Cambridge Assessment International Education

Cambridge IGCSE™

COMBINED SCIENCE **0653/41**

Paper 4 Theory (Extended) **May/June 2020**

MARK SCHEME

Maximum Mark: 80

Published

Students did not sit exam papers in the June 2020 series due to the Covid-19 global pandemic.

This mark scheme is published to support teachers and students and should be read together with the question paper. It shows the requirements of the exam. The answer column of the mark scheme shows the proposed basis on which Examiners would award marks for this exam. Where appropriate, this column also provides the most likely acceptable alternative responses expected from students. Examiners usually review the mark scheme after they have seen student responses and update the mark scheme if appropriate. In the June series, Examiners were unable to consider the acceptability of alternative responses, as there were no student responses to consider.

Mark schemes should usually be read together with the Principal Examiner Report for Teachers. However, because students did not sit exam papers, there is no Principal Examiner Report for Teachers for the June 2020 series.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the June 2020 series for most Cambridge IGCSE™ and Cambridge International A & AS Level components, and some Cambridge O Level components.

[Turn over

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.

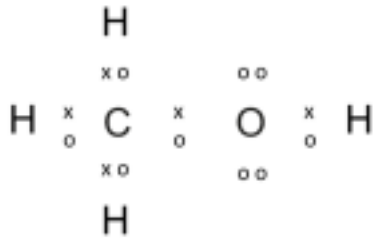
Unless a separate mark is given for a unit, a missing or incorrect unit will normally mean that the final calculation mark is not awarded. Exceptions to this general principle will be noted in the mark scheme.

7 Guidance for chemical equations

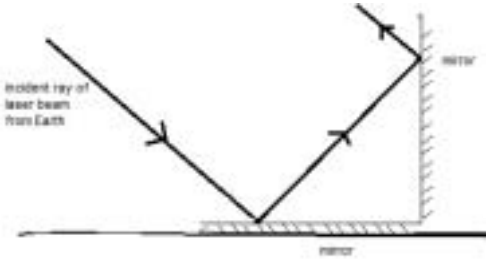
Multiples / fractions of coefficients used in chemical equations are acceptable unless stated otherwise in the mark scheme.

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)	carbon dioxide produced by cells during respiration ; carbon dioxide, diffuses from blood (plasma) / into alveoli / is excreted at the lungs ;	**2**
1(b)	*any two from:* large surface area ; thin surface ; good blood supply ; well ventilated ;	**max 2**
1(c)(i)	goblet cell ;	**1**
1(c)(ii)	(cilia) (beat to) remove mucus ; (mucus) traps pathogens and particles ;	**2**
1(c)(iii)	stimulates mucus production / bronchitis / lung cancer / destroys or paralyses cilia / collects in alveoli / coats gas exchange surface ;	**1**

Question	Answer	Marks
2(a)	contains oxygen / is not just carbon and hydrogen ;	**1**
2(b)(i)	 correct electrons around carbon atom ; correct electrons around oxygen atom ;	**2**
2(b)(ii)	all atoms are non-metallic elements ;	**1**

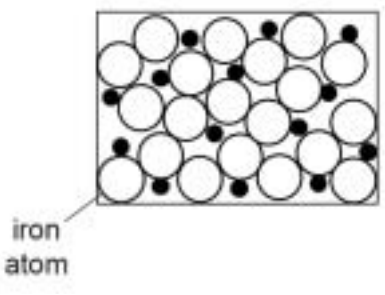
Question	Answer	Marks
2(c)	$(2CH_3OH) + 3O_2 \rightarrow 2CO_2 + 4H_2O$ correct formulae ; correctly balanced ;	**2**
2(d)(i)	reactants on left and products on right ;	**1**
2(d)(ii)	activation energy ;	**1**
2(e)	(carbon dioxide is a greenhouse gas) so **enhanced** greenhouse effect / global warming / climate change / example of an effect of climate change ;	**1**

Question	Answer	Marks
3(a)(i)	(weight = 5000 × 1.6 =) 8000 (N) ;	**1**
3(a)(ii)	(work done =) force × distance = 15 000 × 500 ; = 7 500 000 (J) ;	**2**
3(a)(iii)	(gravitational PE gained =) weight × height = 8000 × 500 ; = 4 000 000 (J) ;	**2**
3(a)(iv)	difference (7 500 000 J – 4 000 000 J = 3 500 000 J) = kinetic energy of the spacecraft ;	**1**
3(b)(i)	 reflections at first and second mirrors ; angles of reflection roughly 45° for both reflections, **and** emergent ray parallel to incident ray ;	**2**

Question	Answer	Marks
3(b)(ii)	distance travelled in 2.56 s = $3.00 \times 10^5 \times 2.56$ (= 7.68×10^5 km for there and back again) ; (distance from the Earth to the Moon (= $\frac{1}{2} \times 7.68 \times 10^5$) = 3.84×10^5 km / 384 000 km ;	**2**

Question	Answer	Marks
4(a)	<u>phototropism</u> ;	**1**
4(b)(i)	arrow drawn coming from the left towards the top of the shoot ;	**1**
4(b)(ii)	increases light intensity on shoot ; for photosynthesis ;	**2**
4(b)(iii)	cells **C** are, longer / elongated, in Fig. 4.2 ;	**1**
4(b)(iv)	more auxin present, in cells on the dark side / in cells **C**, in Fig. 4.2 ; auxin stimulates cell elongation ;	**2**
4(c)	*ticks placed in boxes next to:* increases the blood glucose concentration ; increases the pulse rate ;	**2**

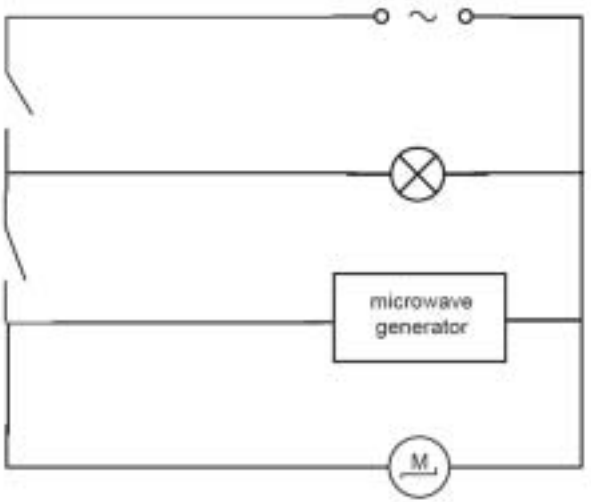
Question	Answer	Marks
5(a)	forms coloured compounds / has high melting point / has high density / catalyst ;	**1**
5(b)(i)	(to provide) energy ; (energy) needed, for work to be done against attractive forces / to break interatomic ‘bonds’ / for particles to break free from solid state ;	**2**

Question	Answer	Marks
5(b)(ii)	 two different atoms **and** semi-regular / most touching ;	**1**
5(c)(i)	iron oxide is reduced / iron oxide loses oxygen ; carbon monoxide is oxidised / carbon monoxide gains oxygen ;	**2**
5(c)(ii)	Fe_2O_3 ;	**1**
5(c)(iii)	magnesium is **too** reactive ; above carbon in reactivity series ;	**2**

Question	Answer	Marks
6(a)	**X** drawn anywhere on curve between 0 s and 3 s ;	**1**
6(b)(i)	(molecules) closer in solid / further apart in liquid ; the idea that the regular arrangement of molecules in solid means that molecules more efficiently packed / owtte ; **or** in liquid, random arrangement so molecules less efficiently packed / owtte ;	**2**
6(b)(ii)	slower in solid / faster in liquid ; in solid less (thermal / kinetic) energy / in liquid more (thermal / kinetic) energy ;	**2**
6(c)	(poor conductor – no mark) good conductors of electricity require free electrons ;	**1**

Question	Answer	Marks
7(a)	(first line) starch ; (second line) lipase **and** glycerol ; (third line) amino acids ;	**3**
7(b)	kills bacteria ; gives an acid pH for enzymes ;	**2**
7(c)(i)	77 (°C) ;	**1**
7(c)(ii)	no activity / reaction rate is reduced ; enzyme denatures / loss of 3D shape ; substrate no longer fits active site ;	**3**
7(c)(iii)	(enzyme) **A and** (reason) high / optimum, activity at body temperature ;	**1**

Question	Answer	Marks
8(a)(i)	(hydrogen ion) gains ; one electron ;	**2**
8(a)(ii)	(test) lighted splint ; (result) goes pop ;	**2**
8(a)(iii)	oxygen ;	**1**
8(b)	*any two from:* particles, move faster / have more kinetic energy / move more ; particles, collide more frequently / more energetically ; more of the collisions provide the activation energy ;	**max 2**
8(c)	magnesium oxide / magnesium carbonate / magnesium hydroxide ;	**1**

Question	Answer	Marks
9(a)	electrical (energy) ; (→) thermal (energy) ;	**2**
9(b)	$v = f\lambda$ so $\lambda = v/f = 3 \times 10^8 / 2.45 \times 10^9$; wavelength = 0.12 / 0.122 (m) ;	**2**
9(c)(i)	 a.c. mains symbol ; microwave generator in parallel with lamp and motor ; second switch in a position where it operates motor and microwave generator only ;	**3**
9(c)(ii)	(current = 0.1 + 2.5 + 0.2 =) 2.8 (A) ;	**1**
9(c)(iii)	Power = $V \times I = 230 \times 2.5$; = 575 ; watts / W ;	**3**