



Cambridge O Level

COMBINED SCIENCE

5129/22

Paper 2 Theory

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MARK SCHEME

Maximum Mark: 80

Published

This mark scheme contains the instructions and marking guidance that our examiners used to mark candidate responses for this component.

Before they start marking, examiners complete a standardisation process. They review a range of candidate responses and discuss the mark scheme in detail to agree which answers can and cannot be accepted. Examiners award marks where it is clear that candidate responses have met the requirements of the mark scheme. These requirements may vary between different components or different versions of the same component, depending on the exact requirements of the question and the candidate responses seen during the standardisation process.

Sometimes, our mark schemes may allow marks to be awarded to responses which contain elements that are factually incorrect or for content not covered by the syllabus. We do this in response to the demands of a specific question to support candidates and make sure that our assessments are fair. However, these allowances should not be used as a guide for teaching and learning.

We cannot discuss the mark scheme with schools, and we recommend that schools read the mark scheme together with the assessment material and the Principal Examiner Report for Teachers.

This document consists of **16** printed pages.

General marking principles

All examiners must apply these marking principles when marking candidate responses.

1	Examiners must award marks for each response in line with: - the specific content defined in the mark scheme - the specific skills defined in the mark scheme or in the level descriptions - the standard of response required as exemplified by the standardisation scripts.
2	Examiners must award whole marks (not half marks, or other fractions).
3	Examiners must award marks positively . This means that: - marks are not deducted for errors or omissions - marks are awarded for correct/valid answers as defined in the mark scheme and also for other valid answers which go beyond the scope of the syllabus and mark scheme referring to your team leader as appropriate - the quality of spelling, punctuation and grammar are judged only when the mark scheme indicates that these features are specifically assessed in the question. However, the meaning of all responses must be unambiguous.
4	Examiners must consistently apply the requirements of the mark scheme and any rules for what to do when candidates have not followed instructions correctly.
5	Examiners must use the full range of marks defined in the mark scheme, unless limited by the quality of the candidate responses seen.
6	Examiners must award marks according to the mark scheme and must not award marks with grade thresholds or grade descriptions 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 <i>n</i> responses (e.g. State two reasons ...): • The response should be read as continuous prose, even when numbered answer spaces are provided. • Any response marked <i>ignore</i> in the mark scheme should not count towards <i>n</i>. • Incorrect responses should not be awarded credit but will still count towards <i>n</i>. • 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 <i>n</i> 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.

Annotations guidance for centres

Examiners use a system of annotations as a shorthand for communicating their marking decisions to one another. Examiners are trained during the standardisation process on how and when to use annotations. The purpose of annotations is to inform the standardisation and monitoring processes and guide the supervising examiners when they are checking the work of examiners within their team. The meaning of annotations and how they are used is specific to each component and is understood by all examiners who mark the component.

We publish annotations in our mark schemes to help centres understand the annotations they may see on copies of scripts. Note that there may not be a direct correlation between the number of annotations on a script and the mark awarded. Similarly, the use of an annotation may not be an indication of the quality of the response.

The annotations listed below were available to examiners marking this component in this series.

Annotations

Annotation	Meaning
	Unclear response
	information missing or insufficient for credit
	benefit of the doubt given
	contradiction in response, mark not awarded
	incorrect point or mark not awarded
	error carried forward applied
	highlight
	incorrect or insufficient point ignored while marking the rest of the response
	power of ten error
	point has been noted, but no credit has been given or blank page seen

Annotation	Meaning
	error in number of significant figures
	Answer outside the tolerance of the mark scheme
	correct point or mark awarded
	response is too vague or there is insufficient detail in response
	Incorrect unit

Mark Scheme Abbreviations:

;	separates marking points
/	alternative responses for the same marking point
R	reject the response
A	accept the response
I	ignore the response
ecf	error carried forward
AVP	any valid point
ora	or reverse argument
AW	alternative wording
<u>underline</u>	actual word given must be used by candidate (grammatical variants excepted)
()	the word / phrase in brackets is not required but sets the context
max	indicates the maximum number of marks that can be given
mp	marking point
cao	Correct answer only

Question	Answer	Marks	Guidance
1	(The heart) has two ventricles ; has walls made of muscle ; pumps blood around body ; pumps blood around lungs ;	4	

Question	Answer	Marks	Guidance
2(a)(i)	straight line with positive gradient ;	1	A straight line with negative gradient
2(a)(ii)	straight horizontal line ;	1	
2(b)	any 2 numbers that multiply to give 2.8 ; kg and m / s ² ;	2	NOT g / grams

Question	Answer	Marks	Guidance
3(a)	Evaporate ;	1	A boil
3(b)	Any three ;;; • sedimentation • filtration • carbon • chlorination	3	I boiling A UV (light) A chlorine for chlorination

Question	Answer	Marks	Guidance
4	<i>name:</i> chloroplast ; <i>function :</i> transfer light energy to chemical energy / makes glucose / makes carbohydrates / photosynthesis ;	2	A contains chlorophyll / absorbs/traps light / uses light to make food for the plant / makes sugars NOT photosynthesis and absorbs water ALLOW if MP1 not awarded, 1 mark for any subcellular structure and its function: • <i>mitochondrion</i> – release of energy from food / respiration (NOT to give energy) • <i>nucleus</i> – controls activities of the cell • <i>ribosome</i> – makes proteins • <i>cytoplasm</i> – site of cell reactions / supports organelles

Question	Answer	Marks	Guidance
5(a)	air resistance / drag / friction ; weight / gravitational / force of gravity ; tension ;	3	NOT reference to energy e.g. friction energy etc. / friction / A gravity NOT gravitational field strength I elastic (suspended by a rope) / pull / push
5(b)	size of A increases as it falls or size of A decreases as it rises ; (because) speed increases as it falls / speed decreases as it rises ;	2	A increases then decreases A 1 mark for 'size of force decreases as it gets slower'

Question	Answer	Marks	Guidance
6(a)(i)	5 to 7 ;	1	
6(a)(ii)	hydrogen ;	1	A H ⁺
6(b)	calcium nitrate ; water ;	2	NOT H ₂ O (word equation) / hydrogen oxide
6(c)	6.4 ;	1	
6(d)	SrO ;	1	A multiples e.g. 2SrO I 2Sr + O ₂ →

Question	Answer	Marks	Guidance
7(a)(i)	fishing items ;	1	
7(a)(ii)	26 (%) ;	1	A answers that round to 26 e.g. 25.5
7(a)(iii)	untreated sewage / nitrogen containing fertilisers ;	1	A human waste / oil / pesticide / chemicals / heavy metals (mercury / lead) / radioactive waste / industrial waste I glass / metal / rubber / cardboard / paper / wood / named objects e.g. cans / tyres / nappies / boxes / fuel unqualified

Question	Answer	Marks	Guidance
7(b)	MP1 rise <u>and</u> decrease ; MP2 gradual / AW, rise (followed by) OR / rapid / large / AW, decrease OR rises to 2016 / falls from 2017 / OR maximum at 2016 ; MP3 (use of data): one correct mass value and corresponding year ;	3	A (each small square = 40 000 tons) e.g. 680 000 (tons) $\pm$ 20 000 in 2011 880 000 $\pm$ 20 000 tons in 2016 280 000 $\pm$ 20 000 tons in 2020 I incorrect mass and year

Question	Answer	Marks	Guidance
8(a)	unit conversion 6 cm = 0.06 m ; rearrangement $F = kx$; $(25 \times 0.06) = 1.5$ (N) ;	3	Correct answer scores 3 marks ALLOW 2 marks for 150 (no unit conversion) ALLOW 1 mark for 1.5×10^n e.g. 15 000 (MP2 evidence of correctly rearranged formula) ALLOW 1 mark for 417 (evidence of 0.06 conversion)
8(b)(i)	gravitational / kinetic AND decreases ;	1	
8(b)(ii)	thermal ;	1	A internal / heat

Question	Answer	Marks	Guidance
9(a)(i)	tin oxide lost oxygen / tin oxide is reduced ; carbon gained oxygen / carbon is oxidised ;	2	A SnO ₂ as AW for tin oxide A if no other mark 'oxygen is lost and gained' (1) OR 'oxidation and reduction' (1) I tin loses oxygen I references to oxide
9(a)(ii)	climate change / global warming / increased greenhouse effect / melting ice caps / sea level rise / extreme weather / ocean acidification / habitat loss / flooding / higher global temperatures ;	1	I acid rain
9(b)(i)	left hand side / middle ;	1	I group I / group II etc.
9(b)(ii)	malleable / ductile / electrical conductor / thermal conductor ;	1	A high melting points / high boiling point / shiny/lustrous / sonorous / dense

Question	Answer		Marks	Guidance
10(a)	<i>structure</i>	<i>function</i>	3	
	X (oviduct)	transports egg cell AW / site of fertilisation / where sperm meets egg ;		A as AW for egg: ovum / ova / female gamete / fertilised egg cell / zygote / (early) embryo A for transfer of sperm to egg
	Y (ovary)	produces egg (cells) / ovulation / store eggs / produces hormones ;		A ovum / ova / female gametes
	Z (uterus)	any one where the embryo / fertilised egg implants ; where the fetus / baby develops / is held ; nourishes / protects fetus / baby ; helps push baby out during birth ;		A 'is placed' as AW for implantation A where menstruation takes place / where periods happen / where the lining is shed

Question	Answer	Marks	Guidance
10(b)	S drawn inside the vagina ;	1	
10(c)	any two ; abstain from sex (of any description) / limit number of sexual partners always use a condom / protection (male or female) / avoid unprotected sex do not inject drugs / share needles / use sterile needles / needle exchange programs AVP (max 1)	2	I avoid people with HIV / antibiotics / staying healthy A clean needles as AW for sterile A toothbrush / razor as AW for needle A e.g. avoid contact with infected blood / use anti-retroviral drugs / regular HIV screening / testing / check-ups / screening of blood for transfusions / use preventative medicine / education programs NOT reference to vaccination I get an injection unqualified

Question	Answer	Marks	Guidance
11(a)	convection ; heated water / it becomes less dense / cold water is denser ;	2	
11(b)	power $\times$ time $\times$ cost per kWh or $1.2 \times 30 \times 2$; 72 cents ;	2	ALLOW 1 marks for 0.72 OR 4320 (2h $\rightarrow$ 120 mins)

Question	Answer	Marks	Guidance
11(c)	less thermal energy / heat is transferred out of the tank ; (less) conduction / poor conductor ;	2	A keeps heat inside / stays hot for longer A water stays hotter for longer due to less conduction = 2 marks

Question	Answer	Marks	Guidance
12(b)	simple molecule ; weak intermolecular forces ;	2	A diatomic molecule
12(a)	(ammonia) turns damp red litmus blue (hydrogen) pops with a lighted splint (oxygen) relights a glowing splint ;;	2	all 3 correct = 2 marks 1 correct = 1 mark
12(c)	increases	1	

Question	Answer	Marks	Guidance
13	ingestion ; physical digestion ; chemical digestion ; absorption / absorbed ; assimilation ;	5	A mechanical digestion ALLOW just digestion if MP3 not scored A digestion unqualified I diffusion

Question	Answer	Marks	Guidance
14	frequency ; wavelength ; amplitude ;	3	

Question	Answer	Marks	Guidance
15(a)(i)	answer between 97 and 40 inclusive ;	1	
15(a)(ii)	Solid ;	1	
15(b)	$2 \text{ Na (s)} + 2 \text{ H}_2\text{O (l)} \rightarrow 2 \text{ NaOH (aq)} + 1 \text{ H}_2\text{(g)}$ balanced ; (l) and (g) ;	2	A multiples NOT liquid / gas / L / G
15(c)	should be +1 ; incomplete outer shell (of electrons) ;	2	I incomplete shell – must refer to outer shell

Question	Answer	Marks	Guidance
16(a)	root hair cells ;	1	
16(b)	mineral ions ;	1	
16(c)	translocation ;	1	
16(d)	water vapour ;	1	

Question	Answer	Marks	Guidance
17	reference to electrons ; loss of electrons ; due to repulsion (between mist droplets) ; due to attraction (between mist and plant) ;	4	