Cambridge IGCSE™

COMBINED SCIENCE **0653/43**

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.

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 document consists of **9** printed 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	<u>'List rule' guidance</u> 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)(i)	*any one from:* biconcave disc / large surface area (to volume ratio) for maximum oxygen absorption ; no nucleus so more space for oxygen transport ; contains haemoglobin ;	**1**
1(a)(ii)	produce antibodies ; phagocytosis ;	**2**
1(b)(i)	there is a circulation to the lungs and a circulation to the body (tissues) ;	**1**
1(b)(ii)	*any two from:* enables blood to go to the body tissues at high pressure ; enables blood to go the lungs at low pressure ; keeps oxygenated blood separate from deoxygenated blood ; enables faster blood flow ;	**2**
1(c)	(increase in breathing rate) enables more oxygen to, diffuse into / enter, the blood (at the lungs) ; (increase in heart rate) transports oxygenated blood faster ;	**2**
1(d)	coronary heart disease (CHD) ; COPD ;	**2**

Question	Answer	Marks
2(a)	(compound **J**) the molecule of **J**, has the formula C_2H_4 / is unsaturated ;	**1**
2(b)(i)	breaking of large hydrocarbon molecules into smaller molecules ;	**1**
2(b)(ii)	heat / use of a catalyst ;	**1**
2(c)	2 electrons shared in single bond between carbon atoms ; all else correct including the symbols ;	**2**

Question	Answer	Marks
2(d)	$CH_4 + H_2O \rightarrow CO + 3H_2$ all formulae correct ; balanced ;	**2**
2(e)	carbon dioxide ; water ;	**2**

Question	Answer	Marks
3(a)(i)	($m = W \div g$ = 820 ÷ 10 =) 82 (kg) ;	**1**
3(a)(ii)	ΔG.P.E. = $mg\Delta h$ / ΔG.P.E. = wΔh / 82 × 10 × 12 ; 9840 (J) ;	**2**
3(b)(i)	use of acceleration = change in speed ÷ time / 27 ÷ 3.0 ; 9.0 ; m / s^2 ;	**3**
3(b)(ii)	**X** marked at time = 3 s ;	**1**
3(b)(iii)	non-constant, deceleration / acceleration (until it comes to rest) ;	**1**
3(c)(i)	(extension = 40.84 – 40.00 =) 0.84 (m) ;	**1**
3(c)(ii)	calculation of k **OR** 1 / k for one test ; calculation of k **OR** 1 / k for second test **AND** shown to be the same ;	**2**

Question	Answer	Marks
4(a)	*any two from:* for growth of bones (of the fetus) ; to, prevent soft bones / keep bones strong / prevent loss of calcium in mother's bones ; to assist calcium absorption ;	2
4(b)(i)	tiredness / feeling dizzy / pale complexion / anaemia ;	1
4(b)(ii)	liver / red meat / green leafy vegetables ;	1
4(c)(i)	the energy (in the food) taken in exceeds the energy needs of the person ;	1
4(c)(ii)	country **H** ;	1
4(d)(i)	acidic conditions / low pH ;	1
4(d)(ii)	best pH for, pepsin / enzyme action in the stomach ;	1

Question	Answer	Marks
5(a)(i)	*neutrons:* 12 ; *protons:* 12 ;	2
5(a)(ii)	as the number of electrons increases the element becomes less metallic ;	1
5(b)	$MgCl_2$;	1
5(c)(i)	ions must be mobile / ions in a solid cannot move ; ions can move to the electrodes / for conduction of electricity	2
5(c)(ii)	gains electrons ; (gains) two electrons / is discharged ;	2
5(d)	energy is taken in for bond breaking / energy is released when bonds are formed / owtte ; (reaction is exothermic because) more energy released than taken in ;	2

Question	Answer	Marks
6(a)	<table><tr><td>gamma</td><td>X-rays</td><td>ultraviolet</td><td>visible light</td><td>infrared</td><td>microwaves</td><td>radio waves</td></tr><tr><td></td><td></td><td>x</td><td></td><td></td><td></td><td>✓</td></tr></table> *lowest frequency:* tick in correct place ; *causes sunburn:* cross in correct place ;	2
6(b)(i)	(even at speed of light) it takes the gamma radiation a (very) long time to travel (billions of kilometres) ;	1
6(b)(ii)	$v = f\,\lambda$ *in any form* / $3.0 \times 10^8 \div 2.0 \times 10^{-14}$; 1.5×10^{22} (Hz) ;	2
6(c)(i)	infrared ;	1
6(c)(ii)	back / wings / head / darker areas, because black is a good absorber (of radiation) / ORA ;	1

Question	Answer	Marks
7(a)(i)	root(s) ;	1
7(a)(ii)	magnesium ;	1
7(a)(iii)	*any three from:* yellow leaves ; reference to chlorophyll transfers light energy to chemical energy ; chlorophyll is needed for photosynthesis / (lack of chlorophyll) reduces rate of photosynthesis reduced, carbohydrate / glucose / starch production ;	3
7(b)(i)	mistletoe / berries → thrush / (small)bird → cat → hawk OR mistletoe / berries → thrush / (small) bird → hawk organisms in correct order in food chain ; arrows pointing in the correct direction ;	2

Question	Answer	Marks
7(b)(ii)	hawks feed on thrushes which are primary consumers / at the second trophic level (so they are secondary consumers) ; hawks feed on cats which are secondary consumers / at the third trophic level (so they are tertiary consumers) ;	**2**

Question	Answer	Marks
8(a)	warm hydrochloric acid particles have more kinetic energy ; more successful collisions / more frequent collisions ;	**2**
8(b)	hard / dense / high melting point / acts as a catalyst / forms coloured compounds ;	**1**
8(c)(i)	bleaches (damp litmus paper) ;	**1**
8(c)(ii)	sterilises water / kills microbes / kills bacteria ;	**1**
8(d)	copper ions = 4.5 (cm) AND solvent front = 8 (cm) (from diagram) ; (4.5 ÷ 8.0 =) 0.56 ;	**2**

Question	Answer	Marks
9(a)	(gas compared to a liquid) distances between molecules are larger ; forces between molecules are smaller ; molecules are faster-moving / molecules have more KE / move more freely ;	**3**
9(b)	increases rate of evaporation ; water (vapour) molecules taken away from surface of bath (by moving air, preventing them returning to the bath water) ;	**2**
9(c)(i)	$P = IV$ *in any form* / 12 ÷ 0.080 ; 150 (V) ;	**2**
9(c)(ii)	($I = P ÷ V$ = 18 ÷ 150 =) 0.12 A ; (current in main circuit = 0.12 + 0.080 =) 0.20 A (so 0.5 A fuse gives suitable margin) ;	**2**