



Cambridge IGCSE™

COMBINED SCIENCE

0653/42

Paper 4 Extended Theory

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.

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This document consists of **9** printed pages.

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.

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)	(vegetable noodles) contain (more) vitamin C ;	1
1(b)	(vegetable noodles) contain less energy ; excess energy would be stored as fat / owtte ;	2
1(c)	carbohydrate / fat / protein ;	1
1(d)	prevents constipation ;	1
1(e)(i)	by haemoglobin ; in red blood cells ;	2
1(e)(ii)	rate / depth of breathing increases ; (due to) increased carbon dioxide (concentration in the blood) ; (because), (rate of) respiration increases / CO ₂ is a product of respiration ;	3

Question	Answer	Marks
2(a)(i)	(compound containing only carbon and hydrogen and) only single (covalent) bonds (between carbon atoms) ;	1
2(a)(ii)	x = 4 ; y = 8 ;	2
2(b)(i)	double bond between carbon atoms; all else correct including chemical symbols ;	2
2(b)(ii)	orange to colourless ;	1
2(c)(i)	carbon dioxide / CO ₂ ; water / H ₂ O ;	2
2(c)(ii)	(bond breaking is) endothermic AND (bond forming is) exothermic ; more energy released during bond formation than energy required for bond breaking ;	2

Question	Answer	Marks
3(a)(i)	Q ;	1
3(a)(ii)	equal (magnitude) AND opposite (direction) ;	1
3(b)(i)	X drawn to show region between (0,0) and (3,0.4) ;	1
3(b)(ii)	Y drawn to show region between (10,0.2) and (14,0.3) ;	1
3(b)(iii)	acceleration = change of speed ÷ time / $-0.2 \div 3$; -0.07 ; m / s^2 ;	3
3(c)(i)	$\Delta\text{G.P.E.} = mg\Delta h$ in any form / $200 \times 10 \times 1.2$; 2400 J (= 2.4 kJ) ;	2
3(c)(ii)	any two from: thermal energy lost to surroundings / work done against friction ; man also has to gain PE going up onto the platform ; kinetic energy transferred / work also done in moving the man (and load) forward ;	2

Question	Answer	Marks
4(a)(i)	guard cell labelled with letter P ;	1
4(a)(ii)	contains, chloroplasts / chlorophyll ;	1
4(b)	any three from: water molecules have increased (kinetic) energy ; increased (rate of) <u>evaporation</u> (from surface of mesophyll cells) ; increased (rate of) <u>diffusion</u> , through stomata / out of leaves ;	3
4(c)(i)	leaves / trees → snails → thrushes → hawks organisms in correct order ; arrows in correct direction ;	2

Question	Answer	Marks
4(c)(ii)	snails ; herbivores / feed on producers / second trophic level ;	2
4(c)(iii)	<i>any two from:</i> respiration / heat / movement ; death ; excretion (of waste / urine) / loss of solid waste / faeces ; not all organisms in the chain, eaten / digested ;	2

Question	Answer	Marks
5(a)	iron oxide ;	1
5(b)	<i>any one from:</i> forms coloured <u>compounds</u> ; has high melting point ; has high density ; reference to use as a catalyst ;	1
5(c)(i)	ions must be mobile ;	1
5(c)(ii)	Al_2O_3 ;	1
5(c)(iii)	(type of bonding) aluminium oxide is ionic AND methane is covalent ; stronger forces of attraction (between oppositely charged ions) in aluminium oxide / weaker forces of attraction (between molecules) in methane ; so more energy needed to separate particles / overcome attraction (hence higher melting point) / ora ;	3
5(d)	as number of (outer shell) electrons increases, element changes from metallic to non-metallic ;	1

Question	Answer	Marks
6(a)(i)	forces decrease / weaken ; distances increase ; move, (more) freely / away from surface (of liquid water) ;	3
6(a)(ii)	black is a good absorber (of radiation) ; warm base of pool transfers thermal energy to water / increase in temperature of water (increases rate of evaporation) ;	2
6(a)(iii)	more-energetic molecules escape ; remaining molecules are less energetic (so lower temperature) ;	2
6(b)	radiation ;	1

Question	Answer	Marks
7(a)	<i>any two paired responses:</i> strong / thick wall, prevents bursting / withstands high pressure ; elastic fibres in wall, prevent bursting / stretch to accommodate high pressure of blood / enable wall to recoil and maintain pressure ; narrow lumen, maintains high pressure ;	2
7(b)	(capillaries have) thin walls ;	1
7(c)(i)	vena cava ;	1
7(c)(ii)	valve 1 opens AND valve 2 closes ;	1
7(d)	prevent backflow of blood / ensure that blood only travels in one direction ;	1

Question	Answer	Marks
8(a)	line with shallower gradient showing slower rate of reaction ; line starting and finishing at same mass ;	2
8(b)	<u>enhanced</u> greenhouse effect / global warming / example of a consequence of climate change ;	1
8(c)	measure distance to spot (from base line) ; measure distance to solvent front (from base line) ; show that $R_f = \text{distance to spot} \div \text{distance to solvent front} = 0.4$;	3
8(d)	idea of electrons gained by copper ions ; <u>two</u> electrons gained (per ion) / ions discharged ;	2

Question	Answer	Marks
9(a)(i)	$R = V \div I$ in any form / $6.0 \div 0.9$; (total resistance =) $6.7 \text{ } (\Omega)$; so resistance of bell = total resistance – resistance of L1 / $6.7 - 4.0 (= 2.7 \text{ } \Omega)$;	3
9(a)(ii)	use of parallel formula $R_{combined} = R_1 R_2 \div R_1 + R_2$ / $16 \div 8.0 (= 2.0 \text{ } \Omega)$; (calculation of total resistance in circuit $R_{total} = 2.7 + 2.0 = 4.7 \text{ } \Omega$; (current in bell = $V \div R_{total} = 6.0 \div 4.7 = 1.28 = 1.3 \text{ } (A)$;	3
9(b)	any two from: if one lamp breaks, the other can still work ; the lamps can be used independently ; each bulb, gets the same voltage / has same brightness ;	2