Second variant Question Paper	Second variant Mark Scheme	Second variant Principal Examiner's Report

Who can I contact for further information on these changes?
Please direct any questions about this to CIE's Customer Services team at: international@cie.org.uk

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.

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 May/June 2009 question papers for most IGCSE, GCE Advanced Level and Advanced Subsidiary Level syllabuses and some Ordinary Level syllabuses.

Question **Expected Answers**

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) <u>hepatic portal vein</u> ; **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 ma**

(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]**

(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 <u>protein</u> *or* <u>polypeptide</u> *or* <u>enzyme</u> / 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 <u>blood</u> / <u>haemoglobin</u>, 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 <u>capillaries</u> 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]

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

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MARK SCHEME for the May/June 2009 question paper

for the guidance of teachers

0610 BIOLOGY

0610/32 Paper 32 (Extended Theory), maximum raw mark 80

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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]**

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A 'concentration returns to normal' / 'reduces glucose level' / AW

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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 ;
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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
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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)** 1 against concentration gradient / from low concentration to high concentration ;
2 across membrane ;
3 (carrier) protein ; *ignore* channel
4 using, ATP / energy ;
5 from, respiration / mitochondria ; **[3 max]**

(b) 6.3 ; **[1]**

(c) temperature ;
humidity ;
air speed ;
light <u>intensity</u> ;
carbon dioxide <u>concentration</u> ;
same species / same variety / same type ;
constant flow (of nutrients) ;
<u>volume</u> of (nutrient) solution ; **R** amount
<u>concentration</u> of (nutrient) solution ; **R** amount
oxygen concentration / aeration, of water ;
R oxygen unqualified / oxygen in the air **R** nutrients unqualified **[3]**

(d) leave to dry for a suitable period of time ; 12 hours / overnight minimum
weigh / use a balance ; **A** scales
repeat until two readings are the same ; **[3 max]**

(e) **(i)** plants small(er) / stunted growth/ shorter plants / poor growth ;
<u>short(er)</u> roots ;
small(er) / few(er), leaves ;
pale / yellow, leaves ; **A** chlorotic
leaves die early ;
<u>stem</u> is thin / plant is spindly ; **R** 'weak' / thin unqualified / stalk **[2 max]**

(ii) used to make amino acids ;
(amino acids) used to make protein ; **A** 'from nitrate'
a use of protein in plants ; e.g. enzyme / membrane / wall / cytoplasm / protoplasm
used to make, nucleic acids / DNA / RNA ;
used to make chlorophyll ; **R** chlorophyll is a protein **R** chloroplast **[2 max]**

(f) **1** it / magnesium, is needed to make / is part of, chlorophyll (molecule) / AW ;
2 (so) little / no, chlorophyll ;
3 little / less / no, absorption of light ;
4 little / less / no, photosynthesis ;
5 little / less / no, food / material (for growth) ;
6 e.g. cellulose / sugars / protein / AW ;
7 little / less / no, energy for, growth / active transport / AW ; **[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 ;

(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 (on its expression) ;
A ref to small number of, genes / alleles, involved **[3 max]**

[Total: 16]

6 **(a)** *this is **not** a question about energy losses in animals*

1 not all plant material is used in the animal feed ; **A** named e.g.
A lost in manufacture of feed

2 light transmitted through plants / not absorbed by plants ;
3 light reflected ;
4 water evaporates from plants / ref transpiration ;

5 temperature too, low / high (to use light efficiently) ;
6 carbon dioxide concentration too low (to use light efficiently) ;

7 loss of energy in (plant) respiration / loss of heat to surroundings / loss of energy in metabolism ;

8 plants are eaten by, insects / pests ;
9 plants are diseased ;
10 leaves / roots, die ;
11 energy to decomposers ;

12 AVP ; e.g. active uptake of ions
13 AVP ;

ignore 'used for growth' / 'used for reproduction' / 'making protein' **[3 max]**

(b) *award two marks if correct answer (19) is given*
if incorrect answer or no answer award mark for correct working – look out for ×100

380 000 / 2 000 000 × 100 ;
19 (%) ; **[2]**

(c)

1 plants = producers / 1st trophic level ;
2 animals / livestock = primary consumers / 2nd trophic level ;

3 energy is lost, between / in each, trophic levels ;
A 'along the food chain' / only 10% is transferred
4 2 000 000 kJ available from first trophic level but 380 000 kJ from, second trophic level / meat ;

5 (only) 19% is transferred from crop plant to humans / 81% is lost / 1 620 000 kJ lost ; **A** *ecf* from **(b)**

energy losses in animals
6 respiration / movement / heat / method of losing heat ;
7 urine / excretion / faeces / food egested ; **[5 max]**

(d)

1 cannot lose (as much) energy in, movement / exercise ;
2 do not have to use as much energy in, keeping warm / keeping cool ;
3 easier to keep animals free of, disease / parasites ;
4 may be provided with better food / food supply better controlled ;
5 AVP ; **[2 max]**

(e)

1 increased use of fossil fuels ;
2 more industrialisation / more transport ; **A** 'more' implied

3 nitrogen oxide(s) / sulfur dioxide, in atmosphere ; **A** NOx
4 dissolves, limestone (marble *or* sandstone) / corrodes zinc roofs ;
5 acidification of, lakes / rivers / freshwater / soils ;
6 kills fish ;
7 some animals cannot form shells properly ;
8 release of aluminium (ions) (in soils) ;
9 defoliation / death of, trees / plants ; **A** crown die back

10 AVP ; e.g. loss of biodiversity if no ref to plant or animals in MP6 / 7 / 9 **[2 max]**

[Total: 14]