



# Cambridge IGCSE™

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CO-ORDINATED SCIENCES

0654/31

Paper 3 Theory (Core)

October/November 2020

MARK SCHEME

Maximum Mark: 120

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**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.

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This document consists of **11** 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)(i)	G ; A ; B ; F / H ;	4								
1(a)(ii)	liver ;	1								
1(a)(iii)	pancreas ;	1								
1(b)	oil (-soluble) circled ; industrial circled ;	2								
1(c)	<table border="1"> <thead> <tr> <th>food molecule</th> <th>smaller molecules</th> </tr> </thead> <tbody> <tr> <td>fats / oils</td> <td>fatty acids and glycerol</td> </tr> <tr> <td>protein ;</td> <td>amino acids</td> </tr> <tr> <td>starch</td> <td>glucose ;</td> </tr> </tbody> </table>	food molecule	smaller molecules	fats / oils	fatty acids and glycerol	protein ;	amino acids	starch	glucose ;	3
food molecule	smaller molecules									
fats / oils	fatty acids and glycerol									
protein ;	amino acids									
starch	glucose ;									

Question	Answer	Marks
2(a)(i)	exothermic ;	1
2(a)(ii)	$2\text{Mg} + \text{O}_2 \rightarrow 2\text{MgO}$ ;	1
2(b)	(magnesium is) malleable ; ductile ; good (electrical / thermal) conductor ;	2
2(c)(i)	difference – gas released with magnesium (and not with the oxide) ; similarity – the solid reacts to form a soluble product / solid dissolves ;	2
2(c)(ii)	magnesium chloride / $\text{MgCl}_2$ ;	1

Question	Answer	Marks
2(d)(i)	copper is low in the reactivity series ; copper is less reactive than hydrogen ;	1
2(d)(ii)	(coloured) copper is a transition metal / transition metal compounds are (usually) coloured / copper compounds are coloured ;	1
2(e)(i)	water / water vapour ;	1
2(e)(ii)	paint / oil / plastic / (named) unreactive metal ;	1
2(e)(iii)	(add other metals to) make it into an alloy / stainless steel ;	1

Question	Answer	Marks
3(a)(i)	<b>X</b> at (0,0) or (160,0) ;	1
3(a)(ii)	(distance travelled) = area under graph <b>or</b> $(60 \times 20) / 2$ ; 600 (m) ;	2
3(b)(i)	50 000 (N) ;	1
3(b)(ii)	Earth ;	1
3(c)(i)	it accelerates / goes faster ;	1
3(c)(ii)	400 000 (N) ;	1
3(d)	45cm = 0.45 m ; force $\times$ distance or $1000 \times 0.45$ ; 450 (m) ;	3

Question	Answer	Marks
4(a)(i)	72 (bpm)	1
4(a)(ii)	<i>athlete</i> 3 (minutes) <b>and</b> non-athlete 7 (minutes) ;	1
4(a)(iii)	$7 - 3 = 4$ (minutes) ;	1
4(a)(iv)	breathing rate would increase ; breathing depth would increase ;	2
4(b)(i)	thick wall ;	1
4(b)(ii)	red blood cell ;	1
4(c)(i)	septum ;	1
4(c)(ii)	muscular (tissue) ;	1

Question	Answer	Marks
5(a)(i)	calcium carbonate ; calcium oxide ;	2
5(a)(ii)	speeds up reaction rate (of both reactions)	1
5(a)(iii)	treat acidic soil ;	1
5(b)(i)	(sodium hydrogencarbonate $\rightarrow$ ) sodium carbonate + carbon dioxide + water ;;	2
5(b)(ii)	gaseous products removed from sodium hydrogencarbonate ;	1
5(c)(i)	mixture <b>Y</b> contains unsaturated hydrocarbons (and <b>X</b> does not) ; molecules (on average) are smaller in <b>Y</b> ;	2
5(c)(ii)	orange to colourless ;	1

Question	Answer	Marks
6(a)(i)	kinetic ;	1
6(a)(ii)	electrons ;	1
6(a)(iii)	chemical potential ;	1
6(a)(iv)	energy transferred to other forms / energy lost to the surroundings / energy lost as thermal energy ; AVP ;	1
6(b)	Sun ; electrical ;	2
6(c)	increase the strength of the magnetic field / increase the current ;	1
6(d)(i)	correct symbols for switch and lamp ; lamps connected in parallel ; one switch controlling both ;	3
6(d)(ii)	if one fails, the other will still light up ;	1

Question	Answer	Marks
7(a)(i)	no sugar – B low – A medium – D high – C ;;;	3
7(a)(ii)	A ;	1
7(b)	movement of <u>water</u> ; across a, partially permeable / cell, membrane ; AVP ;	2
7(c)(i)	light ; chlorophyll ;	2



Question	Answer	Marks
7(c)(ii)	root hair cell ; xylem ;	2
7(d)	producer ;	1

Question	Answer	Marks
8(a)	bauxite ;	1
8(b)	current ; melting ; chemical ;	3
8(c)(i)	sodium chloride / other correct ;	1
8(c)(ii)	the liquid is not an electrolyte / does not contain (free) ions / the compound dissolved is not ionic ;	1
8(c)(iii)	sulfuric (acid) / other correct ;	1
8(d)(i)	reference to protons being positive and electrons being negative ; in atom proton and electron numbers are equal ;	2
8(d)(ii)	ion forms when one electron is lost ; so in ion number of protons / positive charges is one more than electrons / number of negative charges ;	2

Question	Answer	Marks
9(a)(i)	gas to bottom box, liquid to top box, solid to middle box ;	1
9(a)(ii)	(as a liquid is heated) it expands ;	1
9(a)(iii)	ref to 0°C and 100°C; identify / mark temperatures on scale ;	2
9(b)	infrared to box left on microwaves ;	1

Question	Answer	Marks
9(c)	paper placed between sample and detector ; remove paper and if counts increase, $\alpha$ radiation detected ;	2
9(d)	protons = 19 ; neutrons = 21 ;	2

Question	Answer	Marks
10(a)	peripheral ; brain ; electrical ; nerve ;	4
10(b)	sensory (neurone) ;	1
10(c)(i)	ref to gravitropism ; roots grow in the direction of gravity ; shoots grow in opposite direction to gravity ;	3
10(c)(ii)	light / AVP ;	1

Question	Answer	Marks
11(a)(i)	<b>A</b> is diamond ; <b>B</b> is graphite ;	2
11(a)(ii)	covalent (bonding) ; giant (structure) / macromolecule ;	2
11(b)(i)	methane / CH <sub>4</sub> ;	1
11(b)(ii)	damp, red litmus paper ; no reaction with <b>L</b> and turns blue with <b>M</b> ;	2

<b>Question</b>	<b>Answer</b>	<b>Marks</b>
12(a)(i)	normal ;	<b>1</b>
12(a)(ii)	ray drawn to boy from intersection of normal and mirror ;	<b>1</b>
12(a)(iii)	angle of incidence shown and correctly labelled ;	<b>1</b>
12(a)(iv)	laterally inverted ; same size ;	<b>2</b>
12(b)(i)	second ray drawn from bottom of apple to lens ; ray continues to image sensor ;	<b>2</b>
12(b)(ii)	double headed arrow from centre of lens to either point F ;	<b>1</b>
12(c)	$R = V / I$ or $6 / 0.5$ ; 12 ;	<b>2</b>