



**Cambridge Assessment International Education**  
Cambridge International General Certificate of Secondary Education

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**COMBINED SCIENCE**

**0653/31**

Paper 3 Core Theory

**May/June 2019**

MARK SCHEME

Maximum Mark: 80

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**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.

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This document consists of **10** printed pages.

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- 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.

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- marks are awarded when candidates clearly demonstrate what they know and can do
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**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)      | <b>A</b> nucleus ;<br><b>B</b> chloroplast ;<br><b>C</b> vacuole ;                                                                  | <b>3</b> |
| 1(b)(i)   | label <b>X</b> to any part of xylem area ;                                                                                          | <b>1</b> |
| 1(b)(ii)  | label <b>P</b> to any part of phloem area ;                                                                                         | <b>1</b> |
| 1(b)(iii) | transport food substances (from leaves) ;                                                                                           | <b>1</b> |
| 1(c)      | carbon dioxide <b>and</b> water ;<br>(either order)                                                                                 | <b>1</b> |
| 1(d)      | any two of<br>muscle contraction ;<br><br>protein synthesis ;<br><br>growth ;<br><br>maintenance of (a constant body) temperature ; | <b>2</b> |

| Question  | Answer                                                                 | Marks    |
|-----------|------------------------------------------------------------------------|----------|
| 2(a)      | (gas <b>X</b> ) oxygen / $O_2$ ;<br>(gas <b>Y</b> ) nitrogen / $N_2$ ; | <b>2</b> |
| 2(b)(i)   | natural gas ;                                                          | <b>1</b> |
| 2(b)(ii)  | $CH_4$ ;                                                               | <b>1</b> |
| 2(b)(iii) | alkane ;                                                               | <b>1</b> |
| 2(b)(iv)  | carbon dioxide / $CO_2$ <b>and</b> water / $H_2O$ ;                    | <b>1</b> |

| Question | Answer                                                                                                                                                                                        | Marks |
|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| 2(c)     | calcium carbonate / $\text{CaCO}_3$ ;                                                                                                                                                         | 1     |
| 2(d)     | (test) (anhydrous) copper ((II)) sulfate ;<br>(result) turns (from white to) blue ;<br><b>or</b><br>(test) (anhydrous) cobalt ((II)) chloride ;<br>(result) turns (from blue to) pink / red ; | 2     |

| Question  | Answer                                                                       | Marks |
|-----------|------------------------------------------------------------------------------|-------|
| 3(a)(i)   | weight / gravitational force / (force of) gravity                            | 1     |
| 3(a)(ii)  | horizontal arrow pointing to right, with one end touching whale              | 1     |
| 3(a)(iii) | 500 (N)                                                                      | 1     |
| 3(a)(iv)  | slows down ;<br><br>moves upwards ;                                          | 2     |
| 3(b)(i)   | force (exerted by the whale) ;<br><br>distance (travelled) ;                 | 2     |
| 3(b)(ii)  | chemical potential ;<br><br>(to) kinetic ;                                   | 2     |
| 3(c)      | speed = distance/time <b>or</b> $9000 / 6.0$ ;<br>= $1500 \text{ (m / s)}$ ; | 2     |

| Question            | Answer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Marks                                                 |                   |            |          |            |                                                       |          |                |                                         |          |                      |                                    |          |         |                                                       |          |
|---------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------|-------------------|------------|----------|------------|-------------------------------------------------------|----------|----------------|-----------------------------------------|----------|----------------------|------------------------------------|----------|---------|-------------------------------------------------------|----------|
| 4(a)                | <p>One mark each for lines <b>A, B, C, D</b></p> <table> <tr> <th>letter of structure</th><th>name of structure</th><th>definition</th></tr> <tr> <td><b>A</b></td><td>sperm duct</td><td><b>carries sperm (to the urethra/from the testes)</b></td></tr> <tr> <td><b>B</b></td><td><b>urethra</b></td><td>carries urine and semen out of the body</td></tr> <tr> <td><b>C</b></td><td><b>testis/testes</b></td><td>production of male gametes (sperm)</td></tr> <tr> <td><b>D</b></td><td>scrotum</td><td><b>(sac that) holds the testes (outside the body)</b></td></tr> </table> | letter of structure                                   | name of structure | definition | <b>A</b> | sperm duct | <b>carries sperm (to the urethra/from the testes)</b> | <b>B</b> | <b>urethra</b> | carries urine and semen out of the body | <b>C</b> | <b>testis/testes</b> | production of male gametes (sperm) | <b>D</b> | scrotum | <b>(sac that) holds the testes (outside the body)</b> | <b>4</b> |
| letter of structure | name of structure                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | definition                                            |                   |            |          |            |                                                       |          |                |                                         |          |                      |                                    |          |         |                                                       |          |
| <b>A</b>            | sperm duct                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <b>carries sperm (to the urethra/from the testes)</b> |                   |            |          |            |                                                       |          |                |                                         |          |                      |                                    |          |         |                                                       |          |
| <b>B</b>            | <b>urethra</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | carries urine and semen out of the body               |                   |            |          |            |                                                       |          |                |                                         |          |                      |                                    |          |         |                                                       |          |
| <b>C</b>            | <b>testis/testes</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | production of male gametes (sperm)                    |                   |            |          |            |                                                       |          |                |                                         |          |                      |                                    |          |         |                                                       |          |
| <b>D</b>            | scrotum                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <b>(sac that) holds the testes (outside the body)</b> |                   |            |          |            |                                                       |          |                |                                         |          |                      |                                    |          |         |                                                       |          |
| 4(b)(i)             | uterus lining becomes thinner / breaks down ;                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <b>1</b>                                              |                   |            |          |            |                                                       |          |                |                                         |          |                      |                                    |          |         |                                                       |          |
| 4(b)(ii)            | 30 days ;                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <b>1</b>                                              |                   |            |          |            |                                                       |          |                |                                         |          |                      |                                    |          |         |                                                       |          |
| 4(b)(iii)           | preparing for a fertilised egg / implantation ;                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <b>1</b>                                              |                   |            |          |            |                                                       |          |                |                                         |          |                      |                                    |          |         |                                                       |          |
| 4(c)                | fusion / joining ;<br>of the <u>nuclei</u> ;                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>2</b>                                              |                   |            |          |            |                                                       |          |                |                                         |          |                      |                                    |          |         |                                                       |          |

| Question | Answer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Marks |
|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| 5(a)(i)  | (most) calcium<br>magnesium<br>zinc<br>(least) tin<br>Ca most reactive & Sn least reactive ;<br>Mg & Zn in the middle in the correct order ;                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 2     |
| 5(a)(ii) | <i>any two from</i><br>increase temperature ;<br>increase concentration (of acid) ;<br>reduce particle size / use a powder / increase the surface area (of the metal) ;                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 2     |
| 5(b)(i)  | hydrogen / H <sup>2</sup> ;                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 1     |
| 5(b)(ii) | <div style="display: flex; justify-content: space-around; align-items: flex-start;"> <div style="text-align: center;"> <p>gas</p> <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;">ammonia</div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;">carbon dioxide</div> <div style="border: 1px solid black; padding: 5px;">oxygen</div> </div> <div style="text-align: center;"> <p>test</p> <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;">glowing splint</div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;">damp red litmus paper</div> <div style="border: 1px solid black; padding: 5px;">limewater</div> </div> </div> <p>three correct ;;<br/>two or one correct ;</p> | 2     |
| 5(c)     | <i>any two from:</i><br>malleable ;<br>(good) heat conductor ;<br>(good) electrical conductor ;                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 2     |

| Question | Answer                                                                                                                                                                                                                |                    |         |  |                 |                |  | Marks |        |                    |         |  |                 |                |   |
|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|---------|--|-----------------|----------------|--|-------|--------|--------------------|---------|--|-----------------|----------------|---|
| 6(a)(i)  | <table><tr><td></td><td>X-rays</td><td>Ultraviolet/<br/>UV</td><td>visible</td><td></td><td>micro-<br/>waves</td><td>radio<br/>waves</td></tr></table><br>ultraviolet/UV in correct box ;<br>visible in correct box ; |                    |         |  |                 |                |  |       | X-rays | Ultraviolet/<br>UV | visible |  | micro-<br>waves | radio<br>waves | 2 |
|          | X-rays                                                                                                                                                                                                                | Ultraviolet/<br>UV | visible |  | micro-<br>waves | radio<br>waves |  |       |        |                    |         |  |                 |                |   |
| 6(a)(ii) | ultraviolet can be hazardous / dangerous / harmful / cause damage ;<br>to the retina / eyes / eyesight / cells/skin / may cause cancer ;                                                                              |                    |         |  |                 |                |  | 2     |        |                    |         |  |                 |                |   |
| 6(b)(i)  | flow of (electric) charge                                                                                                                                                                                             |                    |         |  |                 |                |  | 1     |        |                    |         |  |                 |                |   |
| 6(b)(ii) | $R = V/I$ <b>or</b> $R = 2000 / 0.5$ ;<br>= 4000 ;<br>ohms / $\Omega$ ;                                                                                                                                               |                    |         |  |                 |                |  | 3     |        |                    |         |  |                 |                |   |
| 6(c)     | idea of water getting into / heat causing damage to devices ;                                                                                                                                                         |                    |         |  |                 |                |  | 1     |        |                    |         |  |                 |                |   |

| Question  | Answer                                                                                                                                                               | Marks |
|-----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| 7(a)      | oxygen ;                                                                                                                                                             | 1     |
| 7(b)(i)   | brown ;<br>(brick) red ;                                                                                                                                             | 2     |
| 7(b)(ii)  | inside the bag ;                                                                                                                                                     | 1     |
| 7(b)(iii) | some / they have moved out of the bag / into the water ;<br>by diffusion / through the membrane ;                                                                    | 2     |
| 7(b)(iv)  | glucose molecules are small(er) / starch molecules are bigg(er) ;<br>glucose molecules can pass through (the bag) / starch molecules cannot pass through (the bag) ; | 2     |
| 7(c)      | carbon dioxide / hormones / ions ;                                                                                                                                   | 1     |

| Question  | Answer                                                                                                                                                                                   | Marks    |
|-----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| 8(a)      | (protons) 13 ;<br>(neutrons) 14 ;                                                                                                                                                        | <b>2</b> |
| 8(b)(i)   | electrolysis ;                                                                                                                                                                           | <b>1</b> |
| 8(b)(ii)  | ionic ;                                                                                                                                                                                  | <b>1</b> |
| 8(b)(iii) | It is a finite resource / (they're) running out / will run out / more energy used for extraction / less energy to recycle (than extract) / no need to mine / does not go into landfill ; | <b>1</b> |
| 8(c)      | copper / Cu is a transition metal / aluminium is not a transition metal ;                                                                                                                | <b>1</b> |
| 8(d)(i)   | carbon ;                                                                                                                                                                                 | <b>1</b> |
| 8(d)(ii)  | (copper oxide is) reduced <b>and</b><br>(explanation) (CuO) loses oxygen ;                                                                                                               | <b>1</b> |

| Question  | Answer                                                                       | Marks |
|-----------|------------------------------------------------------------------------------|-------|
| 9(a)(i)   | (good) insulator / poor conductor ;                                          | 1     |
| 9(a)(ii)  | to heat up the tube / element / water ;                                      | 1     |
| 9(a)(iii) | <i>any 2 from</i><br>convection ;<br>hot water rises ;<br>cools then falls ; | 2     |
| 9(b)(i)   | switch symbol ;<br>fuse symbol + completed circuit ;                         | 2     |
| 9(b)(ii)  | (fuse would) blow / melt in normal use (with a 3 A current) ;                | 1     |



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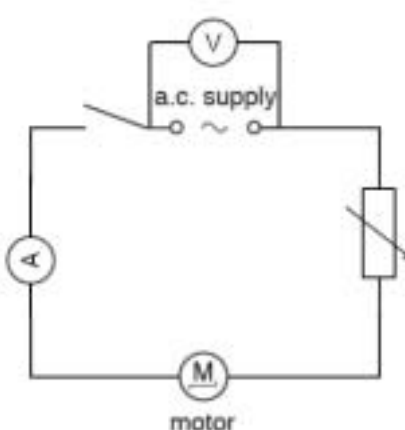
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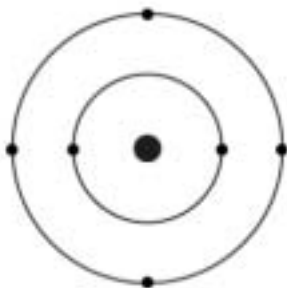
| Question | Answer                                                                                              | Marks    |
|----------|-----------------------------------------------------------------------------------------------------|----------|
| 1(a)(i)  | <i>either order</i><br>growth ;<br>respiration ;                                                    | <b>2</b> |
| 1(a)(ii) | (plants obtain their nutrition by) photosynthesis ;<br>(animals obtain their nutrition by) eating ; | <b>2</b> |
| 1(b)(i)  | sensitivity ;                                                                                       | <b>1</b> |
| 1(b)(ii) | downwards ;<br>gravitropism ;<br>phototropism ;                                                     | <b>3</b> |
| 1(c)     | <i>any two of</i><br>increased breathing rate ;<br>increased pulse rate ;<br>widened pupils ;       | <b>2</b> |

| Question  | Answer                                                                                                                                               | Marks    |
|-----------|------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| 2(a)(i)   | NaCl ;                                                                                                                                               | <b>1</b> |
| 2(a)(ii)  | (ionic)        electrons lost <b>and</b> gained ;<br>(covalent)    electrons shared ;                                                                | <b>2</b> |
| 2(a)(iii) | (sodium chloride)    solute<br>(water)                solvent<br>(aq NaCl)            solution ;;<br>all three correct (2)<br>one or two correct (1) | <b>2</b> |
| 2(b)(i)   | (change)        chemical <b>and</b><br>(explanation)   new substance(s) made ;                                                                       | <b>1</b> |
| 2(b)(ii)  | carbon / C ;                                                                                                                                         | <b>1</b> |

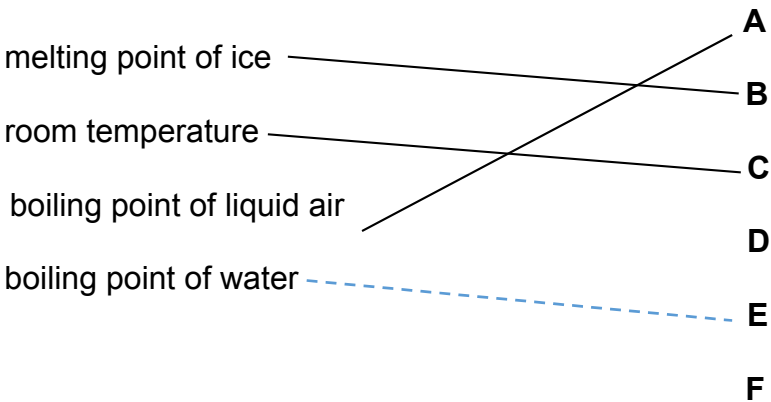
| Question  | Answer                                                                        | Marks |
|-----------|-------------------------------------------------------------------------------|-------|
| 2(b)(iii) | (positive) anode <b>and</b><br>(negative) cathode ;                           | 1     |
| 2(b)(iv)  | (positive) chlorine / $\text{Cl}_2$ ;<br>(negative) hydrogen / $\text{H}_2$ ; | 2     |

| Question  | Answer                                                                                                                                                                                                                      | Marks |
|-----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| 3(a)(i)   | sound ;                                                                                                                                                                                                                     | 1     |
| 3(a)(ii)  | microwave ;                                                                                                                                                                                                                 | 1     |
| 3(a)(iii) | ultraviolet ;                                                                                                                                                                                                               | 1     |
| 3(b)      |  <p>ammeter symbol ;<br/>variable resistor symbol ;<br/>voltmeter symbol ;<br/>voltmeter in parallel across a.c. supply <b>only</b> ;</p> | 4     |
| 3(c)      | increase frequency / decrease wavelength ;                                                                                                                                                                                  | 1     |

| Question  | Answer                                                                                                                                                   | Marks |
|-----------|----------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| 4(a)(i)   | banana stay white / colour remains unchanged ;<br><u>oil</u> prevents / blocks / stops / provides a barrier to oxygen / air (from reaching the banana) ; | 2     |
| 4(a)(ii)  | boiling / heat / high temperature affects the enzyme ;<br>makes the enzyme inactive / destroys the enzyme / can't speed up the reaction ;                | 2     |
| 4(a)(iii) | acidic / acid ;                                                                                                                                          | 1     |
| 4(b)      | add Benedict's solution (and heat);<br>(Benedict's solution) goes red ;                                                                                  | 2     |

| Question | Answer                                                                                                       | Marks |
|----------|--------------------------------------------------------------------------------------------------------------|-------|
| 5(a)(i)  | gasoline ;                                                                                                   | 1     |
| 5(a)(ii) | refinery gas ;                                                                                               | 1     |
| 5(b)(i)  | alkane(s) / saturated ;                                                                                      | 1     |
| 5(b)(ii) | carbon dioxide / CO <sub>2</sub> <b>and</b> water / H <sub>2</sub> O ;                                       | 1     |
| 5(c)(i)  | ethene / C <sub>2</sub> H <sub>4</sub> / any named alkene / any correct alkene formula / alkene ;            | 1     |
| 5(c)(ii) | addition (polymerisation) ;                                                                                  | 1     |
| 5(d)(i)  |  <p>2,4 arrangement ;</p> | 1     |

| Question  | Answer                                                                       | Marks |
|-----------|------------------------------------------------------------------------------|-------|
| 5(d)(ii)  | $\text{H}^{\times}\text{H}$                                                  | 1     |
| 5(d)(iii) | they / carbon and hydrogen are (both) non-metals / it is a simple molecule ; | 1     |

| Question | Answer                                                                                                                     | Marks |
|----------|----------------------------------------------------------------------------------------------------------------------------|-------|
| 6(a)     |  <p>1 mark for each correct link ;;;</p> | 3     |
| 6(b)(i)  | thermal expansion (as temperature rises) ;                                                                                 | 1     |
| 6(b)(ii) | resistance ;                                                                                                               | 1     |
| 6(c)(i)  | radiation ;                                                                                                                | 1     |
| 6(c)(ii) | convection ;<br>hot gases rise / move out from the centre (to the surface) ;                                               | 2     |

| Question  | Answer                                                                                                                                                                      | Marks        |
|-----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| 7(a)(i)   | <i>any two of</i><br>high in / a lot of fat ;<br>high in / a lot of carbohydrate ;<br>not enough vitamins / named vitamin / not enough mineral salts / named mineral salt ; | <b>max 2</b> |
| 7(a)(ii)  | add fruit / vegetable / named fruit or vegetable ;<br>adds vitamins / minerals ;                                                                                            | <b>2</b>     |
| 7(b)(i)   | glycogen ;<br>starch ;                                                                                                                                                      | <b>2</b>     |
| 7(b)(ii)  | makes small / soluble molecules ;<br>that can be absorbed / pass through walls (of alimentary canal) / pass into the blood ;                                                | <b>2</b>     |
| 7(b)(iii) | <i>any two of</i><br>mouth (cavity) ;<br>stomach ;<br>small intestine ;                                                                                                     | <b>max 2</b> |

| Question  | Answer                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Marks    |
|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| 8(a)(i)   | (most reactive)      calcium / Ca<br>aluminium / Al<br>(least reactive)      iron / Fe                                                                                                                                                                                                                                                                                                                                                                        | <b>1</b> |
| 8(a)(ii)  | LHS ;<br>RHS ;<br><div style="display: flex; align-items: center; justify-content: center; gap: 10px;"> <div style="border: 1px solid black; padding: 2px 10px;">aluminium</div> <div>+</div> <div style="border: 1px solid black; padding: 2px 10px;">iron oxide</div> <div>→</div> <div style="border: 1px solid black; padding: 2px 10px;">(aluminium oxide)</div> <div>+</div> <div style="border: 1px solid black; padding: 2px 10px;">iron</div> </div> | <b>2</b> |
| 8(a)(iii) | (aluminium is)<br>(explanation)      oxidised <b>and</b><br>it gains oxygen / reacts with oxygen                                                                                                                                                                                                                                                                                                                                                              | <b>1</b> |
| 8(b)(i)   | heat / increase temperature ;                                                                                                                                                                                                                                                                                                                                                                                                                                 | <b>1</b> |

| Question | Answer                                                                                              | Marks |
|----------|-----------------------------------------------------------------------------------------------------|-------|
| 8(b)(ii) | (test) (aqueous) sodium hydroxide / (aqueous) ammonia ;<br>(result from correct reagent) blue ppt ; | 2     |

| Question  | Answer                                                                                                                         | Marks |
|-----------|--------------------------------------------------------------------------------------------------------------------------------|-------|
| 9(a)(i)   | R ;                                                                                                                            | 1     |
| 9(a)(ii)  | R, P ;                                                                                                                         | 1     |
| 9(b)(i)   | 5000 (N) ;                                                                                                                     | 1     |
| 9(b)(ii)  | greater ;                                                                                                                      | 1     |
| 9(b)(iii) | more work ;<br>(same force / box lifted through) greater distance (from the ground) / box lifted through 3 m rather than 1 m ; | 2     |
| 9(c)(i)   | average speed = total distance / total time <b>or</b> $\text{speed} = \frac{d}{t} = \frac{225}{60}$ ;<br>= 3.75 m/s ;          | 2     |
| 9(c)(ii)  | accelerating / speeding up ;                                                                                                   | 1     |
| 9(c)(iii) | chemical / potential) ;<br>(to) electrical ;                                                                                   | 2     |



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**COMBINED SCIENCE**

**0653/33**

Paper 3 Core Theory

**May/June 2019**

MARK SCHEME

Maximum Mark: 80

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**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 **10** 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.

| Question | Answer                                                              | Marks    |
|----------|---------------------------------------------------------------------|----------|
| 1(a)     | <b>A</b> trachea ;<br><b>B</b> rib ;<br><b>C</b> bronchiole ;       | <b>3</b> |
| 1(b)     | 4 (%) ;                                                             | <b>1</b> |
| 1(c)(i)  | carried by haemoglobin ;<br>in red blood cells ;                    | <b>2</b> |
| 1(c)(ii) | needed for respiration ;<br>reacts with glucose / releases energy ; | <b>2</b> |
| 1(d)     | breathing rate increases ;<br>depth of breathing increases ;        | <b>2</b> |

| Question  | Answer                                                                                              | Marks    |
|-----------|-----------------------------------------------------------------------------------------------------|----------|
| 2(a)(i)   | (contains) atoms (chemically) joined / bonded / combined (together) ;                               | <b>1</b> |
| 2(a)(ii)  | boiling / evaporation ;                                                                             | <b>1</b> |
| 2(a)(iii) | (change) physical <b>AND</b><br>(explanation) no new substance(s) made ;                            | <b>1</b> |
| 2(b)(i)   | releases (heat / thermal) energy ;                                                                  | <b>1</b> |
| 2(b)(ii)  | (sodium ion) drawn 2, 8 electrons (outer shell blank) ;<br>(chloride ion) drawn 2, 8, 8 electrons ; | <b>2</b> |

| Question  | Answer                                                                                  | Marks |
|-----------|-----------------------------------------------------------------------------------------|-------|
| 2(b)(iii) | (solid) zero / poor / non-conductor <b>AND</b><br>(liquid) good / conducts ;            | 1     |
| 2(b)(iv)  | (type) covalent <b>AND</b><br>(explanation) carbon and chlorine / both are non-metals ; | 1     |

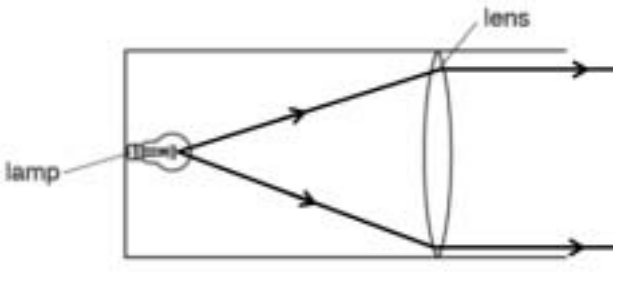
| Question | Answer                                                                                                                                         | Marks |               |           |               |             |  |             |   |
|----------|------------------------------------------------------------------------------------------------------------------------------------------------|-------|---------------|-----------|---------------|-------------|--|-------------|---|
| 3(a)(i)  | arrow pointing left to right, touching swimmer ;                                                                                               | 1     |               |           |               |             |  |             |   |
| 3(a)(ii) | 40 N because are equal and opposite / forces balance ;                                                                                         | 1     |               |           |               |             |  |             |   |
| 3(b)     | speed = distance / time <b>or</b> time = distance / speed <b>or</b> time = 25 / 0.8 ;<br>= 31 (s)                                              | 2     |               |           |               |             |  |             |   |
| 3(c)     | 10–20 s / for 10 s, constant speed (of 0.8 m / s) ;<br>20–40 s / next 20 s, changing speed / slowing down / decelerating (to a stop at 40 s) ; | 2     |               |           |               |             |  |             |   |
| 3(d)(i)  | X-rays are harmful ;                                                                                                                           | 1     |               |           |               |             |  |             |   |
| 3(d)(ii) | <table><tr><td></td><td>X-rays</td><td></td><td>visible light</td><td>infra-red</td><td></td><td>radio waves</td></tr></table>                 |       | X-rays        |           | visible light | infra-red   |  | radio waves | 1 |
|          | X-rays                                                                                                                                         |       | visible light | infra-red |               | radio waves |  |             |   |

| Question | Answer                                                                             | Marks |
|----------|------------------------------------------------------------------------------------|-------|
| 4(a)(i)  | sensitivity ;<br><br>movement ;                                                    | 2     |
| 4(a)(ii) | rate stops / reduces<br><b>and</b> less leaf area / less light (energy) absorbed ; | 1     |

| Question | Answer                                                                                                    | Marks |
|----------|-----------------------------------------------------------------------------------------------------------|-------|
| 4(b)(i)  | wheat → mouse → snake → badger<br><br>correct order of organisms ;<br>arrows going in correct direction ; | 2     |
| 4(b)(ii) | snake / badger ;<br><br>mouse ;                                                                           | 2     |
| 4(c)     | Sun ;                                                                                                     | 1     |

| Question  | Answer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Marks |
|-----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| 5(a)(i)   | increases ;                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 1     |
| 5(a)(ii)  | <div style="border: 1px solid black; padding: 5px; display: inline-block; text-align: center;">             calcium<br/>hydroxide           </div> + <div style="border: 1px solid black; padding: 5px; display: inline-block; text-align: center;">             sulfuric acid           </div> → <div style="border: 1px solid black; padding: 5px; display: inline-block; text-align: center;">             calcium<br/>sulfate           </div> + <div style="border: 1px solid black; padding: 5px; display: inline-block; text-align: center;">             (water)           </div> ..<br>LHS (1)<br>RHS (1) | 2     |
| 5(a)(iii) | (test) (aqueous) sodium hydroxide ;<br><br>(result) white precipitate ;                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 2     |
| 5(b)(i)   | react with <b>all</b> the acid / (make sure) all acid is used up ;                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 1     |
| 5(b)(ii)  | filter ;                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1     |

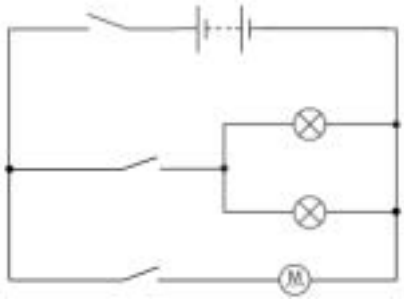
| Question  | Answer                                                                                                                            | Marks |
|-----------|-----------------------------------------------------------------------------------------------------------------------------------|-------|
| 5(b)(iii) | <p><i>any two from</i><br/>heat / boil / evaporate ;</p> <p>leave to crystallise / leave to cool ;</p> <p>filter (crystals) ;</p> | 2     |

| Question | Answer                                                                                                                                                                                     | Marks |
|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| 6(a)     | <p>...evaporates... molecules ... faster... ; ;</p> <p>any 2 correct for 1 mark</p> <p>all three correct for 2 marks</p>                                                                   | 2     |
| 6(b)     | <p>(molecules in the cylinder are) close together / less far apart ORA / random in both / arrangement irregular ;</p> <p>same speed (at same temperature) / both free to move around ;</p> | 2     |
| 6(c)(i)  | <p>20 ;</p> <p>Hz / hertz ;</p>                                                                                                                                                            | 2     |
| 6(c)(ii) | any sensible value above 20 000 (Hz) ;                                                                                                                                                     | 1     |
| 6(d)(i)  | <p>(3 cm) <i>no mark</i></p> <p>(to produce a parallel beam) must come from (principal) focus ;</p>                                                                                        | 1     |
| 6(d)(ii) |                                                                                                         | 1     |

| Question  | Answer                                                                                                                                                                                                                                                                                                                | Marks    |
|-----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| 7(a)      | <p> <b>A</b>      absorption      faeces leave the body<br/> <b>B</b>      digestion      food is taken into the body<br/> <b>C</b>      egestion      insoluble food molecules are broken down<br/> <b>D</b>      ingestion      soluble food molecules enter the blood </p> <p style="text-align: right;">; ; ;</p> | <b>3</b> |
| 7(b)      | stores bile ;                                                                                                                                                                                                                                                                                                         | <b>1</b> |
| 7(c)(i)   | contains all the nutrients ;<br>in the (correct / appropriate) proportions / amounts / quantities / to meet a person's needs / for health ;                                                                                                                                                                           | <b>2</b> |
| 7(c)(ii)  | growth / repair of tissues ;                                                                                                                                                                                                                                                                                          | <b>1</b> |
| 7(c)(iii) | biuret solution ;<br>(biuret solution) goes purple ;                                                                                                                                                                                                                                                                  | <b>2</b> |

| Question  | Answer                                                                                                          | Marks |
|-----------|-----------------------------------------------------------------------------------------------------------------|-------|
| 8(a)(i)   | reduction ;                                                                                                     | 1     |
| 8(a)(ii)  | slower (reaction) ;                                                                                             | 1     |
| 8(a)(iii) | argon / noble gases / Group VIII gases have full outer electron shell ;                                         | 1     |
| 8(b)      | aluminium is more reactive (than carbon) ;                                                                      | 1     |
| 8(c)(i)   | bauxite ;                                                                                                       | 1     |
| 8(c)(ii)  | electrolysis ;                                                                                                  | 1     |
| 8(d)      | (difference) density / melting point / hardness / strength ;<br>(similarity) (electrical / heat) conductivity ; | 2     |
| 8(e)      | metals/ores are running out/finite / no need to mine / does not go into landfill ;                              | 1     |

| Question | Answer                                                                                                            | Marks |
|----------|-------------------------------------------------------------------------------------------------------------------|-------|
| 9(a)(i)  | 24 V ;                                                                                                            | 1     |
| 9(a)(ii) | must not touch the electricity line ;<br>11 000 V / the electricity line (can produce a current which) is fatal ; | 2     |
| 9(b)(i)  | $R = V/I$ or $R = 240 / 0.005$ ;<br>$= 48\,000\ (\Omega)$ ;                                                       | 2     |
| 9(b)(ii) | (rubber is a) good insulator ;                                                                                    | 1     |

| Question | Answer                                                                                                                                                                                                                                                                                                      | Marks    |
|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| 9(c)     |  <p>battery symbol ;<br/>motor symbol and additional switch symbol (anywhere) in circuit ;<br/>switch to lamps in correct place ;<br/>motor and switch connected in parallel with lamps ;</p> | <b>4</b> |