

# Cambridge IGCSE™

**COMBINED SCIENCE**

Paper 4 Theory (Extended)

MARK SCHEME

Maximum Mark: 80

**0653/42**

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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.

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## 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.

| Question  | Answer                                                                                                                                   | Marks |
|-----------|------------------------------------------------------------------------------------------------------------------------------------------|-------|
| 1(a)(i)   | mango (fruit) → (fruit) flies → thrushes → eagle ; ;<br><i>correct order = one mark</i><br><i>arrows in correct direction = one mark</i> | 2     |
| 1(a)(ii)  | secondary ;<br>three ;                                                                                                                   | 2     |
| 1(b)(i)   | $\frac{0.82 \times 85}{100}$<br>0.697 ;<br>0.7 ;                                                                                         | 3     |
| 1(b)(ii)  | lipase ;<br>fatty acids <b>and</b> glycerol ;                                                                                            | 2     |
| 1(b)(iii) | contains fibre ;                                                                                                                         | 1     |

| Question | Answer                                                                                                                                                                              | Marks |
|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| 2(a)(i)  | water ;                                                                                                                                                                             | 1     |
| 2(a)(ii) | hydrogen <b>ions</b> attracted to / move to, cathode / negative electrode ;<br>reference to gain of electrons ;<br>(two) hydrogen atoms join to form a molecule (of hydrogen gas) ; | 3     |
| 2(b)(i)  | chlorine ;                                                                                                                                                                          | 1     |

| Question | Answer                                                       | Marks |
|----------|--------------------------------------------------------------|-------|
| 2(b)(ii) | (damp) litmus (paper) <b>and</b> bleached / goes white ;     | 1     |
| 2(c)(i)  | is inert / is unreactive <b>and</b> conducts (electricity) ; | 1     |
| 2(c)(ii) | transition (elements / metals) ;                             | 1     |

| Question | Answer                                                                                                                                                                                                                                                                        | Marks |
|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| 3(a)(i)  | at constant speed / at 20 m / s ;                                                                                                                                                                                                                                             | 1     |
| 3(a)(ii) | <b>X</b> at top / bottom of line between $t = 45$ s and $t = 50$ s / between $t = 58$ s and $t = 60$ s ;                                                                                                                                                                      | 1     |
| 3(b)     | max speed of car = 25 m / s ;<br>(unit conversions) $100 \times 1000 \div 3600 / 27.8$ m / s (so limit not broken) ;<br><b>OR</b><br>max speed of car = 25 m / s ;<br>(unit conversions) $25 \times 3600 \div 1000 / 90$ km / h (less than 100 km / h (so limit not broken) ; | 2     |
| 3(c)     | use of area under graph (stated or evidence) ;<br>(implementation): $20 \times 10 + \frac{1}{2} \times 20 \times 15$ ;<br>350 (m) ;                                                                                                                                           | 3     |
| 3(d)(i)  | focal length ;                                                                                                                                                                                                                                                                | 1     |
| 3(d)(ii) | $\text{speed} = \text{distance} \div \text{time}$ (stated or evidence of use) / $t = 15 \div 3 \times 10^8$ ;<br>$5(.0) \times 10^{-8}$ (s) ;                                                                                                                                 | 2     |

| Question | Answer                                                                                                                                                |                                         |                                      | Marks |
|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|--------------------------------------|-------|
| 4(a)     | letter                                                                                                                                                | name of part                            | function                             | 3     |
|          | (A)                                                                                                                                                   | palisade<br>(mesophyll<br>cell / layer) | (photosynthesis)                     |       |
|          | (D)                                                                                                                                                   | stoma / stomata                         | to allow gas exchange                |       |
|          | C                                                                                                                                                     | (phloem)                                | transport (sucrose / amino<br>acids) |       |
|          | one mark for each correct row                                                                                                                         |                                         |                                      | ...   |
| 4(b)(i)  | 6 (H <sub>2</sub> O) + 6 (CO <sub>2</sub> ) ;<br><br>C <sub>6</sub> H <sub>12</sub> O <sub>6</sub> + 6O <sub>2</sub> ;                                |                                         |                                      | 2     |
| 4(b)(ii) | any three from:<br>photosynthesis stops / slows down ;<br>enzymes denature ;<br>active site changes shape ;<br>substrate no longer fits active site ; |                                         |                                      | 3     |
| 4(c)     | phototropism ;<br>auxin ;<br>elongation ;                                                                                                             |                                         |                                      | 3     |

| Question | Answer                                                                                                                                                                                                                                        | Marks |
|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| 5(a)     | temperature: $< 20$ ;<br>concentration of acid: $< 1.0$ ;                                                                                                                                                                                     | 2     |
| 5(b)     | experiment 2 is faster because it is at a higher temperature ;<br>particles, have more energy / move faster / have more frequent collisions ;<br>more particles have energy greater than the activation energy / more successful collisions ; | 3     |
| 5(c)     | experiment 3 ;<br>it is the highest concentration ;                                                                                                                                                                                           | 2     |
| 5(d)(i)  | (no gas given off because) copper, is unreactive / does not react with acids ;                                                                                                                                                                | 1     |
| 5(d)(ii) | named metal, more reactive than calcium / any of the metals in the table ;                                                                                                                                                                    | 1     |

| Question | Answer                                                                                                                                                                                                                                                                                                                                                                          | Marks |
|----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| 6(a)(i)  | nuclear fusion ;                                                                                                                                                                                                                                                                                                                                                                | 1     |
| 6(a)(ii) | nuclear (fission) / tidal ;                                                                                                                                                                                                                                                                                                                                                     | 1     |
| 6(b)(i)  | boils / turns to steam ;<br>(temperature of rock is) above $100^{\circ}\text{C}$ / boiling point of water is $100^{\circ}\text{C}$ / higher than the b.pt of water ;                                                                                                                                                                                                            | 2     |
| 6(b)(ii) | pressure = force $\div$ area / $F = p \times A$ ( <i>stated</i> or evidence of use) ;<br>area of borehole $A = \pi r^2 / 3.14 \times 0.12 \times 0.12 \times 0.12 / 0.045 \text{ (m}^2\text{)} ;$<br>$F = 6 \times 10^6 \times 3.14 \times 0.12 \times 0.12 \times 0.12 / 6 \times 10^6 \times 0.045 ;$<br>$0.27 \times 10^6 \text{ N} / 270\,000 \text{ N} / 270 \text{ kN} ;$ | 4     |

| Question | Answer                                                                                                    | Marks    |
|----------|-----------------------------------------------------------------------------------------------------------|----------|
| 6(c)(i)  | <b>gravitational</b> potential ;                                                                          | <b>1</b> |
| 6(c)(ii) | (PE stored =) $mg\Delta h$ (stated or evidence of use) / $1000 \times 10 \times 200$ ;<br>2 000 000 (J) ; | <b>2</b> |

| Question | Answer                                                                                                                               | Marks    |
|----------|--------------------------------------------------------------------------------------------------------------------------------------|----------|
| 7(a)(i)  | diffusion ;                                                                                                                          | <b>1</b> |
| 7(a)(ii) | <i>any two from:</i><br>large surface area ;<br>thin surface ;<br>good ventilation ;<br>AVP, e.g. moist / short diffusion distance ; | <b>2</b> |
| 7(b)     | produce mucus ;<br>(mucus) traps, particles / pathogens / microbes ;                                                                 | <b>2</b> |
| 7(c)     | chronic obstructive pulmonary disease / COPD ;                                                                                       | <b>1</b> |

| Question | Answer                                                                                                                                                | Marks |
|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| 8(a)     | decane <b>and</b> pentane ;<br><br>reason: they are saturated (hydrocarbons) / do not contain double (C=C) bonds / contain <b>only</b> single bonds ; | 2     |
| 8(b)     | <i>any two from:</i><br>high temperature ;<br>high pressure ;<br>catalyst ;                                                                           | 2     |
| 8(c)     | (some carbon – carbon single) bonds break ;<br><br>(some) carbon atoms form double bonds (with each other) ;                                          | 2     |
| 8(d)     | they have different boiling points ;                                                                                                                  | 1     |
| 8(e)(i)  | bottled gas / heating and cooking ;                                                                                                                   | 1     |
| 8(e)(ii) | (source / reactant for) making (other) chemicals ;                                                                                                    | 1     |

| Question | Answer                                                                                                                                                                                                                         | Marks |
|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| 9(a)(i)  | resistance = p.d. ÷ current (stated or evidence of use) / (R =) $6.0 \div 0.75$ ;<br><br>$8(.0) (\Omega)$ ;                                                                                                                    | 2     |
| 9(a)(ii) | correct symbol connected in parallel ;<br><br>connection to right of battery made between battery and bell push ;                                                                                                              | 2     |
| 9(b)     | resistance of wiring increases with length / idea that resistance in the bell branch is too high ;<br><br>p.d. <b>across bell</b> now less (than 6.0 V while still 6.0 V across lamp) / <b>current in the bell</b> decreases ; | 2     |