Cambridge Assessment International Education

Cambridge IGCSE™

COMBINED SCIENCE **0653/43**

Paper 4 Theory (Extended) **May/June 2023**

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 May/June 2023 series for most Cambridge IGCSE, Cambridge International A and AS Level and Cambridge Pre-U 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.

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.

Question	Answer	Marks
1(a)	<table><tr><th>letter</th><th>name</th><th>function</th></tr><tr><td>D</td><td>(scrotum)</td><td>hold testes outside body</td></tr><tr><td>(B)</td><td>testes</td><td>(produce male) gametes / sperm</td></tr><tr><td>C</td><td>urethra</td><td>(carries urine and semen out of the body)</td></tr></table> ;;; *one mark for each correct row*	**3**
1(b)	jelly ; nuclei ;	**2**
1(c)	*any two from:* allows nutrients / oxygen, to pass to fetus ; allows toxins / excretory products, to pass from fetus ; provides barrier for toxins ;	**2**

Question	Answer	Marks
2(a)(i)	hydroxide (ions) ; lose electrons ; to form (water and) oxygen ;	**3**
2(a)(ii)	+ 2e ; $\rightarrow H_2$;	**2**

Question	Answer	Marks
2(b)	*any two from:* (molten or aqueous solution of) an **ionic** compound / a liquid (molten or solution) that contains ions ; the idea that an electrolyte, conducts electricity / contains mobile ions ; the idea that the compound in the electrolyte is broken down (into elements) ;	**2**
2(c)	(aqueous) sodium chloride / other correct ;	**1**

Question	Answer	Marks
3(a)(i)	25 (m / s) ;	**1**
3(a)(ii)	**X** marked at any point between t = 0 s and t = 0.3 s ;	**1**
3(a)(iii)	*any two from:* air resistance ; kinetic energy is transferred into gravitational potential energy ; reference to gravitational force (downwards as ball is going upwards) ;	**2**
3(b)(i)	gravitational force on ball / weight of ball = mg / 0.4 × 10 ; 4(.0) (N) ;	**2**
3(b)(ii)	forces are balanced / no resultant force (when ball is not moving) ;	**1**
3(c)	unit conversions: 0.45 kg or 0.0041 m^3 ; (density =) mass ÷ volume / (=) 0.45 ÷ 0.0041 ; 110 (kg / m^3) ;	**3**

Question	Answer	Marks
4(a)(i)	*any **two** from:* (large) vacuole ; cell membrane ; cell wall ; nucleus ; cytoplasm ;	**1**
4(a)(ii)	large surface area ; increases (rate of) absorption of, water / mineral ions ;	**2**
4(a)(iii)	ref to (large numbers of) chloroplasts ; that contain chlorophyll ; transfers light energy to chemical energy ;	**3**
4(b)(i)	170 – 54 / 116 ; (170 – 54) ÷ 54 × 100 / 116 ÷ 54 × 100 / (170 ÷ 54 × 100) – 100 / 214.814 ; 215 (%) ;	**3**
4(b)(ii)	*any three from:* rate of transpiration decreases ; (idea of higher humidity causes) increased concentration of water surrounding leaves / lower concentration gradient ; decrease in evaporation (from mesophyll cells) ; decrease in diffusion from, **stomata** / **leaves** ;	**3**

Question	Answer	Marks
5(a)	(solute) ammonium nitrate ; (solvent) water ;	2
5(b)(i)	endothermic / energy taken in ; the idea expressed that the energy of products is greater than reactants / products at higher energy level ;	2
5(b)(ii)	**A** bonds are breaking ; **B** bonds are forming ; **A** energy is taken in / **B** energy is given out ;	3
5(c)	all non-metals ; atoms in one molecule: 2,4,3 ;	2

Question	Answer	Marks
6(a)	parallel ;	1
6(b)	kinetic energy (of rotating blades / blown air) ;	1
6(c)(i)	power (rating of lamp) = $V \times I$ / (I =) 11 ÷ 12 ;	1
6(c)(ii)	(power rating of whole circuit = $V \times I$ =) 12 × 8.0 / 96 ; (power rating of fan = (12 × 8) – 11 =) 85 (W) ; **OR** (current in fan circuit =) 8.0 – 0.92 / 7.1 ; (power rating of fan = 12 × 7.1 =) 85(.2) (W) ;	2

Question	Answer	Marks
6(d)	rating of fuse (10 A) much higher than lamp current but closer to the fan current **OR** fuse allows (up to) 10 A to flow with no damage to fan but causes damage to lamp ;	**1**
6(e)	second lamp in series ; two fuse symbols correct, **and** one in each branch ; battery symbol and connecting wiring complete with no short circuits ;	**3**

Question	Answer	Marks
7(a)(i)	either atrium labelled ;	**1**
7(a)(ii)	*any two from:* mixing of blood from lungs and body ; less oxygen transported (to body) ; decrease in blood pressure (to body) ; AVP, e.g. reduction in (aerobic) respiration in cells ;	**max 2**
7(b)(i)	blockage of **coronary** artery ;	**1**
7(b)(ii)	*any two from:* stress ; smoking ; genetic predisposition ; age ; gender / sex ; AVP, e.g. lack of exercise ;	**2**

Question	Answer	Marks
7(c)	(respiration is a) reaction with oxygen ; breakdown of nutrient (molecules) to release energy ;	**2**

Question	Answer	Marks
8(a)	ethene **and** butene ; they both contain a double bond / are unsaturated / are alkenes ;	**2**
8(b)	*either order:* carbon dioxide CO_2 ; water H_2O ;	**2**
8(c)	alkanes ;	**1**
8(d)	cannot be reversed by physical means ; new products formed ;	**2**
8(e)(i)	butane has weaker forces **between its molecules** ;	**1**
8(e)(ii)	similar boiling points ;	**1**

Question	Answer	Marks
9(a)(i)	(peaks represent) particles closer together ; (troughs represent) particles further apart ;	**2**
9(a)(ii)	(transferred to) thermal energy ;	**1**

Question	Answer	Marks
9(b)	*any two from, and in any order:* shorter wavelength ; higher frequency ; electromagnetic (as opposed to pressure waves) ; transverse ; can travel in a vacuum ;	**2**
9(c)	speed = frequency × wavelength / $v = f\lambda$ **OR** $f = 3 \times 10^8 \div 0.030$; 1.0×10^{10} ; Hz ;	**3**