Cambridge Assessment International Education

Cambridge IGCSE™

BIOLOGY **0610/42**

Paper 4 Theory (Extended) **October/November 2021**

MARK SCHEME

Maximum Mark: 80

Published

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 should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the October/November 2021 series for most Cambridge IGCSE™, Cambridge International A and AS Level components and some Cambridge O Level components.

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Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

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GENERIC MARKING PRINCIPLE 5: Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).
GENERIC MARKING PRINCIPLE 6: Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Science-Specific Marking Principles

1	Examiners should consider the context and scientific use of any keywords when awarding marks. Although keywords may be present, marks should not be awarded if the keywords are used incorrectly.
2	The examiner should not choose between contradictory statements given in the same question part, and credit should not be awarded for any correct statement that is contradicted within the same question part. Wrong science that is irrelevant to the question should be ignored.
3	Although spellings do not have to be correct, spellings of syllabus terms must allow for clear and unambiguous separation from other syllabus terms with which they may be confused (e.g. ethane / ethene, glucagon / glycogen, refraction / reflection).
4	The error carried forward (ecf) principle should be applied, where appropriate. If an incorrect answer is subsequently used in a scientifically correct way, the candidate should be awarded these subsequent marking points. Further guidance will be included in the mark scheme where necessary and any exceptions to this general principle will be noted.
5	<u>'List rule' guidance</u> For questions that require ***n*** responses (e.g. State **two** reasons …): • The response should be read as continuous prose, even when numbered answer spaces are provided. • Any response marked *ignore* in the mark scheme should not count towards ***n***. • Incorrect responses should not be awarded credit but will still count towards ***n***. • Read the entire response to check for any responses that contradict those that would otherwise be credited. Credit should **not** be awarded for any responses that are contradicted within the rest of the response. Where two responses contradict one another, this should be treated as a single incorrect response. • Non-contradictory responses after the first ***n*** responses may be ignored even if they include incorrect science.

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6 Calculation specific guidance

Correct answers to calculations should be given full credit even if there is no working or incorrect working, **unless** the question states 'show your working'.

For questions in which the number of significant figures required is not stated, credit should be awarded for correct answers when rounded by the examiner to the number of significant figures given in the mark scheme. This may not apply to measured values.

For answers given in standard form (e.g. $a \times 10^n$) in which the convention of restricting the value of the coefficient (a) to a value between 1 and 10 is not followed, credit may still be awarded if the answer can be converted to the answer given in the mark scheme.

Unless a separate mark is given for a unit, a missing or incorrect unit will normally mean that the final calculation mark is not awarded. Exceptions to this general principle will be noted in the mark scheme.

7 Guidance for chemical equations

Multiples / fractions of coefficients used in chemical equations are acceptable unless stated otherwise in the mark scheme.

State symbols given in an equation should be ignored unless asked for in the question or stated otherwise in the mark scheme.

Mark scheme abbreviations

- **;** separates marking points
- **/** alternative responses for the same marking point
- **R** reject the response
- **A** accept the response
- **I** ignore the response
- ecf error carried forward
- AVP any valid point
- ora or reverse argument
- AW alternative wording
- underline actual word given must be used by candidate (grammatical variants excepted)
- ( ) the word / phrase in brackets is not required but sets the context

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Question	Answer	Marks	Guidance
1(a)	duodenum ;	**1**	
1(b)(i)	*any three from:* ref. to membrane for active transport ; uses (chemical) energy ; energy from, the cell / respiration / mitochondria ; (substances move) against concentration gradient / low to high concentration ; using / AW, proteins / carriers (in membranes) ;	**3**	
1(b)(ii)	*idea of* more (cell) membrane / large surface (area) ; allow, increased rate of / fast, absorption (of nutrients) ;	**2**	
1(c)(i)	mucus ;	**1**	
1(c)(ii)	*any two from:* *(to protect the intestine from)* bacteria / viruses / microorganisms / parasites / pathogens ; (named) toxin(s) ; (named) enzymes / prevents self digestion ; (hydrochloric) acid / alkali / base / extreme pH ; physical damage by food passing through intestine / AW ;	**2**	
1(d)	absorbs, fats / fatty acids (and glycerol) ; transports, fats / fatty acids, into, lymph(atic) vessels / lymph(atic) system / lymph ;	**2**	
1(e)	organ ; cell structure ; tissue ; organ ;	**4**	

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Question	Answer	Marks	Guidance
1(f)(i)	*conclusions* **1** fungal extract contains amylase and pectinase **;** **2** clear zone is where substrate has been, digested / broken down **;** **3** extract has a higher concentration than 1% of amylase **;** **4** extract has lower concentration than 1% of pectinase **;** **5** extract has, higher concentration of / more, amylase than pectinase **;** *evidence - can refer to what is in the wells (***A** to **D**)* **6** **D** / fungal extract, in both Petri dishes has clear zones (MP1) **;** **7** no staining in clear zones shows that enzyme was active (MP2) **;** **8** size of clear zone, **D** / with fungal extract, is bigger than **A** / amylase solution (MP3) **;** **9** size of clear zone, **D** / with fungal extract, is smaller than **B** / pectinase solution (MP4) **;** **10** clear zone in, **D** / with fungal extract, is larger in the plate containing starch than in the plate containing pectin (MP5) **;** **11** enzymes, diffuse / move, through the agar **;** **12** greater the clear area the greater, the activity / concentration, of the enzyme **;** **13** no clearance / no breakdown / no change, with water **;**	**5**	**MP3** ***ignore*** more effective *If awarding **MP3** and **MP4**, then award **MP1** as well; if awarding **MP5** also award **MP1*** **MP8 A** more digested **MP9 A** less digested
1(f)(ii)	(same pattern but) smaller / no, clear zones **;**	**1**	

Question	Answer	Marks	Guidance
2(a)(i)	(thread-like structure) made / length / strand / composed / molecule, of DNA **;** carries / contains, genes / alleles / genetic information *or* material **;**	**2**	
2(a)(ii)	prevent pollination (from another flower *or* plant) / to prevent (other) pollen landing on stigma **;**	**1**	
2(a)(iii)	*any two from:* reference to meiosis **;** gametes contain different alleles **;** *idea of* new / different, combinations of, maternal and paternal chromosomes / alleles **;** *idea of* random fertilisation / fusion of gametes with different, genotypes *or* alleles **;** AVP **;**	**2**	
2(a)(iv)	***either:*** **1** meiosis halves the number of chromosomes ***or*** gametes are haploid ***or*** gametes, have one of each type of chromosome / have one set of chromosomes **;** ***and*** **2** *idea that* parental / diploid, number is restored at fertilisation ***or*** cells have 23 chromosomes and fuse together form a cell with 23 pairs **;**	**2**	**A** diploid to haploid in meiosis **A** sperm and eggs / ova / pollen **A** haploid gametes fuse to form diploid, zygote / offspring = 2 marks

Question	Answer	Marks	Guidance
2(b)(i)	P^RP^R ; P^RP^W ; P^RP^R, P^RP^W, P^WP^W ;	**3**	
2(b)(ii)	codominance ;	**1**	

Question	Answer	Marks	Guidance
3(a)(i)	ovary ;	**1**	
3(a)(ii)	plasma / blood (vessels) ;	**1**	
3(a)(iii)	*any two from:* **1** both hormones, follow the same pattern / increase and decrease ; **2** both hormones reach a peak at, day 14 / the same time / the same day ; **3** LH starts increasing before FSH ; **ora** **4** LH has a higher concentration than FSH at, the peak / day 14 ; **5** LH concentrations are lower than FSH before the peak ; **ora** **6** LH concentrations are higher than FSH after the peak; **ora** **7** comparative data quote between concentrations of LH and FSH ;	**2**	
3(b)	*any four from:* **1** FSH stimulates, development / growth / maturation, of <u>follicles</u> (in ovary) ; **2** FSH stimulates, development / growth / maturation, of, egg (cell) / ova / ovum / (female) gamete(s) ; **3** FSH stimulates, production / release / secretion, of oestrogen (from ovary) ; **4** (FSH and) LH (surge) stimulates, ovulation / release of egg from ovary ; **5** LH stimulates (corpus luteum / yellow body / empty follicle), secretion / production / release, of progesterone ; **6** decrease in LH decreases secretion of progesterone (by corpus luteum) ; **7** AVP ;	**4**	

Question	Answer	Marks	Guidance
3(c)	*any three from:* **1** loss / thinning, of lining (of uterus), at the beginning of the cycle / during first week / between day 1–7 **;** **2** regrowth / thickening of, lining (of uterus), during second week / after loss (of lining) / before ovulation **;** **3** thickness of lining remains constant, in the last two weeks / at the end of the cycle / after ovulation / if no fertilisation **;** **4** ref. to, blood vessels / glands **;**	**3**	
3(d)	*any three from:* **1** (contraceptives contain) progesterone (with oestrogen) **;** **2** decreases secretion / prevents release, of FSH / LH **;** **3** prevents, development / maturation of, follicles / eggs / ova **;** **4** prevents ovulation / described **;** **5** AVP **;** e.g. changes / thickens, cervical mucus to prevent entry of sperm OR prevents, regrowth / thickening, of uterus lining (reducing chance of implantation)	**3**	

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>4(a)</td><td>one mark for each row:
<table><tr><th>function</th><th>name</th><th>letter on Fig. 4.1</th></tr><tr><td>conducts impulses to CNS</td><td>sensory / afferent, neurone</td><td>V</td></tr><tr><td>conducts impulses to an effector</td><td>motor / effector / efferent, neurone</td><td>Y</td></tr><tr><td>conducts impulses within the CNS</td><td>relay / connector / intermediate, neurone</td><td>X</td></tr><tr><td>detects / senses, stimulus / change in temperature</td><td>receptor</td><td>U</td></tr><tr><td>contracts / causes movement / carry out response</td><td>biceps / muscle / effector</td><td>Z</td></tr></table>;</td><td>5</td><td>A nerve cell / nerve throughout

A interneurone

A receive
A change in, environment / surroundings
A heat / hot object

A carry out an action
ignore triceps</td></tr>
<tr><td>4(b)</td><td>any four from:
1 vesicles move towards end of, pre-synaptic neurone / axon / AW ;
2 vesicles fuse with (pre-synaptic) membrane ;
3 (named) neurotransmitter released ;
4 neurotransmitter <u>diffuses</u> across, synapse / gap / synaptic cleft ;
5 neurotransmitter binds to receptor, on post-synaptic neurone ;
6 <u>impulse</u> (generated) in post-synaptic neurone ;
7 AVP ;</td><td>4</td><td></td></tr>
<tr><td>4(c)</td><td>blinking / pupil reflex / iris reflex / accommodation / corneal reflex / tear reflex / AVP ;</td><td>1</td><td></td></tr>
</table>

Question	Answer	Marks	Guidance
5(a)	*any two from:* water / fluid / liquid, intake **;** exercise / activity level **;** sweating **;** temperature **;** salt / salty food, intake **;** quantity of urea produced / concentration of urea in blood **;** (named) drug **;** (named) medical condition **;** AVP **;** e.g. water potential of <u>blood</u> / AW	**2**	
5(b)	*any five from:* **1** protein, broken down / digested / decomposed, to amino acids **;** **2** ammonification / mineralisation **;** **3** amino acids converted to, ammonium (ions) / NH_4^+ **;** **4** by, decomposers / fungi / bacteria **;** *if linked to MP1, MP2 or MP3* **5** ammonium (ions) / NH_4^+, converted / oxidised to, nitrate (ions) / NO_3^- **;** **6** nitrification / nitrifying bacteria **;** **7** plants, absorb / use, nitrate (ions) (and ammonium ions) **;** **8** AVP **;** e.g. deamination of amino acids	**5**	MP5 **A** nitrite converted to nitrate if ammonium not given

Question	Answer	Marks	Guidance
5(c)	*any six from:* **1** <u>eutrophication</u> **;** **2** increased growth of, plants / producers / algae **;** **3** plants / producers, compete with each other for light / AW **,** **4** plants / producers, die ***or*** plants / producers, are decomposed **;** **5** increase in, decomposers / bacteria **;** **6** bacteria / decomposers, use / absorb, (dissolved) oxygen in water **;** **7** decrease in concentration of (dissolved) oxygen **;** *reasons for reduction in biodiversity:* **8** death of, (named) animals / fish / invertebrates (due to lack of dissolved oxygen) **;** **9** decrease in, food / energy, available in, ecosystem / AW **;** **10** ref to, pathogens / disease / toxins / poisons **;** **11** ref to <u>aerobic respiration</u> (*in either section*) **12** AVP **;**	**6**	**MP2 A** algal bloom **MP3 A** no photosynthesis as no light **MP8 A** if linked to MP7 **MP9 A** disruption of food, chains / webs

Question	Answer	Marks	Guidance
6(a)	(substance) that increases the rate of (chemical) reactions ; not changed, during / by, the reaction ;	**2**	
6(b)(i)	**T** ;	**1**	
6(b)(ii)	(**T**) fits into / binds to, enzyme / active site ; active site has a complementary shape (to **T**) / active site and **T** are complementary ;	**2**	**A T** and enzyme form an, enzyme-substrate complex / ESC
6(c)	glucose ; pepsin / trypsin / protease ; fatty acids and glycerol ; lactase ; (DNA) ligase ; cuts / breaks / digests, DNA (molecule / strand(s)) / gene / plasmid ;	**6**	**A** other named proteases **A** makes sticky ends

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