Cambridge Assessment International Education

Cambridge Pre-U

BIOLOGY **9790/04**

Paper 4 Practical **October/November 2020**

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 2020 series for most Cambridge IGCSE™, Cambridge International A and AS Level and Cambridge Pre-U components, and some Cambridge O Level components.

This syllabus is regulated for use in England, Wales and Northern Ireland as a Cambridge International Level 3 Pre-U Certificate.

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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.

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	‘List rule’ guidance 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.

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.

Notes:
The following abbreviations may be used in mark schemes:
; separates marking points
/ alternative and acceptable answers for the same marking point
allow / accept / **A** answers that can be accepted
not / reject / **R** answers that are not worthy of credit
ignore / **I** statements that are irrelevant – applies to neutral answers
AW / owtte credit alternative wording / or words to that effect
ecf error carried forward
(words) bracketed words that are not essential to gain credit
words underlined words must be present in answer to gain credit
max indicates the maximum number of marks that can be given
ORA or reverse argument
AVP any valid point – marking points not listed on the mark scheme but which are worthy of credit

Question	Answer	Marks	Guidance
1(a)	*any two from* white / creamy, solid / precipitate ; (lumps) stick to test-tube ; supernatant / liquid, is (more) translucent ;	**2**	Ignore transparent
1(b)	time given with units ;	**1**	**A** minutes and seconds
1(c)	the volume remaining in the milk test-tube is a lower proportion of the total volume / ORA ;	**1**	**A** smaller percentage error
1(d)	*one mark for correct identification of pH* milk 7–8 milk with acid 5 milk with chymosin 7–8 chymosin solution 6 ; *idea that* results show that clotting by chymosin is not due to its acidity ;	**2**	*check values of pH with Supervisor's report*
1(e)	hydrophobic contents are shielded from water by clumping ;	**1**	
1(f)	acid forms, H^+ ions / protons ; H^+ ions interact with charged R groups on protein, leading to denaturation / clotting ; chymosin activity relies on successful collisions between substrate and active site / AW ; specific orientation of molecules ref to, larger number of protons (than enzymes) / ORA ;	**3**	**A** reduces pH faster speed of movement
1(g)	sufficient result(s) recorded (to be able to make a decision) ; appropriate decision made about range ; appropriate comment on the end-point to use ;	**3**	**A** a variety of approaches, e.g. determine whether any difference between 8% and 10% and whether any clotting occurs at 1%

Question	Answer	Marks	Guidance
1(h)	preparation of a suitable range of chymosin concentrations suitable number of concentrations – minimum of 4 different dilutions **;** correct calculation of final concentrations **;** dilution table has headings with units **;** *concentration of chymosin / %* *volumes of water and chymosin solution in* cm^3 total volume of each chymosin solution is $\geqslant 5\ cm^3$ **;**	**4**	e.g. 10% to 2% No units in body of table Same number of decimal places **ignore** 0 and 10 as these do not involve any diluting
1(i)	**1** data recorded in a tabular form **;** **2** concentration of chymosin shown in table **;** **3** informative column headings with correct units **;** *concentration of chymosin / %* *time taken for clotting / s* or *rate of clotting /* s^{-1} **4** results recorded in seconds **;** **5** results agree with expected trend **;** **6** rates of clotting calculated correctly and shown to same number of significant figures **;**	**6**	**A** percentage concentration of chymosin *check against Supervisor's report*
1(j)	axes with correct titles and units **;** *concentration of chymosin / %* *rate of clotting /* $^{-1}$ axes scaled with ascending linear scales **;** graph covers at least half the grid **;** points plotted accurately **;** points joined, clearly / neatly, by straight lines **;**	**5**	**A** time for clotting as ECF from table tolerance = half a small square **A** line/curve of best fit if supported by results **R** any extrapolation after 10%
1(k)	description of pattern **;** increase in active sites **;** increase in successful collisions **;**	**3**	

Question	Answer	Marks	Guidance
1(l)	**1** labelled test-tubes / syringes, to avoid misidentification **;** **2** took, replicates / repeats, to calculate mean / identify anomalies / check for concordance **;** **3** used stated precaution, to take the same end point **;** **4** used syringes of appropriate volume, to reduce percentage error **;** **5** used stated method e.g. wiped, glass rod / bung or wash out syringe with solution, to avoid contamination when preparing the solutions **;** **6** used a staggered start / carry out on one tube at a time, for accurate timing **;**	**4**	e.g. compare with reference tube / roll tube same number of times
1(m)	*error:* cooling effect when tube is out of water bath **;** *improvement:* keep tube in water-bath while observing clotting **;** *error:* judging the end point **;** *improvement:* take a video of each tube to ensure same end point used each time **;** *error:* inaccuracy of syringes **;** *improvement:* use, higher calibre pipettes / micropipettes **;** *error:* start temperature varies between 38 ^{o}C and 42 ^{o}C **;** *improvement:* (use a) thermostatically controlled water bath **;** *error:* initial rate of reaction not measured ; *improvement:* method to observe first signs of clotting ;	**6**	**R** any human errors, e.g. starting stopwatch at different times in the procedure **R** any repetition of precautions taken earlier *improvement must match error*

Question	Answer	Marks	Guidance
1(n)	description of the pattern shown by the bar chart peak at pH 2 is greater than pH 6 **;** peak at pH 6 confirms the statement **;** peak at pH 2 could be caused by acid, causes clotting (as in Method 1) **;** at pH 4 enzyme is denatured but pH is not low enough to cause clotting **;** no units on *y*-axis so hard to determine extent of differences / if differences are significant **;** no error bars or no idea of sample size, so no idea of variability **;**	**4**	**A** 'no scale' for no units **A** ref to standard deviation, standard error or 95% CI

Question	Answer	Marks	Guidance
2(a)(i)	*drawing to max 5* • drawing fills at least half the space available / length of drawing is at least 120 mm ; • outlines drawn clearly with thin lines and without feathering and without shading, no cells drawn ; • epithelial layer drawn ; • correct number of tissue layers ; • tissue layers are the correct proportion ; • villi drawn accurately with crenulations ; *labels to max 8 [could be adjusted at coordination]* • muscularis externa ; • longitudinal muscle ; • circular muscle ; • submucosa ; • mucosa ; • villus / villi ; • epithelium ; • lamina propria ; • lacteal ; • crypts (of Lieberkühn) ; • lumen (of ileum) ;	**12**	*suggest 80 mm depth is minimum* **Ignore** light stippling *if two types of muscle not labelled or labelled the wrong way around, allow one mark for muscle*
2(a)(ii)	*actual size could be measured with ruler or graticule* actual size and drawing size indicated on the drawing ; correct calculation shown – drawing size divided by actual size ; correct magnification ;	**3**	if magnification is not correct **A** 1 mark for correct working - drawing size divided by actual size allow 2 marks for correct magnification even if no calculation shown

Question	Answer	Marks	Guidance
2(b)(i)	individual cells drawn to minimum width of 10 mm ; drawing shows an appropriate number of cells ; drawing includes (to max 4): • a goblet cell ; • droplets of mucus ; • mucus, at surface of goblet cells ; • enterocytes drawn column-shaped ; • depth of, brush border / microvilli, indicated ; • basal nuclei ;	**5**	**A** a minimum of 4/5, maximum of 15 **R** cuboidal shaped
2(b)(ii)	*labels* goblet cell ; enterocyte / columnar epithelium ;	**2**	
2(b)(iii)	appearance of goblet cell ; appearance of enterocyte ; (goblet cells) secrete mucus ; (enterocytes) secrete enzymes (on cell surface) / absorb (named) nutrients ;	**4**	*examples* colour, shape, staining of nucleus, basal 'stalk' of some goblet cells ECF – if cells named incorrectly accept functions if label line to correct cell
2(c)(i)	**A** chief / peptic / zymogenic, cell ; **B** parietal / oxyntic, cell ;	**2**	
2(c)(ii)	*gastric epithelium has:* denser /darker, cytoplasm ; no villi evident ; no goblet cells ; differences in staining ; cells do not have, brush border / microvilli ; nuclei arranged at different positions within cells ; B cells rounded / not columnar ; AVP ;	**3**	

Question	Answer	Marks	Guidance
2(c)(iii)	parietal cells in gastric epithelium secrete hydrochloric acid ; chief cells in gastric epithelium secrete, pepsin(ogen) / rennin / protease ; mucous neck cells (not goblet cells) secrete mucus in stomach ; cells / tissues / wall, not adapted for absorption ; food molecules not small enough to be absorbed ; use of different stains ; AVP ; AVP ;	**4**	