



Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education

CO-ORDINATED SCIENCES

0654/32

Paper 3 Theory (Core)

October/November 2019

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 **16** 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.

| Question | Answer | Marks |
|-----------------|--|--------------|
| 1(a)(i) | white blood cell labelled ; | 1 |
| 1(a)(ii) | red blood cell ; | 1 |
| 1(b)(i) | 12 ; | 1 |
| 1(b)(ii) | pathogen was destroyed ; | 1 |
| 1(c) | line decreasing / flat from 15–20 days ; line shown increasing (and decreasing) ; | 2 |
| 1(d) | blood clotting ; | 1 |

| Question | Answer | Marks |
|-----------|---|-------|
| 2(a)(i) | electrons have (virtually) zero mass ; | 1 |
| 2(a)(ii) | argon / Ar ; <i>and then one from</i> there are 18 electrons / (and so) 18 protons (in the atom) ; so the proton number / atomic number = 18 (and so is argon) ; eight outer electrons so Group VIII and three shells so third period ; | 2 |
| 2(a)(iii) | outer (electron) shell is full / no need to lose or gain electrons for stability / owtte ; | 1 |
| 2(b)(i) | mass of oxygen is added to the mass of calcium / owtte ; | 1 |
| 2(b)(ii) | mixture pH is >7 to 14 ; mixture is alkaline / mixture contains calcium hydroxide / it is a metal oxide / it is a basic oxide ; | 2 |

| Question | Answer | Marks |
|-----------|--|-------|
| 3(a) | stopwatch ; | 1 |
| 3(b)(i) | X anywhere on horizontal section ; | 1 |
| 3(b)(ii) | at $t = 0$ s or $t = 110$ s ; | 1 |
| 3(b)(iii) | as the gradient is steeper / changed speed in a shorter period of time ; | 1 |
| 3(b)(iv) | use of area under graph or $0.5 \times 15 \times 4$; = 30 (m) ; | 2 |
| 3(c)(i) | correct symbols for cell and switch ; all connected in series ; | 2 |
| 3(c)(ii) | $V = IR$, $I = V / R$, $6 / 2$; 3 (A) ; | 2 |
| 3(c)(iii) | 20 (Hz) to 20 000 (Hz) ; | 1 |

| Question | Answer | Marks |
|----------|---|----------|
| 4(a) | cells ; molecules ; energy ; | 3 |
| 4(b)(i) | B and C ; | 1 |
| 4(b)(ii) | line drawn between carbon in plants and carbon dioxide in the atmosphere ; arrowhead pointing towards carbon in plants ; | 2 |
| 4(c) | loss of shelter / habitat ; extinction ; loss of food source ; avp ; max 2 | 2 |

| Question | Answer | Marks |
|-----------|--|----------|
| 5(a)(i) | sulfur dioxide ; | 1 |
| 5(a)(ii) | causes acid rain ; effect of acid rain ; causes respiratory problems (in humans) ; max 2 | 2 |
| 5(a)(iii) | carbon monoxide ; oxides of nitrogen / NO _x / named oxide of nitrogen ; | 2 |
| 5(b)(i) | chromatography ; | 1 |
| 5(b)(ii) | water moves up the paper ; dyes carried along with the water / dyes dissolve in the water ; different dyes move at different speeds / move to different heights ; | 3 |
| 5(b)(iii) | three spots vertically in a line above the letter P ; shape, shading and heights of the spots all a reasonable attempt to reproduce the individual spots for Q R and S ; | 2 |
| 5(b)(iv) | the impurities may be poisonous / impurities affect the colour ; | 1 |

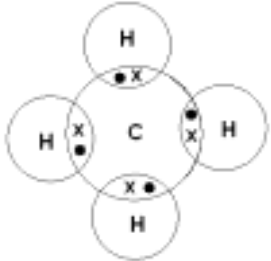
| Question | Answer | Marks |
|-----------|--|----------|
| 6(a)(i) | $\rho = m/v$ or $200/250$; $0.8 \text{ (g/cm}^3\text{)}$; | 2 |
| 6(a)(ii) | $W = mg$, 0.200×10 ; 2 (N) ; | 2 |
| 6(b)(i) | the position of the COM in A is not through the centre of the tower base / COM is not directly above the base ; it is unstable, (or opposite for B) ; | 2 |
| 6(b)(ii) | it is lifted up through the furthest distance compared to the other blocks ; | 1 |
| 6(b)(iii) | gravitational potential ; | 1 |
| 6(c) | $s = d/t$; $(39 + 39)/0.25$; 310 m/s ; | 3 |

| Question | Answer | Marks |
|----------|--|----------|
| 7(a)(i) | <i>part A</i> blue-black ; <i>part B</i> orange / yellow / brown ; | 2 |
| 7(a)(ii) | light ; | 1 |
| 7(b) | (magnesium ions are) needed for production of chlorophyll ; chlorophyll is necessary for photosynthesis ; | 2 |
| 7(c)(i) | (water enters) through the <u>root hair cell</u> ; by osmosis ; | 2 |
| 7(c)(ii) | ref. to transpiration ; evaporation of water (from mesophyll cells) ; diffusion (of water vapour) ; through the stomata ; max 3 | 3 |

| Question | Answer | Marks |
|-----------|--|-------|
| 8(a)(i) | electrolysis ; | 1 |
| 8(a)(ii) | electrolyte labelled anywhere ; negative electrode labelled ; | 2 |
| 8(a)(iii) | chlorine / hydrogen ; | 1 |
| 8(b)(i) | sodium oxide / hydroxide / carbonate ; | 1 |
| 8(b)(ii) | alkanes (relatively) unreactive / alkanes do not react with sodium ; | 1 |
| 8(c)(i) | pH 7 ; <u>green</u> ; | 2 |
| 8(c)(ii) | squeaky pop ; hydrogen ; | 2 |
| 8(d)(i) | ionic / electrovalent ; | 1 |
| 8(d)(ii) | $2 \text{ Na} + \text{Br}_2 \rightarrow 2 \text{ NaBr}$; | 1 |

| Question | Answer | Marks |
|-----------------|---|--------------|
| 9(a)(i) | proton and neutron ; | 1 |
| 9(a)(ii) | nucleon number / mass number ; atomic number / proton number ; | 2 |
| 9(a)(iii) | atomic number / proton number is the same ; | 1 |
| 9(b)(i) | visible light in the centre box ; | 1 |
| 9(b)(ii) | Volts, V ; | 1 |
| 9(c) | solid then gas then liquid 1 mark for 1 correct ; 2 marks for all 3 correct ; | 2 |

| Question | Answer | | Marks | | | | | | | | |
|---------------------|---|---------------------|-------------------|---|--|--|--|--|---|--|----------|
| 10(a)(i) | <table border="1"> <tr> <td data-bbox="282 252 589 320">sensory neurone cut</td> <td data-bbox="589 252 887 320">motor neurone cut</td> </tr> <tr> <td data-bbox="282 320 589 389">✓</td> <td data-bbox="589 320 887 389"></td> </tr> <tr> <td data-bbox="282 389 589 458"></td> <td data-bbox="589 389 887 458"></td> </tr> <tr> <td data-bbox="282 458 589 526"></td> <td data-bbox="589 458 887 526">✓</td> </tr> </table> | sensory neurone cut | motor neurone cut | ✓ | | | | | ✓ | | 2 |
| sensory neurone cut | motor neurone cut | | | | | | | | | | |
| ✓ | | | | | | | | | | | |
| | | | | | | | | | | | |
| | ✓ | | | | | | | | | | |
| 10(a)(ii) | automatic circled ; rapid circled ; | | 2 | | | | | | | | |
| 10(b) | in the form of an electrical signal ; | | 1 | | | | | | | | |
| 10(c) | brain ; spinal cord ; | | 2 | | | | | | | | |
| 10(d) | gland ; | | 1 | | | | | | | | |

| Question | Answer | Marks |
|------------|--|----------|
| 11(a)(i) | <u>fractional distillation</u> ; | 1 |
| 11(a)(ii) | (physical) no new substances produced / only changes of state involved ; | 1 |
| 11(a)(iii) | refinery gas heating / cooking / other correct ; bitumen surfacing roads / water-proofing / other correct ; | 2 |
| 11(b) | the idea that single substances (hexane) have a single boiling point but mixtures (gasoline) boil over a temperature range ; | 1 |
| 11(c)(i) |  <p>1 mark symbols correct ; 1 mark bonding pairs correct ;</p> | 2 |
| 11(c)(ii) | only single bonds ; | 1 |
| 11(c)(iii) | ethene ; | 1 |

| Question | Answer | Marks |
|-----------------|--|--------------|
| 12(a) | evaporation ; | 1 |
| 12(b)(i) | due to a change of speed ; | 1 |
| 12(b)(ii) | angle drawn between the normal and the ray from the object and labelled with the letter 'i' ; | 1 |
| 12(c) | frequency ; amplitude ; wavelength ; | 3 |
| 12(d)(i) | slows down ; | 1 |
| 12(d)(ii) | constant ; | 1 |
| 12(e) | molecules gain KE / move apart ; liquid expands ; | 2 |

| Question | Answer | | | Marks | | | | | | | | | | | | | | | |
|----------|---|-----------------------------|--|----------|--------------------|----------|-------|---|-----------------------------|--------|---|-----------------|-------|---|------------------|-------|---|-----------------|----------|
| 13(a) | <table border="1" data-bbox="286 252 1218 584"> <thead> <tr> <th data-bbox="286 252 577 320">part</th> <th data-bbox="577 252 824 320">letter in Fig. 5.1</th> <th data-bbox="824 252 1218 320">function</th> </tr> </thead> <tbody> <tr> <td data-bbox="286 320 577 389">sepal</td> <td data-bbox="577 320 824 389">E</td> <td data-bbox="824 320 1218 389">protects flower when in bud</td> </tr> <tr> <td data-bbox="286 389 577 458">anther</td> <td data-bbox="577 389 824 458">C</td> <td data-bbox="824 389 1218 458">produces pollen</td> </tr> <tr> <td data-bbox="286 458 577 526">petal</td> <td data-bbox="577 458 824 526">A</td> <td data-bbox="824 458 1218 526">attracts insects</td> </tr> <tr> <td data-bbox="286 526 577 584">ovary</td> <td data-bbox="577 526 824 584">D</td> <td data-bbox="824 526 1218 584">produces ovules</td> </tr> </tbody> </table> <p data-bbox="286 624 315 655">...</p> | | | part | letter in Fig. 5.1 | function | sepal | E | protects flower when in bud | anther | C | produces pollen | petal | A | attracts insects | ovary | D | produces ovules | 3 |
| part | letter in Fig. 5.1 | function | | | | | | | | | | | | | | | | | |
| sepal | E | protects flower when in bud | | | | | | | | | | | | | | | | | |
| anther | C | produces pollen | | | | | | | | | | | | | | | | | |
| petal | A | attracts insects | | | | | | | | | | | | | | | | | |
| ovary | D | produces ovules | | | | | | | | | | | | | | | | | |
| 13(b) | ref to pollen and ovule ; fusion of nuclei ; | | | 2 | | | | | | | | | | | | | | | |
| 13(c) | zygote ; | | | 1 | | | | | | | | | | | | | | | |
| 13(d) | 1 and 2 ; | | | 1 | | | | | | | | | | | | | | | |