



Cambridge IGCSE™

CO-ORDINATED SCIENCES

0654/32

Paper 3 Theory (Core)

October/November 2020

MARK SCHEME

Maximum Mark: 120

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 **15** 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

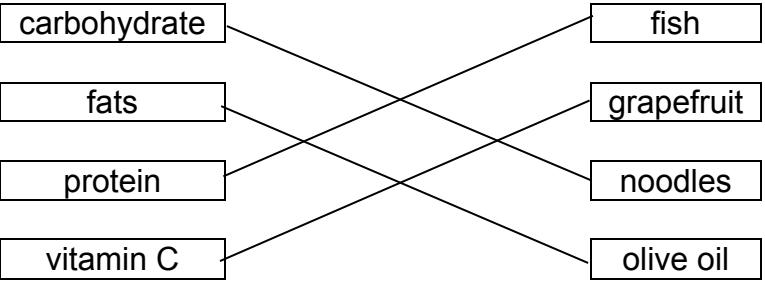
Multiples / fractions of coefficients used in chemical equations are acceptable unless stated otherwise in the mark scheme.

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) | green algae → limpets → crab → lobster / phytoplankton → mussels → crab → lobster ;; | | | | | | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1(a)(ii) | <table border="1" data-bbox="338 347 1697 710"> <thead> <tr> <th></th> <th>carnivore</th> <th>herbivore</th> <th>producer</th> <th>primary consumer</th> <th>tertiary consumer</th> </tr> </thead> <tbody> <tr> <td>crab</td> <td>✓</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>limpets</td> <td></td> <td>✓</td> <td></td> <td>✓</td> <td></td> </tr> <tr> <td>lobster</td> <td>✓</td> <td></td> <td></td> <td></td> <td>✓</td> </tr> <tr> <td>phytoplankton</td> <td></td> <td></td> <td>✓</td> <td></td> <td></td> </tr> </tbody> </table> | | | | | | | carnivore | herbivore | producer | primary consumer | tertiary consumer | crab | ✓ | | | | | limpets | | ✓ | | ✓ | | lobster | ✓ | | | | ✓ | phytoplankton | | | ✓ | | | 4 |
| | carnivore | herbivore | producer | primary consumer | tertiary consumer | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| crab | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| limpets | | ✓ | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| lobster | ✓ | | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| phytoplankton | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1(a)(iii) | <i>population of green algae increase</i> due to less predation (by limpets) ; <i>population of mussels decrease</i> more predation of mussels by, <u>crabs / lobsters</u> ; | | | | | | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1(b) | loss of habitat ; loss of soil ; flooding ; build-up of carbon dioxide in the atmosphere ; AVP ;; | | | | | | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

| Question | Answer | Marks |
|----------|---|----------|
| 2(a)(i) | bromine and liquid chlorine and gas iodine and solid ; ; | 2 |
| 2(a)(ii) | colour becomes darker down the group / owtte ; | 1 |
| 2(b) | ✓ x ✓ x ✓ ; ; | 2 |
| 2(c)(i) | ionic; | 1 |
| 2(c)(ii) | the idea that the ions / particles of both elements have opposite electrical charges ; opposite electrical charges attract ; | 2 |
| 2(d) | ref to flame (test); sodium gives yellow flame / potassium gives lilac flame ; | |

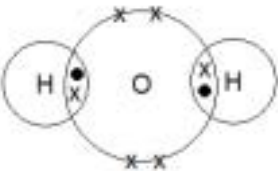
| Question | Answer | Marks |
|-----------------|---|--------------|
| 3(a)(i) | area under graph or $50 \times 10/2$; 250 (m); | 2 |
| 3(b) | friction / air resistance; | 1 |
| 3(c)(i) | 850(N); forces balance / travelling at constant speed; | 2 |
| 3(c)(ii) | 10; N/kg; | 2 |
| 3(d) | volume calculation – volume = 15 (m ³); mass = density \times volume or 1800×15 ; 27 000 (kg); | 3 |

| Question | Answer | Marks |
|----------|--|----------|
| 4(a) |  | 3 |
| 4(b)(i) | <p><i>any two from</i> it has a greater variety of nutrients / food types ; also contains (more) fruit / vegetables ; contains less fats ; contains less sugar ; it contains more vitamins / minerals ;</p> <p>max 2</p> | 2 |
| 4(b)(ii) | as a solvent ticked ; | 1 |
| 4(c)(i) | mouth ; | 1 |
| 4(c)(ii) | <p><i>similarity</i> – both involve movement of (digested) food; <i>difference</i> – absorption is into the blood / assimilation is into the cells ;</p> | 2 |
| 4(d) | <p><i>any two from</i> movement ; respiration ; sensitivity ; growth ; excretion ; reproduction ;</p> <p>max 2</p> | 2 |

| Question | Answer | Marks |
|-----------------|--|--------------|
| 5(a)(i) | malleability / it is malleable ; | 1 |
| 5(a)(ii) | unreactive / does not react with food ; | 1 |
| 5(b)(i) | $100 - (4.0 + 0.6 + 0.7 + 0.5) = 94.2$ (g) | 1 |
| 5(b)(ii) | copper and chromium ; | 1 |
| 5(b)(iii) | alloy is stronger ; | 1 |
| 5(c)(i) | cathode ; | 1 |
| 5(c)(ii) | carbon oxidises / carbon burns / $C + O_2 \rightarrow CO_2$; the idea that a gaseous product is released ; | 2 |
| 5(c)(iii) | bauxite ; | 1 |
| 5(c)(iv) | recycle (waste) aluminium ; | 1 |

| Question | Answer | Marks |
|-----------|--|----------------------|
| 6(a)(i) | correct symbol for cell and switch ; all connected in series; | 2 |
| 6(a)(ii) | chemical; light and thermal; | 1 1 |
| 6(a)(iii) | $I = V/R$ or $12/8$; ($I =$)1.5(A) | 2 |
| 6(b)(i) | ammeter; | 1 |
| 6(b)(ii) | electrons; | 1 |
| 6(c) | $3 + 4 = 7$; | 1 |

| Question | Answer | Marks |
|-----------|--|----------|
| 7(a)(i) | F ; C ; G ; B ; | 4 |
| 7(a)(ii) | diffusion occurs due to random movement of particles ticked ; substances move into cells by diffusion ticked ; | 2 |
| 7(b)(i) | (inspired air) contains less carbon dioxide ; (inspired air) contains less water (vapour) ; AVP ; (inspired air) is cooler | 2 |
| 7(b)(ii) | respiration releases energy (for protein synthesis) ; | 1 |
| 7(b)(iii) | glucose ; | 1 |

| Question | Answer | Marks |
|-----------|---|-------|
| 8(a) | cobalt chloride ; (blue to) pink ; OR anhydrous copper(II) sulfate ; (white to) blue ; | 2 |
| 8(b)(i) | different numbers of oxygen atoms on LHS and RHS / the numbers of each type of atom is not the same on both sides ; | 1 |
| 8(b)(ii) | $2 \text{H}_2 + \text{O}_2 \rightarrow 2 \text{H}_2\text{O}$; | 1 |
| 8(c) |  <p>symbols correct ; dot-and -cross diagram correct;</p> | 2 |
| 8(d)(i) | the idea that water boils and potassium chloride does not / water is more volatile than potassium chloride ; because water is covalent / molecular and potassium chloride is ionic ; | 2 |
| 8(d)(ii) | 100 cm ³ contains 2.5 g KCl so concentration is 25 (g / dm ³) ; | 1 |
| 8(d)(iii) | addition of (acidified aqueous) silver nitrate ; white precipitate ; | 2 |

| Question | Answer | Marks | | | | | | | |
|---------------|---|---------------|--|------------------|--|------------------|--|--|----------|
| 9(a)(i) | increased vibration; | 1 | | | | | | | |
| 9(a)(ii) | escape of more energetic molecules; from the surface of the liquid; | 2 | | | | | | | |
| 9(b) | convection; | 1 | | | | | | | |
| 9(c) | <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 15%; text-align: center; vertical-align: middle;">gamma rays</td> <td style="width: 15%;"></td> <td style="width: 15%; text-align: center; vertical-align: middle;">ultraviolet</td> <td style="width: 15%;"></td> <td style="width: 15%; text-align: center; vertical-align: middle;"><i>infrared;</i></td> <td style="width: 15%;"></td> <td style="width: 15%;"></td> </tr> </table> | gamma rays | | ultraviolet | | <i>infrared;</i> | | | 1 |
| gamma rays | | ultraviolet | | <i>infrared;</i> | | | | | |
| 9(d)(i) | A on the arrow from the x axis to the top of the crest; | 1 | | | | | | | |
| 9(d)(ii) | 20 (Hz) to 20 000 (Hz); | 1 | | | | | | | |
| 9(e) | advantage: renewable ; disadvantage: does not work in the dark / less electricity produced when it is cloudy; | 2 | | | | | | | |

| Question | Answer | Marks |
|-----------------|--|--------------|
| 10(a)(i) | <i>Person A</i> and has the greatest concentration of adrenaline (in the blood) ; | 1 |
| 10(a)(ii) | 03:00 ; | 1 |
| 10(a)(iii) | increased breathing rate ; increased pulse rate ; widened pupils ; AVP ; | 2 |
| 10(a)(iv) | plasma ; | 1 |
| 10(b)(i) | $(6980 - 3100) = 3880$; | 1 |
| 10(b)(ii) | <i>any two from</i> breastfeeding ; using contaminated needles ; transfer of sexual fluids ; blood to blood contact ; contaminated blood transfusions ; | 2 |
| 10(b)(iii) | acquired immune deficiency (syndrome) / AIDS ; | 1 |

| Question | Answer | Marks |
|------------|--|----------|
| 11(a)(i) | (B and D) they are hydrocarbons / contain only hydrogen and carbon ; they contain only single bonds / they are saturated ; | 2 |
| 11(a)(ii) | (bottle E / heptane) name ending -ane denotes an alkane ; alkanes are hydrocarbons ; name ending -ol shows it is not a hydrocarbon / is an alcohol / contains oxygen ; max 1 | 1 |
| 11(b)(i) | increases the rate (of reaction) ; | 1 |
| 11(b)(ii) | aqueous bromine / bromine water / bromine solution ; | 1 |
| 11(b)(iii) | molecules contain a double bond (between carbon atoms) / molecule does not contain the maximum possible number of hydrogen atoms ; | 1 |
| 11(c)(i) | + oxygen ; → carbon dioxide + water ; | 2 |
| 11(c)(ii) | (balance reading decreases) gases / carbon dioxide / water vapour released ; | 1 |

| Question | Answer | Marks |
|-----------------|--|--------------|
| 12(a)(i) | correct angles labelled with i and r; | 1 |
| 12(a)(ii) | ray drawn in same direction to edge of glass and then out of glass; parallel to incident ray; | 2 |
| 12(b)(i) | focal length; | 1 |
| 12(b)(ii) | enlarged; inverted; | 2 |
| 12(c)(i) | radiation is ionising; human cells can be damaged / cancer; | 2 |
| 12(c)(ii) | evidence of working (on graph) / count divided by two; 2 ; | 2 |
| 12(d) | any 2 of: increasing the current, increase the number of turns on the coil, increase the strength of the magnet;; | 2 |