



Cambridge IGCSE™

CO-ORDINATED SCIENCES

0654/31

Paper 3 Theory (Core)

May/June 2020

MARK SCHEME

Maximum Mark: 120

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.

This document consists of **13** printed pages.

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 (see examples below)

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.

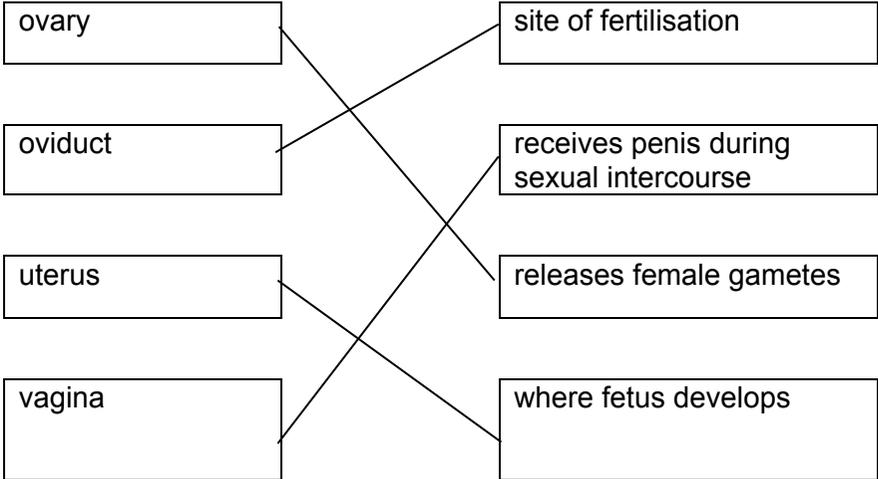
For answers given in standard form, (e.g. $a \times 10^n$) in which the convention of restricting the value of the coefficient (*a*) to a value between 1 and 10 is not followed, credit may still be awarded if the answer can be converted to the answer given in the mark scheme.

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)	ovary, uterus and vagina correctly labelled (clockwise from bottom left hand side) ;;;	3
1(a)(ii)	 <p>... 1 correct for 1 mark 2-3 correct for 2 marks all correct for 3 marks</p>	3
1(b)(i)	$(4500 - 3100) = 1400$;	1
1(b)(ii)	(number of new HIV infections) increases then decreases ; peaks at, 2002 / 7000 (new infections) ;	2
1(c)	control transmission transmission ;; 2 correct for 1 mark all correct for 2 marks	2

Question	Answer	Marks
2(a)(i)	Q R Q P ... 1 correct for 1 mark 2 or 3 correct for 2 marks all correct for 3 marks	3
2(a)(ii)	only changes of state occurring / no new substances formed ;	1
2(b)(i)	7 ;	1
2(b)(ii)	allow a range from <7 to 3 ;	1
2(c)	salt + water ;	1
2(d)(i)	(acidic) oxide of a non-metal / non-metal oxides in the table are acidic ;	1
2(d)(ii)	burning of fuel / named fuel / hydrocarbons in car engines ;	1
2(d)(iii)	carbon monoxide / CO / sulfur dioxide / SO ₂ / other correct ;	1

Question	Answer	Marks
3(a)(i)	speed = distance / time; 15.5 (m/s);	2
3(a)(ii)	area under graph from 0 s to 8 s; $23 \times 8 \times 0.5 = 92$ (m);	2
3(a)(iii)	friction ;	1

Question	Answer	Marks
3(b)(i)	weight = mass \times g / $W = mg / 85 \times 10$; = 850 (N);	2
3(b)(ii)	the Earth;	1
3(b)(iii)	transferred;	1

Question	Answer	Marks
4(a)(i)	oxygen ;	1
4(a)(ii)	light is needed for photosynthesis ;	1
4(b)(i)	protein ; (biological) catalyst ;	2
4(b)(ii)	enzymes stop working / enzyme activity slows down ;	1
4(c)(i)	chloroplast ;	1
4(c)(ii)	cell membrane ; cytoplasm ; nucleus ;	3
4(c)(iii)	elongated shape ; contains no chloroplasts ;	2
4(c)(iv)	absorb, water / mineral ions ;	1

Question	Answer	Marks
5(a)	vertical column of elements / elements whose atoms have same number of outer electrons ;	1
5(b)(i)	(N) idea that the other four are in same horizontal row ;	1

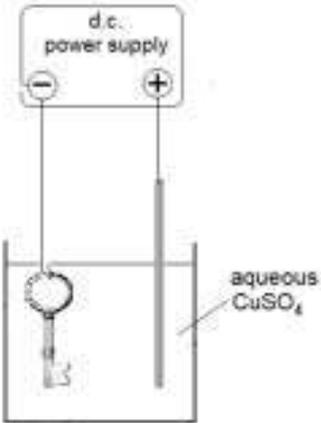
Question	Answer	Marks
5(b)(ii)	two from N / P / S ;	1
5(b)(iii)	improves fertility / increases crop yield (size) / to replenish nutrients ;	1
5(c)	Cl / chlorine ; sterilises the water / kills (harmful) microorganisms ;	2
5(d)(i)	argon has full outer shell (of electrons) ; filled shell is stable / means argon is inert / does not lose or gain electrons to become stable ;	2
5(d)(ii)	(potassium atom) loses one electron ; changes from 2.8.8.1 to 2.8.8 ; (chlorine atom) gains one electron; changes from 2.8.7. to 2.8.8 ;	2
5(d)(iii)	ionic / electrovalent ;	1

Question	Answer	Marks
6(a)	advantage – renewable source ; disadvantage – cannot produce electricity when it is dark ;	2
6(b)(i)	remains constant (at 0°C);	1
6(b)(ii)	the liquid contracts / particles closer together ; idea of particles having less (kinetic) energy;	2
6(b)(iii)	escape of water molecules from the surface; escape of more energetic molecules;	2

Question	Answer	Marks
7(a)(i)	156 – 160 (cm) ;	1
7(a)(ii)	continuous ;	1
7(a)(iii)	height is a range (between two extremes) / not distinct categories ;	1

Question	Answer	Marks
7(b)	competition ; survive ; die ; survive ;	4
7(c)	any two from: pollution hunting deforestation / any change of land use introducing new disease introducing new (competitive) species ; ;	2

Question	Answer	Marks
8(a)(i)	any two from: (good) electrical conductor (good) thermal conductor solid / high melting / boiling point malleable / ductile lustrous / sonorous ;;	2
8(a)(ii)	(a transition metal) forms coloured compounds ; can act as a catalyst ; has (relatively) high density / melting point ;	max 2
8(a)(iii)	(calcium) gas evolved / metal dissolves / white insoluble solid forms ; (copper) no change ;	2
8(b)(i)	same number of all types of atom on LHS and on RHS / shown in reactants and products ;	1
8(b)(ii)	Cu^{2+} ; reference to the loss of oxygen ;	2

Question	Answer	Marks
8(c)	 <p>key and copper electrode connected and dipping into the solution ; correct polarity ;</p>	2

Question	Answer	Marks
9(a)(i)	second ray drawn (parallel) to ray 1 towards lens; from lens, through F to a point further up on the image sensor;	2
9(a)(ii)	diminished; inverted;	2
9(a)(iii)	microwaves to mobile telephones X-rays to security at airports visible light to photographic cameras ;; 2 correct for 1 mark all correct for 2 marks	2
9(b)(i)	light travels faster than sound ;	1

Question	Answer	Marks																		
9(b)(ii)	space is a vacuum ; sound needs a medium to travel / light can travel through a vacuum;	2																		
9(c)(i)	steel is magnetic (most other metals are not) ; magnet can be switched off to release the steel;	2																		
9(c)(ii)	<table border="1"> <thead> <tr> <th></th> <th>electrical conductor</th> <th>electrical insulator</th> </tr> </thead> <tbody> <tr> <td>aluminium</td> <td>✓</td> <td></td> </tr> <tr> <td>cardboard</td> <td></td> <td>✓</td> </tr> <tr> <td>copper</td> <td>✓</td> <td></td> </tr> <tr> <td>polystyrene</td> <td></td> <td>✓</td> </tr> <tr> <td>PVC</td> <td></td> <td>✓</td> </tr> </tbody> </table> <p>;;</p> <p>3 correct for 1 mark all correct for 2 marks</p>		electrical conductor	electrical insulator	aluminium	✓		cardboard		✓	copper	✓		polystyrene		✓	PVC		✓	2
	electrical conductor	electrical insulator																		
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Question	Answer	Marks
10(a)	in the blood (plasma) ;	1
10(b)	increased breathing rate ticked ; widened pupils ticked ;	2
10(c)(i)	glucose + oxygen → carbon dioxide + water ;;	2
10(c)(ii)	respiration releases energy (needed for muscle contraction) ;	1

Question	Answer	Marks
10(d)	any two from: movement sensitivity growth reproduction excretion nutrition ;;	2

Question	Answer	Marks
11(a)(i)	car fuel ;	1
11(a)(ii)	refinery gas / naphtha / diesel (gas oil) / bitumen ;	1
11(b)(i)	methane ;	1
11(b)(ii)	carbon and hydrogen ;	1
11(c)(i)	(aqueous) bromine ; no reaction with alkane and orange to colourless / decolourised with alkene ;	2
11(c)(ii)	alkenes contain a double bond (between carbon atoms) / alkanes contain only single bonds ;	1
11(c)(iii)	cracking ;	1

Question	Answer	Marks
12(a)(i)	P – variable resistor; Q – voltmeter;	2

Question	Answer	Marks
12(a)(ii)	volt;	1
12(a)(iii)	ammeter 1 will be lower than ammeter 2; current from the source is larger than the current in each branch;	2
12(b)	damaged cable, insulation damaged;	1
12(c)	18 protons ; 22 neutrons;	2
12(d)(i)	counts recorded (without paper); put paper in front of sample to see if counts reduce ;	2
12(d)(ii)	background radiation;	1