Cambridge Assessment International Education

Cambridge O Level

COMBINED SCIENCE **5129/03**

Paper 3 Experimental Skills and Investigations **For examination from 2023**

MARK SCHEME

Maximum Mark: 40

Specimen

This document has **8** pages.

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.

Abbreviations used in the Mark Scheme

- **;** separates marking points
- **/** separates alternatives within a marking point
- **OR** gives alternative marking point
- **AND** statements on both sides of the **AND** are needed for that mark
- **Reject** reject
- **Ignore** ignore (mark as if this material was not present)
- **Accept** accept (a less than ideal answer which should be marked correct)
- **max** indicates the maximum number of marks that can be awarded
- **ecf** credit a correct statement that follows a previous wrong response
- **( )** the word / phrase in brackets is not required, but sets the context
- **underline** actual word given must be used by candidate

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>1(a)</td><td>suitable table with headings ;
mm unit in heading ;
three correct heights ± 1 mm recorded to the nearest 0.5 mm (half a scale division) ;
remaining two correct heights ± 1 mm recorded to the nearest 0.5 mm (half a scale division) ;
Reject values recorded to the nearest 0.1 mm

<table><tr><th>pH</th><th>height (of foam) / mm</th></tr><tr><td>5</td><td>20.0</td></tr><tr><td>6</td><td>30.0</td></tr><tr><td>7</td><td>50.0</td></tr><tr><td>8</td><td>43.0</td></tr><tr><td>9</td><td>35.0</td></tr></table></td><td>**4**</td></tr>
<tr><td>1(b)</td><td>thermometer ;</td><td>**1**</td></tr>
<tr><td>1(c)</td><td>Any **two** from:
concentration of hydrogen peroxide solution ;
concentration of catalase solution ;
size/diameter of test-tube ;

Ignore volumes of solutions as stated in question</td><td>**2**</td></tr>
<tr><td>1(d)</td><td>Any **two** from:
as the pH increases from 5 to 7 the activity of catalase increases ;
the activity of catalase is at a maximum at pH 7 / optimum pH for catalase is pH 7;
as pH increases above 7 the activity of catalase decreases ;

Accept ecf from **1(a)**</td><td>**2**</td></tr>
<tr><td>1(e)</td><td>(test) biuret (reagent) ;
(positive result) purple/mauve/lilac ;</td><td>**2**</td></tr>
</table>

Question	Answer	Marks
2(a)(i)	**B** NaC*l* / sodium chloride ; **C** NaBr / sodium bromide ;	**2**
2(a)(ii)	flame test ; Na^+ yellow flame **and** K^+ lilac flame ;	**2**
2(b)(i)	measuring cylinder ; **Accept** volumetric pipette	**1**
2(b)(ii)	to make sure all of the acid reacts / to increase the rate of reaction / to increase surface area	**1**
2(b)(iii)	solid remains in the beaker / solid does not disappear / effervescence stops;	**1**
2(b)(iv)	diagram of filter funnel with filter paper over a suitable collection vessel ; filter funnel **and** filter paper labelled ;	**2**
2(b)(v)	dry (the crystals) / put between filter papers / put in warm oven ; remove water ;	**2**

Question	Answer	Marks
3(a)	(l_1 =) 22.5 ± 1 (mm) and recorded to the nearest 0.5 mm (half a scale division); **Reject** values recorded to the nearest 0.1 mm	**1**
3(b)(i)	the stand will fall over ; **OR** spring could slip off the stand (and hit the student) ;	**1**
3(b)(ii)	Dependent mark – the improvement must relate to the hazard turn the stand round (by 180°) / attach the spring lower down ; **Accept** put a weight on the base / clamp the stand **OR** fix the spring to the stand ; **Ignore** wear eye protection	**1**
3(c)(i)	(l_2 =) 50.5 mm ± 1 mm (no mark) substitution of candidate's l_2 and l_1 ; answer in the range from 26 to 30 (mm) ;	**2**
3(c)(ii)	(F =) 1.3 (N) ; Correct answer only	**1**
3(c)(iii)	($k = \frac{F}{x}$ =) correct substitution of x (from **(c)(i)**) and F (from **(c)(ii)**) values ; correct answer, correctly rounded to 2 s.f. ;	**2**
3(d)(i)	straight line of best fit through the origin and with even distribution of points above and below ;	**1**
3(d)(ii)	points marked on the drawn line of best fit, using at least half the length of the drawn line as the hypotenuse of the triangle ; **Accept** use of plotted points if they are on the line of best fit **Accept** ecf on candidate's line in **(i)** coordinates of both marked points substituted into $\frac{\Delta y}{\Delta x}$, seen **AND** evaluated ;	**2**

Question	Answer	Marks
4	**One** mark from each section and any other **three** marks from: **1 Apparatus** balance and measuring cylinder (to measure reagents) ; thermometer (to measure temperature) ; **2 Method, measurements and safety** measure the mass of sodium hydroxide ; measure the volume of water ; measure the initial temperature of the water ; mix the two substances ; gloves / goggles to protect eyes / skin from sodium hydroxide ; measure the final / highest temperature (of the mixture) ; **3 Control and repeats** repeat experiment with (at least) five different masses of sodium hydroxide ; repeat each mass (at least once) ; keep the volume of water the **same** in each experiment ; **4 Processing and use of results** calculate the temperature rise ; calculate the mean temperature rise for each mass of sodium hydroxide ; compare the (mean) temperature rises for each mass of sodium hydroxide ;	**7**