



COMBINED SCIENCE

0653/41

Paper 4 Extended Theory

October/November 2019

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 **12** 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.

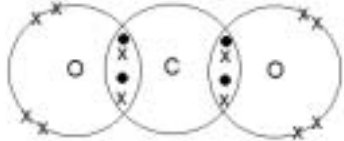
GENERIC MARKING PRINCIPLE 5:

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.

Question	Answer	Marks
1(a)	<i>any two of the following correctly labelled:</i> nucleus ; chloroplast ; cell wall ; vacuole ;	2
1(b)	for (rapid) absorption of water ;	1
1(c)(i)	for movement ;	1
1(c)(ii)	acrosome containing enzymes used in fertilisation / many mitochondria to release energy for swimming ;	1
1(d)(i)	glucose ;	1
1(d)(ii)	haemoglobin ; red blood cells ; diffusion ;	3
1(d)(iii)	capillary <u>walls</u> are thin ;	1

Question	Answer	Marks
2(a)	covalent ; bond between two non-metals ;	2
2(b)(i)	heat / <u>high</u> temperature ; catalyst ;	2
2(b)(ii)	(4) C ₂ H ₄ ;	1
2(c)(i)	 <p>one carbon atom and two oxygen atoms shown and correct electron distribution for carbon atom ; correct electron distribution for both oxygen atoms/lone pairs on both oxygen atoms ;</p>	2
2(c)(ii)	<u>enhanced</u> greenhouse effect / global warming / climate change / consequence of climate change ;	1

Question	Answer	Marks
3(a)(i)	lake surface ;	1
3(a)(ii)	<i>any 2 from:</i> penstock (pipe from dam to turbine) ; turbine ; generator ;	1
3(b)	<i>advantage:</i> no emissions / can be used for flood control ; <i>disadvantage:</i> creating reservoirs can flood useful land / destroy local ecosystems ;	2
3(c)(i)	3×10^8 m/s ;	1
3(c)(ii)	use of $v = f\lambda$; ($\lambda = v \div f = 3 \times 10^8 \div 600 \times 10^6$) = 0.5 m ;	2
3(c)(iii)	microwaves ;	1
3(d)	vibrations / oscillations of particles / air molecules or compressions and rarefactions ; longitudinal / vibration (direction) is parallel to direction of wave propagation / energy propagation ;	2

Question	Answer	Marks
4(a)(i)	6 CO₂ + 6 H₂O → C₆H₁₂O₆ + 6 O₂ LHS ; RHS ;	2
4(a)(ii)	respiratory substrate / for respiration / to release energy ; to make starch (for storage) ;	2
4(b)(i)	B ;	1
4(b)(ii)	greatest number of chloroplasts / large amounts of chlorophyll present ; to absorb light / needed for photosynthesis ;	2
4(c)	(less transpiration means) less <u>diffusion</u> of water (vapour through the stomata / out of leaf) ; due to increased concentration of water vapour in the air / due to reduced difference in water potential ;	2

Question	Answer	Marks
5(a)	high density / high melting point / acts as catalyst ;	1
5(b)(i)	cathode ;	1
5(b)(ii)	gains electrons ; two electrons ;	2
5(c)(i)	carbon ;	1
5(c)(ii)	aluminium is too reactive / aluminium more reactive than carbon ;	1
5(d)	(aqueous) sodium hydroxide ; (pale) blue ppt ; or flame test ; blue–green / turquoise colour ;	2

Question	Answer	Marks
6(a)	Earth ;	1
6(b)	use of $d = m/V$; ($3.29 \times 10^{23} / 0.608 \times 10^{20}$) = 5.41×10^3 (3sf) ; kg/m ³ ;	3
6(c)	Earth ; greatest mass / highest gravitational field strength ;	2
6(d)	darker colour / duller surface ;	1
6(e)	(on Venus) pressure of atmosphere much higher so molecules more concentrated ; so (atmospheric) resistance is greater / more work done by probe pushing molecules aside / owtte ; ORA	2

Question	Answer	Marks
7(a)(i)	(a unit containing) all the organisms and their environment ; interacting together ;	2
7(a)(ii)	light ; chemical (potential) energy ;	2
7(b)	<i>any two from:</i> death of organisms ; (excretion of) waste products from organisms ; respiration ; heat ;	2
7(c)	die / become extinct ; source of food/energy has gone / loss of habitat ;	2

Question	Answer	Marks
8(a)(i)	30 to 55 °C inclusive ;	1
8(a)(ii)	violent / very fast ;	1
8(b)(i)	RbOH ;	1
8(b)(ii)	in range 8–14 ; the solution is an alkali ;	2
8(c)	RbOH is ionic attractive forces between ions are strong more thermal energy (heat) needed to separate ions or water is covalent ; attractive forces between molecules are weak ; less thermal energy (heat) needed to separate molecules ;	3
8(d)	temperature increases / thermal energy released ; chemical energy is changed into thermal energy ;	2

Question	Answer	Marks
9(a)(i)	use of $1/R = 1/R_2 + 1/R_3$; ($1/3 + 1/6$ or $3/6 \rightarrow$) combined $R = (6/3) = 2 \Omega$; total $R = 8 + 2 = 10 \Omega$;	3
9(a)(ii)	$2.7 - 1.8 = 0.9$ (A) ;	1
9(a)(iii)	current from the source (ammeter reading) is the sum of the currents in the separate branches (in R_2 and R_3) of a parallel circuit / owtte ;	1
9(a)(iv)	must be resistance inside the battery / resistance of connecting wires / the idea of greater resistance ;	1
9(b)	use of $P = VI$ or $P = I^2R$; (45×9 or $9^2 \times 5$) = 405 W ;	2