



Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

COMBINED SCIENCE

0653/04

Paper 4 Theory (Extended)

For examination from 2019

MARK SCHEME

Maximum Mark: 80

Specimen

This document consists of **8** 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.

mark scheme abbreviations

| | |
|--------------------|---|
| ; | separates marking points |
| / | alternative responses for the same marking point |
| not | do not allow |
| allow | accept the response |
| ignore | mark as if this material was not present |
| ecf | error carried forward |
| avp | any valid point |
| ora | or reverse argument |
| owtte | or words to that effect |
| underline | 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 |
| any [number] from: | accept the [number] of valid responses |
| note: | additional marking guidance |

| Question | Answer | Marks | Guidance | | | | | | | | | | |
|------------------|--|---------|------------------------|-------|---|---------------|--------------------|---------------|--------------------------------------|------------------|---|---|---|
| 1(a) | <table border="1"> <tr> <td>cuticle</td> <td>waterproofs the leaf ;</td> </tr> <tr> <td>stoma</td> <td>allows gaseous exchange with surroundings ;</td> </tr> <tr> <td>palisade cell</td> <td>produces glucose ;</td> </tr> <tr> <td>phloem tissue</td> <td>transports sucrose out of the leaf ;</td> </tr> <tr> <td>spongy mesophyll</td> <td>allows diffusion of gases within the leaf ;</td> </tr> </table> | cuticle | waterproofs the leaf ; | stoma | allows gaseous exchange with surroundings ; | palisade cell | produces glucose ; | phloem tissue | transports sucrose out of the leaf ; | spongy mesophyll | allows diffusion of gases within the leaf ; | 4 | award: 5 correct = 4 marks 3 or 4 correct = 3 marks 2 correct = 2 marks 1 correct = 1 marks |
| cuticle | waterproofs the leaf ; | | | | | | | | | | | | |
| stoma | allows gaseous exchange with surroundings ; | | | | | | | | | | | | |
| palisade cell | produces glucose ; | | | | | | | | | | | | |
| phloem tissue | transports sucrose out of the leaf ; | | | | | | | | | | | | |
| spongy mesophyll | allows diffusion of gases within the leaf ; | | | | | | | | | | | | |
| 1(b) | transport of minerals / ions / named mineral or ion (into the leaf) ; providing support (to leaf) ; | 2 | not: nitrogen | | | | | | | | | | |
| 1(c) | starch ; | 1 | | | | | | | | | | | |
| 1(d) | <u>evaporation</u> of water from the surfaces of mesophyll cells ; (followed by) loss /diffusion of <u>water vapour</u> out of stomata/stoma ; | 2 | | | | | | | | | | | |

| Question | Answer | Marks | Guidance |
|-----------|---|-------|----------|
| 2(a) | 7 ; number of outer electrons = Group number ; | 2 | |
| 2(b)(i) | $2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$ formulae ; balancing ; | 2 | |
| 2(b)(ii) | provides <u>activation</u> energy / provides minimum energy for reaction (to occur) ; | 1 | |
| 2(b)(iii) | 4 electrons shared between two O atoms ; non-bonding electrons on O correct ; | 2 | |

| Question | Answer | Marks | Guidance |
|----------|--|-------|--|
| 3(a) | $W = m g$ or 0.40×10 ; 4.0 N ; | 2 | note: Correct numerical answer and unit |
| 3(b)(i) | use of area under the graph / average speed \times time / $\frac{1}{2} \times 31 \times 3.1$; 48.1 (m) ; | 2 | allow: $\frac{1}{2}$ base \times height |

| Question | Answer | Marks | Guidance |
|-----------|--|-------|--|
| 3(b)(ii) | $E_k = \frac{1}{2} m v^2$; $= \frac{1}{2} \times 0.40 \times 31^2$; $= 192 \text{ (J)}$; | 3 | award first and second mark allow: 190 or 192.2 |
| 3(b)(iii) | kinetic energy converted to thermal energy / (work is done against) friction (as the ball falls) ; | 1 | |

| Question | Answer | Marks | Guidance |
|-----------|---|-------|---|
| 4(a) | transports oxygen ; | 1 | |
| 4(b) | Any one from: more space for haemoglobin ; more flexible shape (to move through capillaries) ; | 1 | max 1 allow: more space for oxygen |
| 4(c)(i) | B (red blood cells) are normal shape / biconcave ; D (red blood cells) have shrunk / crenation / owtte ; | 2 | |
| 4(c)(ii) | Any three from: ref to osmosis ; net movement of water molecules into cells ; cell membrane is fragile / cannot withstand water pressure ; down a water potential gradient / from high water potential to low water potential ; | 3 | max 3 |
| 4(c)(iii) | cell wall present in plant cells ; gives cell strength to resist / prevent bursting ; | 2 | allow: correct reference to cell wall in plants |

| Question | Answer | Marks | Guidance |
|----------|--|-------|----------|
| 5(a) | cobalt(II) carbonate CoCO_3 ; cobalt(II) chloride Cl^- ; | 2 | |
| 5(b) | filter / centrifuge / decant ; (partially) evaporate / heat / boil ; allow to crystallise / cool / let crystals form ; dry crystals / dry between filter paper / leave in a warm place to dry ; | 4 | |

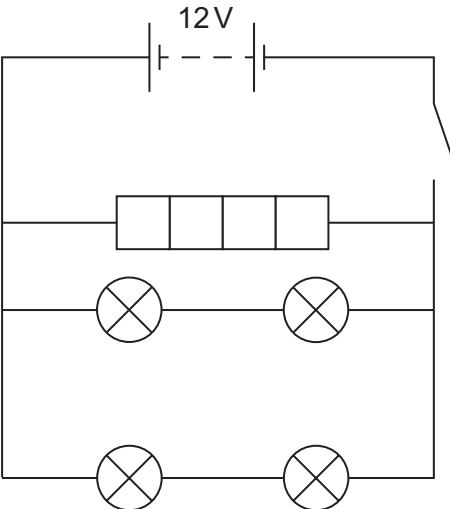
| Question | Answer | Marks | Guidance |
|----------|--|-------|----------|
| 5(c) | more (acid) particles ; per unit volume ; more frequent collisions ; | 3 | |

| Question | Answer | Marks | Guidance |
|----------|--|-------|---|
| 6(a)(i) | vibration is perpendicular to direction of travel of wave ; | 1 | owtte |
| 6(a)(ii) | sound waves ; | 1 | allow: seismic/mass oscillating on a spring |
| 6(b) | changes – speed/wavelength ; same – frequency/amplitude ; | 2 | |
| 6(c)(i) | frequency less than lower limit of hearing ; | 1 | |
| 6(c)(ii) | by vibrations of <u>air particles</u> ; forming compressions and rarefactions ; | 2 | allow: for max 1 mark: vibrations of the air forming longitudinal waves |
| 6(d) | $(v =) f\lambda$; $v = 30 \times 0.80 = 24$; | 2 | |
| 6(e) | 3.0×10^8 (m/s) ; | 1 | allow: correct value in any format |

| Question | Answer | Marks | Guidance |
|----------|--|-------|---------------------------------------|
| 7(a)(i) | A or B (no mark) smaller molecule than C ; | 1 | |
| 7(a)(ii) | it has an active site ; complementary in shape to substrate ; | 2 | not: same shape |
| 7(b)(i) | molecules have less kinetic energy/moving more slowly ; fewer collisions per unit time/less frequent collisions ; | 2 | |
| 7(b)(ii) | enzyme is (becoming) denatured ; substrate no longer fits active site/3-d structure of enzyme destroyed ; | 2 | |
| 7(c) | protease ; <u>amino acids</u> ; | 2 | allow: any named protease e.g. pepsin |

| Question | Answer | Marks | Guidance |
|----------|--|-------|----------|
| 8(a) | refinery gas ; road surfaces ; naphtha ; | 3 | |
| 8(b) | different boiling points / viscosity / flammability ; refinery gas has lowest boiling point / viscosity / highest flammability / identifies correct trend down the fractions ; correctly relates property to size of molecules in fractions larger molecules have higher boiling points / viscosity / lower flammability ; | 3 | |
| 8(c) | contains 2 carbon atoms and 6 hydrogen atoms ; idea that $2n + 2$ gives $(2 \times 2 + 2) = 6$; | 2 | |
| 8(d) | only contains single (carbon-carbon) bonds ; molecules contain hydrogen and carbon only ; | 2 | |

| Question | Answer | Marks | Guidance |
|----------|--|-------|----------|
| 9(a) | (6V) potential difference / voltage ; maximum voltage / safe voltage / working voltage (to allow lamp to work) ; (120W) power / energy transferred per second ; 120 (watts) is the power at working voltage / owtte ; | 4 | |

| Question | Answer | Marks | Guidance |
|----------|---|-------|----------|
| 9(b) |  <p>sidelamps remain in series with each other and each pair in parallel with the battery ; heater, sidelamps, headlamps all in parallel ;</p> | 2 | |
| 9(c) | $(Q =) It / 12.5 \times 2 \times 60 ;$ $= 1500 (C) ;$ | 2 | |
| 9(d) | convection ; | 1 | |