GradeMax

Cambridge Assessment International Education

# Cambridge IGCSE™

**COMBINED SCIENCE** **0653/43**

Paper 4 Theory (Extended) **October/November 2022**

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 2022 series for most Cambridge IGCSE™, Cambridge International A and AS Level components and some Cambridge O Level components.



© UCLES 2022

**[Turn over**

GradeMax



**PUBLISHED**

## 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.

© UCLES 2022

GradeMax



| |
|---|
| GENERIC MARKING PRINCIPLE 5:<br><br>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:<br><br>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<br><br>For questions that require ***n*** responses (e.g. State **two** reasons …):<br><br>• The response should be read as continuous prose, even when numbered answer spaces are provided.<br>• Any response marked *ignore* in the mark scheme should not count towards ***n***.<br>• Incorrect responses should not be awarded credit but will still count towards ***n***.<br>• 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.<br>• Non-contradictory responses after the first ***n*** responses may be ignored even if they include incorrect science. |

© UCLES 2022

GradeMax



| | |
|---|---|
| 6 | Calculation specific guidance<br><br>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'.<br><br>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.<br><br>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.<br><br>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<br><br>Multiples / fractions of coefficients used in chemical equations are acceptable unless stated otherwise in the mark scheme.<br><br>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 |
| / | separates alternative responses for the same marking point |
| 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 accepted) |
| ( ) | the word / phrase in brackets is not required but sets the context |

© UCLES 2022

GradeMax



| Question | Answer | Marks |
|---|---|---|
| 1(a)(i) | **A** stigma ;<br>**B** anther ; | **2** |
| 1(a)(ii) | ovary labelled ; | **1** |
| 1(a)(iii) | *any two from:*<br>stigma feathery ;<br>anther outside (flower) ;<br>no petals ; | **2** |
| 1(b)(i) | grass → vole (→ coyote) → wolf<br><br>correct order of organisms ;<br>arrows in correct direction ; | **2** |
| 1(b)(ii) | coyote / wolf ; | **1** |
| 1(b)(iii) | coyote ; | **1** |
| 1(c) | $6H_2O + 6CO_2 \rightarrow C_6H_{12}O_6 + 6O_2$<br><br>correct substrates (in either order) ;<br>correct products (in either order) ; | **2** |

© UCLES 2022

GradeMax



| Question | Answer | Marks |
|---|---|---|
| 2(a) | chloride ion has: (ORA chloride atom)<br>(one) more electron / a full (outer) shell of electrons / 8 electrons in outer shell / 18 electrons ;<br>a negative (charge) / charge of –1 ; | **2** |
| 2(b)(i) | the number of electrons in the atom (17) is the same as the proton number ; | **1** |
| 2(b)(ii) | the number of shells is the same as the period / AW ; | **1** |
| 2(b)(iii) | *element **X*** bromine / iodine / astatine ;<br>*reason* further down the group (so less reactive) ; | **2** |
| 2(c) | chlorine has simple, molecules / covalent structure OR sodium chloride has, (giant) ionic structure / ionic lattice ;<br><br>attractive forces between ions in sodium chloride are strong(er) than (attractive forces between) molecules in chlorine / attraction between ions is high due to opposite electrical charges / strong electrostatic attraction between ions ;<br><br>more energy is required to separate ions in sodium chloride (hence higher melting point) / ORA ; | **3** |

© UCLES 2022

GradeMax



| Question | Answer | Marks |
|---|---|---|
| 3(a)(i) | N ; | **1** |
| 3(a)(ii) | resultant force (to right) means boat, accelerates / goes faster / speed increases ; | **1** |
| 3(b)(i) | (142 × 3600 ÷ 1000 =) 511 (km / h) ; | **1** |
| 3(b)(ii) | evidence of, $W = Fd$ / 15 000 × 504 ;<br>7 600 000 ;<br>J ; | **3** |
| 3(c)(i) | 130 (m / s) ; | **1** |
| 3(c)(ii) | recognition that area under graph is used to calculate distance ;<br>correct calculation of an area, e.g. ½ x 40 × 130 = 2600 OR (80 – 40) × 130 = 5200 ;<br>7800 (m) ; | **3** |

© UCLES 2022

GradeMax



| Question | Answer | Marks |
|---|---|---|
| 4(a)(i) | ***Q*** coronary artery ;<br>*explanation* (CHD occurs) when it becomes blocked ; | **2** |
| 4(a)(ii) | *any two from:*<br>stress ;<br>genetic predisposition ;<br>age ;<br>gender / sex ; | **2** |
| 4(b)(i) | correct numbers from graph / calculation of percentage, e.g. 144 and 60 or (144 – 60) ÷ 60 × 100 ;<br>140(%) ; | **2** |
| 4(b)(ii) | *any three from:*<br>increase blood flow to muscle ;<br>muscles require (more), energy / oxygen ;<br>increased muscle contraction ;<br>reference to respiration ;<br>need to remove more carbon dioxide from muscle ; | **3** |

© UCLES 2022

GradeMax



| Question | Answer | Marks |
|---|---|---|
| 5(a)(i) | $Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$<br><br>carbon dioxide shown ;<br>equation balanced with 2 AND 3 ; | **2** |
| 5(a)(ii) | *reducing agent* carbon monoxide AND<br>*explanation* because it takes oxygen from iron (oxide) ; | **1** |
| 5(b)(i) | idea that, oxidation is gain of oxygen ; | **1** |
| 5(b)(ii) | *method* suitable method stated, e.g. painting / coating ;<br>*description* corresponding description given, e.g. (stops oxidation) by providing a barrier against, water / oxygen ; | **2** |
| 5(c)(i) | $FeCl_2$ ; | **1** |
| 5(c)(ii) | bond breaking, absorbs / takes in, energy ;<br>bond forming releases energy ;<br>exothermic means, net release of energy / temperature rises ; | **3** |

© UCLES 2022

GradeMax



| Question | Answer | Marks |
|---|---|---|
| 6(a) | correct voltmeter symbol AND in parallel with heating element ; | **1** |
| 6(b)(i) | ($R_T = R_1 + R_2 = 54 + 36 =$) 90 (Ω) ; | **1** |
| 6(b)(ii) | (total resistance decreases so) current increases ;<br>thermal energy proportional to current / $E = VIt$ ; | **2** |
| 6(c)(i) | evidence of, $\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2}$ ;<br>$\frac{1}{41.0} + \frac{1}{53.0}$ OR $\frac{2173}{94}$ = 23.1(1702128) (Ω) ; | **2** |
| 6(c)(ii) | evidence of, $I = V \div R$ / 240 ÷ 60.0 ;<br>(current in main branch =) 4.0 (A) ;<br>(heater 2 current = 4.0 – 2.3 =) 1.7 (A) ; | **3** |

| Question | Answer | Marks |
|---|---|---|
| 7(a)(i) | *any three from:*<br>(tar causes an) increased production of mucus by goblet cells ;<br>mucus blocks airways ;<br>(tar) damages cilia ;<br>(cilia) cannot (re)move, particles / pathogens ; | **3** |
| 7(a)(ii) | (carbon monoxide) combines with <u>haemoglobin</u> ;<br>idea of, reduced ability to transport oxygen ; | **2** |
| 7(b) | good blood supply ;<br>good ventilation (with air) ; | **2** |

© UCLES 2022

GradeMax



| Question | Answer | Marks |
|---|---|---|
| 8(a)(i) | argon ; | **1** |
| 8(a)(ii) | the relative amounts of constituents can be changed in a mixture ;<br>the relative amounts of constituents are fixed in a compound ;<br><br>OR<br><br>a mixture contains two or more substances not combined / joined / bonded ;<br>a compound contains two or more elements chemically combined / joined / bonded ;<br><br>OR<br><br>mixtures maintain the properties of constituents ;<br>compounds have properties different to those of the elements it contains ; | **2** |
| 8(b) | (oxygen) is used in the, combustion / burning ;<br>of, fuel / carbon compounds / hydrocarbons ; | **2** |
| 8(c) | climate change / named environmental impact due to climate change ; | **1** |
| 8(d) | sulfur dioxide ; | **1** |

© UCLES 2022

GradeMax



| Question | Answer | Marks |
|---|---|---|
| 9(a)(i) | (gamma radiation) \| \| \| (visible light) \| infrared (radiation) ; \| \| | **1** |
| 9(a)(ii) | $3.0 \times 10^8$ (m / s) ; | **1** |
| 9(a)(iii) | remote controllers for televisions / intruder alarms / AVP ; | **1** |
| 9(b)(i) | *convection* (reduced by) vacuum / stopper ;<br>*radiation* (reduced by) silver (coating) ; | **2** |
| 9(b)(ii) | (conduction) through the, solid material / plastic outer case / rubber supports / walls of glass container / plastic stopper ;<br>molecular vibrations passed from one molecule to the next ; | **2** |
| 9(b)(iii) | *component* nitrogen AND<br>*reason* lowest boiling point (of the 3 components) ; | **1** |

© UCLES 2022