www.dynamicpapers.com

Cambridge Assessment International Education

Cambridge IGCSE™

COMBINED SCIENCE **0653/42**

Paper 4 Theory (Extended) **March 2021**

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 March 2021 series for most Cambridge IGCSE™, Cambridge International A and AS Level components and some Cambridge O Level components.

© UCLES 2021

[Turn over

www.dynamicpapers.com

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 2021

www.dynamicpapers.com

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.

© UCLES 2021

www.dynamicpapers.com

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.

© UCLES 2021

www.dynamicpapers.com

Question	Answer	Marks
1(a)(i)	liver ;	1
1(a)(ii)	kill bacteria ; provide <u>acidic</u> pH for enzymes ;	2
1(a)(iii)	chemical (digestion) **AND** mechanical (digestion) ;	1
1(b)(i)	carbon dioxide + (water) $\xrightarrow[\text{chlorophyll}]{\text{(light)}}$ (glucose) + oxygen ;; *one mark for carbon dioxide and oxygen* *one mark for chlorophyll*	2
1(b)(ii)	iodine (solution) tests for <u>starch</u> / shows blue-black with <u>starch</u> ; glucose made in photosynthesis is converted to starch ;	2
1(c)	as light intensity increases so does (rate of) photosynthesis (then it levels off) ; idea that rate is higher, at 30°C than 20°C / at higher temperature ;	2

Question	Answer	Marks
2(a)	<table><tr><th>number of neutrons</th><th>number of protons</th><th>number of electrons</th></tr><tr><td>6</td><td>6</td><td>6</td></tr><tr><td>8</td><td>8</td><td>8</td></tr></table> ;; *one mark neutrons correct* *second mark protons and electrons correct*	2
2(b)	carbon has 4 outer shell electrons and oxygen has 6 ;	1

www.dynamicpapers.com

Question	Answer	Marks
2(c)	four bonding electrons shown between carbon and each oxygen ; (dependent on MP1) rest of molecule correct ;	**2**
2(d)	gas ;	**1**
2(e)	*one point from:* CO_2 is a greenhouse gas / causes enhanced greenhouse effect / causes atmosphere to heat up / traps excess heat in atmosphere / causes global warming ; *and one point from:* climate change ; extreme weather events / named example, e.g. hurricanes ; sea level rise / flooding (of coastal areas) ; polar ice caps melt ;	**2**

Question	Answer	Marks
3(a)	9 (m / s) ;	**1**
3(b)	use of gradient of line / use of $v = u + at$; (9.0 – 5.5) ÷ (6.0 – 4.5) = 2.3(3) ; m/s^2 ;	**3**
3(c)	use of area under graph / $5.5 \times (4.5 - 3.0) + ½ \times (10.0 - 5.5) \times (4.5 - 3.0)$; = 11.6(25) (m) ;	**2**
3(d)(i)	air resistance / friction / AVP, e.g. drag ;	**1**
3(d)(ii)	500 N / equal (and opposite so balanced) ; (because) speed is constant / there is no resultant force ;	**2**
3(d)(iii)	work done = force × distance / $W = F \times d$ / 500×30 ; = 15 000 (J) ;	**2**

© UCLES 2021

www.dynamicpapers.com

Question	Answer	Marks
4(a)(i)	(green) plant ; slug / aphid ; fox / blackbird ;	**3**
4(a)(ii)	the position of an organism in a food chain or food web ;	**1**
4(a)(iii)	passes to slug when slug eats (green) plant passes to hedgehog when hedgehog eats slug passes to fox when fox eats hedgehog ;; *all three = 2 marks* *one or two = 1 mark*	**2**
4(b)	concentration of carbon dioxide increases ; *because,* carbon dioxide is produced by burning (the forest) ; less carbon dioxide removed (from the air) by **photosynthesis** ;	**3**

Question	Answer	Marks
5(a)	iron(III) oxide ;	**1**
5(b)(i)	equation 1 / $C + O_2 \rightarrow CO_2$;	**1**
5(b)(ii)	carbon monoxide ;	**1**
5(b)(iii)	carbon / C ; carbon dioxide / CO_2 ; CO / carbon monoxide (gap 1) **and** Fe_2O_3 / iron oxide (gap 2) ;	**3**
5(c)(i)	copper ; zinc ;	**2**

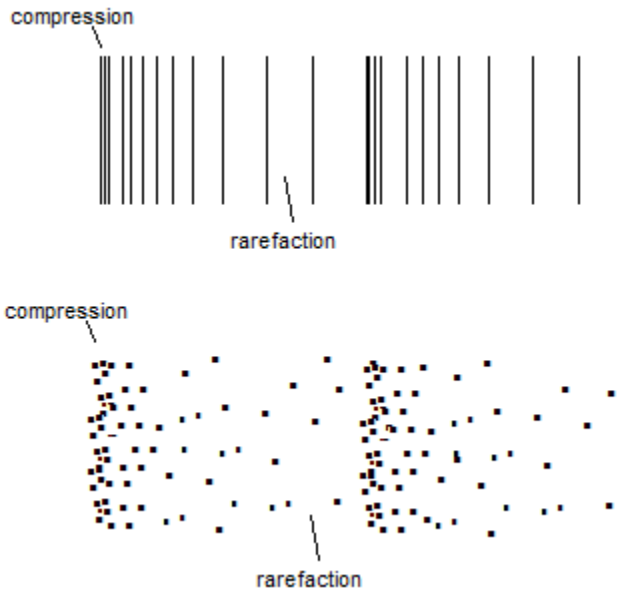
www.dynamicpapers.com

Question	Answer	Marks
5(c)(ii)	(aluminium/magnesium/sodium) **AND** because too reactive / very reactive / more reactive than carbon ;	**1**
5(c)(iii)	electrolysis ;	**1**

Question	Answer	Marks
6(a)(i)	*any two from:* random (arrangement) ; the idea of far apart ; moving, freely / around / quickly / randomly ;	**2**
6(a)(ii)	closer / not as far apart ;	**1**
6(a)(iii)	increase in temperature ;	**1**
6(b)(i)	amplitude correctly indicated on **Fig. 6.2** ;	**1**
6(b)(ii)	$v = f\lambda$ / $\lambda = v \div f$ / $330 \div 400$; = 0.825 / 0.83 (m) ;	**2**

© UCLES 2021

www.dynamicpapers.com

Question	Answer	Marks
6(b)(iii)	(series of) compressions and rarefactions ; description of what these terms mean by reference to air pressure or distance between molecules / diagram such as one of those below,  ;	2

www.dynamicpapers.com

Question	Answer	Marks
7(a)(i)	less, blood / oxygen transported to heart (muscle) ; (heart) muscle unable to respire effectively ;	**2**
7(a)(ii)	*any two from:* gender / sex ; stress ; smoking ; age ; genetic predisposition ; AVP, e.g. obesity / lack of exercise ;	**2**
7(b)	*any one adaptation and explanation pairing for arteries from:* thick **muscular** wall ; to withstand high pressure ; **OR** elastic (muscle fibres in walls) ; to allow, contraction / relaxation / maintain blood flow rate ; **OR** narrow lumen ; to maintain, blood pressure / flow rate ; *adaptation and explanation for capillaries:* thin **walls** / **walls** only one cell thick ; to allow for exchange of materials / to allow substances to diffuse in and out ;	**4**

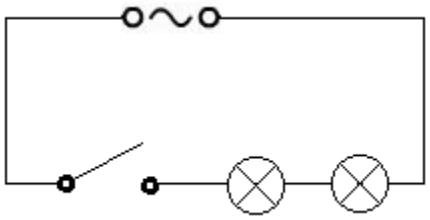
© UCLES 2021

www.dynamicpapers.com

Question	Answer	Marks
8(a)	(thermal) energy / heat, is given out / reaction is exothermic ;	1
8(b)(i)	(fizzing occurs because) hydrogen / a gas, is made ; (Universal Indicator turns purple because) an alkali is made / pH > 7 / a basic solution is made ; (metal) hydroxide is made / named metal hydroxide ;	3
8(b)(ii)	potassium ; *and any one from:* quotes **comparative** observations from the table to show potassium reacts the most vigorously with water ; potassium is the most reactive metal (of the three) / is lower down Group 1 ;	2
8(c)(i)	rubidium hydroxide **and** hydrogen ;	1
8(c)(ii)	(rate of reaction is) **faster** **AND** (explanation) because rubidium is more reactive / because rubidium is lower down the group ;	1

© UCLES 2021

www.dynamicpapers.com

Question	Answer	Marks
9(a)(i)	 correct symbol for a switch and a lamp ; one switch and two lamps in series and all else correct ;	2
9(a)(ii)	failed lamp means no circuit ;	1
9(b)(i)	1.2 (A) ;	1
9(b)(ii)	220 (V) ;	1
9(b)(iii)	$P = V \times I$ $= 220 \times 0.4$; $= 88$ (W) ;	2