

# Gas Exchange in Humans

## Mark Scheme 1

|                   |                         |
|-------------------|-------------------------|
| <b>Level</b>      | IGCSE                   |
| <b>Subject</b>    | Biology                 |
| <b>Exam Board</b> | CIE                     |
| <b>Topic</b>      | Gas Exchange in Humans  |
| <b>Paper Type</b> | (Extended) Theory Paper |
| <b>Booklet</b>    | Mark Scheme 1           |

**Time Allowed:** 59 minutes

**Score:** /49

**Percentage:** /100

| Question   |   |   |        | Mark    | Guidance                                |          |        |   |          |       |  |          |            |   |          |           |  |            |   |  |          |                                |                      |          |           |  |  |     |  |
|--|---|---|--------|---------|---|----------|--------|---|----------|-------|--|----------|------------|---|----------|-----------|--|------------|---|--|----------|--------------------------------|----------------------|----------|-----------|--|--|-----|--|
| 1 (a)  | <table border="1"> <thead> <tr> <th data-bbox="315 300 712 339">function</th> <th data-bbox="719 300 869 339">letter</th> <th data-bbox="869 300 1182 339">name</th> </tr> </thead> <tbody> <tr> <td data-bbox="315 339 712 411">structure that makes sounds</td> <td data-bbox="719 339 869 411"><b>A</b></td> <td data-bbox="869 339 1182 411">larynx</td> </tr> <tr> <td data-bbox="315 411 712 515">bone that provides protection for the lungs</td> <td data-bbox="719 411 869 515"><b>E</b></td> <td data-bbox="869 411 1182 515">rib ;</td> </tr> <tr> <td data-bbox="315 515 712 619">airway that allows passage of air only into the right lung</td> <td data-bbox="719 515 869 619"><b>J</b></td> <td data-bbox="869 515 1182 619">bronchus ;</td> </tr> <tr> <td data-bbox="315 619 712 722">airway that allows passage of air into both lungs</td> <td data-bbox="719 619 869 722"><b>B</b></td> <td data-bbox="869 619 1182 722">trachea ;</td> </tr> <tr> <td data-bbox="315 722 712 858">contracts to increase the volume of the thorax</td> <td data-bbox="719 722 869 858"><b>F/G</b></td> <td data-bbox="869 722 1182 858">(F) diaphragm / (G) external intercostal muscle ;</td> </tr> <tr> <td data-bbox="315 858 712 962">muscle that contracts to lower the ribcage</td> <td data-bbox="719 858 869 962"><b>K</b></td> <td data-bbox="869 858 1182 962">internal intercostal muscles ;</td> </tr> <tr> <td data-bbox="315 962 712 1010">site of gas exchange</td> <td data-bbox="719 962 869 1010"><b>M</b></td> <td data-bbox="869 962 1182 1010">alveoli ;</td> </tr> </tbody> </table> | function  | letter | name    | structure that makes sounds             | <b>A</b> | larynx | bone that provides protection for the lungs | <b>E</b> | rib ; | airway that allows passage of air only into the right lung | <b>J</b> | bronchus ; | airway that allows passage of air into both lungs | <b>B</b> | trachea ; | contracts to increase the volume of the thorax | <b>F/G</b> | (F) diaphragm / (G) external intercostal muscle ; | muscle that contracts to lower the ribcage | <b>K</b> | internal intercostal muscles ; | site of gas exchange | <b>M</b> | alveoli ; |  |  | [6] |  |
| function   | letter  | name  |        |         |   |          |        |   |          |       |  |          |            |   |          |           |  |            |   |  |          |                                |                      |          |           |  |  |     |  |
| structure that makes sounds                                | <b>A</b>  | larynx  |        |         |   |          |        |   |          |       |  |          |            |   |          |           |  |            |   |  |          |                                |                      |          |           |  |  |     |  |
| bone that provides protection for the lungs                | <b>E</b>  | rib ;   |        |         |   |          |        |   |          |       |  |          |            |   |          |           |  |            |   |  |          |                                |                      |          |           |  |  |     |  |
| airway that allows passage of air only into the right lung | <b>J</b>  | bronchus ;  |        |         |   |          |        |   |          |       |  |          |            |   |          |           |  |            |   |  |          |                                |                      |          |           |  |  |     |  |
| airway that allows passage of air into both lungs          | <b>B</b>  | trachea ;   |        |         |   |          |        |   |          |       |  |          |            |   |          |           |  |            |   |  |          |                                |                      |          |           |  |  |     |  |
| contracts to increase the volume of the thorax             | <b>F/G</b>  | (F) diaphragm / (G) external intercostal muscle ; |        |         |   |          |        |   |          |       |  |          |            |   |          |           |  |            |   |  |          |                                |                      |          |           |  |  |     |  |
| muscle that contracts to lower the ribcage                 | <b>K</b>  | internal intercostal muscles ;                    |        |         |   |          |        |   |          |       |  |          |            |   |          |           |  |            |   |  |          |                                |                      |          |           |  |  |     |  |
| site of gas exchange                                       | <b>M</b>  | alveoli ;   |        |         |   |          |        |   |          |       |  |          |            |   |          |           |  |            |   |  |          |                                |                      |          |           |  |  |     |  |
| (b)  | keeps, airways / trachea / bronchi, open ;<br>allows (free flow of) air into (the lungs) ;<br>allows flexibility / can breathe even when, bent / swallowing / AW ;<br>AVP ;   |   |        | [max 2] | I protection                            |          |        |   |          |       |  |          |            |   |          |           |  |            |   |  |          |                                |                      |          |           |  |  |     |  |
| (c) (i)  | (aerobic) respiration ;   |   |        | [1]     | R anaerobic respiration                 |          |        |   |          |       |  |          |            |   |          |           |  |            |   |  |          |                                |                      |          |           |  |  |     |  |
| (ii)   | rate (of breathing) increases ;   |   |        | [1]     | R it increase<br>A it's faster / deeper |          |        |   |          |       |  |          |            |   |          |           |  |            |   |  |          |                                |                      |          |           |  |  |     |  |

| Question |  | Mark               | Guidance |
|----------|--|--------------------|----------|
| 1 (iii)  | stimulus (is CO <sub>2</sub> ); <b>A</b> acidic/pH, of blood decreases ;<br>(CO <sub>2</sub> / pH) detected by the brain ;<br>by a receptor ;<br>ref to (named) neurone in context ;<br>brain sends impulses to, (intercostal) muscles / diaphragm / effectors ;<br>(intercostal) muscles / diaphragm / effectors, contract more (frequently) ;<br>negative feedback / homeostasis ;<br>reflex / automatic / involuntary ; | [max 3]            |          |
|          |  | <b>[Total: 13]</b> |          |

| Question  | Expected Answers                          |  | Marks   | Additional Guidance |
|-----------|---|--|---------|---------------------|
| 2 (a) (i) | bronchus/bronchiole(s) ;                  |  | [1]     |                     |
| (ii)      | 1<br>2<br>3<br>4                          | goblet cells, release / produce, mucus ;<br>mucus traps, dirt / particles / pathogens ;<br>cilia, beat / AW ;<br>to move, fluid / AW, up / out (of airway) ;   | max [3] | R 'cilia trap dirt' |
| (b) (i)   | 1<br>2<br>3<br>4                          | diffusion ;<br>across (cell / permeable) membranes ;<br>high concentration to low concentration (of O <sub>2</sub> ) / down concentration gradient ;<br>moist lining / AW / O <sub>2</sub> is dissolved ;  | max [3] |                     |
| (b) (ii)  | 1<br>2<br>3<br>4<br>5<br>6<br>7<br>8      | <u>external</u> intercostal muscles contract ;<br><u>internal</u> intercostal muscles relax ;<br>lifts ribs, upwards / outwards ;<br>diaphragm contracts ;<br>diaphragm, flattens / drops ;<br>volume of, thorax / lungs / chest, increases ;<br>pressure in, thorax / lungs / chest, decreases ;<br>air flows in down a pressure gradient ; | max [4] | A ribcage expands   |
| (iii)     | carbon dioxide ;<br>water <u>vapour</u> ; |  | max [1] |                     |

| Question | Expected Answers   |  | Marks              | Additional Guidance                               |
|----------|--|--|--------------------|---|
| 2 (c)    | <b>1</b><br><b>2</b><br><b>3</b><br><b>4</b><br><br><b>5</b><br><b>6</b><br><b>7</b><br><b>8</b><br><br><b>9</b><br><b>10</b><br><b>11</b> | tar/carcinogens ;<br>carcinogenic/ can cause, lung cancer ;<br>sticks to/blocks / damages, (named) air passages/ alveoli/ cilia ;<br>(trigger) production of, more/excess, mucus ;<br><br>(smoke) particles ;<br>trigger white blood cells ;<br>irritant/causes asthma/prone to infection ;<br>phagocytosis described ;<br><br>carbon monoxide ;<br>combines with haemoglobin (permanently) ;<br>reduced oxygen transport (of blood) ; | max [4]            | <i>component must be linked to correct effect</i> |
|          |  |  | <b>[Total: 16]</b> |   |

|           |  |                    |   |
|-----------|--|--------------------|---|
| 3 (a) (i) | <p>award two marks if the answer is correct – 12<br/>if there is no answer or it is incorrect, award one mark for correct working</p> <p>6 s – 1s = 5 seconds for 1 breath ;<br/>60/5 = 12 (breaths per minute) ;</p>  | max [2]            | Alternative: 4 s – 9 s = 5 s for 1 breath<br>Allow 10 s for 2 breaths for working mark. |
| (ii)      | <p>slower breathing rate before match ; <b>ora</b><br/>deeper breathing during match ; <b>ora</b><br/>during the match breaths are different from each other ; <b>ora</b><br/>pressure (in lungs) increases during the match ;</p>   | max [3]            |   |
| (b)       | <p><u>external</u> intercostal muscles contract ;<br/><u>internal</u> intercostal muscles relax ;<br/>lifts ribs, upwards/outwards ;<br/>diaphragm contracts ;<br/>diaphragm, flattens / drops ;<br/>volume of, thorax/lungs/chest, increases ;<br/>pressure in, thorax/lungs/chest, decreases ;<br/>air flows in down a pressure gradient/description ;</p> | max [4]            | Note: internal and external must be stated  |
| (c) (i)   | <p>(CO<sub>2</sub>) is metabolic/AW, waste ;<br/>(CO<sub>2</sub>) is toxic ;</p>   | max [1]            | <b>ignore</b> – from body (in question stem)  |
| (ii)      | (blood) plasma ;   | [1]                |   |
| (iii)     | pH decreases/becomes acidic ;  | [1]                |   |
| (d)       | <p>more, (aerobic) respiration ;<br/>steeper concentration gradient ;</p>  | [2]                | <b>A</b> description of gradient.   |
|           |  | <b>[Total: 14]</b> |   |

|       |   |  |  |
|-------|---|--|--|
| 4 (a) | diaphragm <u>contracts</u> and, lowers / flattens / AW;<br>rib cage rises / moves, upwards / outwards;<br>external intercostal muscles <u>contract</u> ;  | <p style="text-align: center;"><b>max 3</b></p>      | <p><b>A</b> increases in volume / expands</p>  |
| (b)   | pH decreases;<br>increased rate of aerobic respiration;<br>more carbon dioxide (into blood plasma);<br>forms (carbonic) acid;<br>anaerobic respiration occurs (during strenuous exercise);<br>lactic acid produced; | <p style="text-align: center;"><b>max 3</b></p>      | idea of <u>more</u> needs to be apparent at least once for <b>MP2</b> and <b>MP3</b><br><br><p><b>A</b> carbon dioxide is acidic</p> |
|       |   | <p style="text-align: center;"><b>[Total: 6]</b></p> |  |