# Respiration

## Mark Scheme 2

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| **Level** | IGCSE |
| **Subject** | Biology |
| **Exam Board** | CIE |
| **Topic** | Respiration |
| **Paper Type** | (Extended) Theory Paper |
| **Booklet** | Mark Scheme 2 |



**Time Allowed:** **60 minutes**

**Score:** **/50**

**Percentage:** **/100**

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| 1 **(a** | have a nucleus;<br>different composition of cell wall;<br>can reproduce sexually;<br>reproduce (asexually) by budding;<br>larger in size;<br>have mitochondria; | **max 1** | **I** hyphae<br>**A** cell wall made of chitin<br><br>**A** bacteria use binary fission |
| **(b)** | 2 $CO_2$ ;<br>2 $C_2H_5OH$ ; | **2** | **A** 2 $C_2OH_6$ |
| **(c) (i)** | maintain constant temperature / prevent the temperature increasing or decreasing too much;<br><br>prevents the enzymes (in yeast) being denatured;<br><br><br>respiration (by yeast) releases heat; | **max 2** | <br><br>**A** for optimum temperature for, enzymes **/** (yeast) growth /fermentation **A** prevents yeast being killed by high temperature<br><br>**A** reaction is exothermic |
| **(ii)** | used to make, amino acids / proteins;<br>amino acids used to make proteins;<br>e.g. enzymes; | **max 2** | **I** source of proteins / amino acids |
| **(iii)** | control pressure;<br>allows carbon dioxide to escape;<br>prevents oxygen entering;<br>to keep respiration anaerobic;<br>prevents entry of, bacteria / viruses / contaminants; | **max 2** | <br>**I** air / gas unqualified<br><br>**A** anaerobic conditions<br>**R** 'keep in clean' / AW |
| **(d) (i)** | lag phase / described;<br>log / exponential, phase / described;<br>stationary / plateau, phase / described;<br>key data quote with mass <u>and</u> time; | **max 3** | units need to be used at least once<br>0 h, 1 g $dm^{-3}$ (start)<br>0 – 1 h, 1 – 1.2 g $dm^{-3}$ (lag)<br>1 h – 10 h, 1.2 – 6.5 g $dm^{-3}$ (log)<br>10 h, 6.5 g $dm^{-3}$ (stationary) |

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| 1 (ii) | lag phase:<br>(dry) yeast adapting to the environment / AW;<br>yeast are reproducing / dividing;<br><br>log phase:<br>no <u>limiting factors</u>;<br>enough / plenty of, (named) nutrients;<br><br>stationary phase:<br>no more reproduction;<br><u>limiting factors</u>;<br>none / reduction in, (named) nutrients;<br>build-up of, toxic waste / alcohol;<br>reference to carrying capacity; | **max 3** | e.g. glucose, sugar, ammonia, ammoni (compounds), minerals<br>**A** low alcohol / toxin, concentration / correct pH<br><br>**A** no growth of yeast (cells)<br><br>**A** competition for nutrients<br>**A** wrong pH |
| **(e)** | (named) alcohol production (for consumption);<br>alcohol for fuel;<br>bread making / making dough rise;<br>yeast extract / probiotics / nutrient supplements; e.g. vegemite<br>production of carbon dioxide;<br>bioremediation; | **max 2** | **A** brewing / wine<br><br>**I** baking unqualified |
| | | **[Total: 17]** | |

| | Answer | Marks | Guidance for Examiners |
|---|---|---|---|
| 2 (a) | <table><tr><td>structure</td><td>letter from Fig. 1.1</td></tr><tr><td>left lung</td><td>**D**</td></tr><tr><td>bronchus</td><td>**J**</td></tr><tr><td>diaphragm</td><td>**E**</td></tr><tr><td>intercostal muscle</td><td>**H**</td></tr><tr><td>rib</td><td>**C**</td></tr><tr><td>trachea</td><td>**B**</td></tr></table> | [5] | *Only one letter per box; if more than one letter no mark*<br><br>*If letter crossed out but not rewritten mark it*<br><br>**JEHCB** |
| (b) (i) | 3750 ; *no mark for working alone* | [1] | *if the answer is not in the table look for it in the space for working* |
| (ii) | number of breaths (per minute) / different rate of breathing ;<br>exhaled breath has a higher temperature ; | [max 1] | **A** faster, slower, change in frequency<br>**ignore** depth (as in the table) / heavier |
| (iii) | water vapour / $H_2O$ / any **named** rare *or* inert gas *or* pollutant ; | [1] | *names, correct symbols or formulae for any of the following*: $H_2$, Ar, He, Xe, Ne, Rn, Kr, $SO_2$, $O_3$, CO, $NO_2$, $N_2O$, $CH_4$, $NH_3$, $I_2$ |
| (iv) | *in breathed out air*<br>**1** after exercise less oxygen <u>and</u> more carbon dioxide / ora ;<br>**2** use of data <u>with %</u> to quantify (for either oxygen or carbon dioxide) ;<br>*explanation in terms of the following increasing*<br>**3** more oxygen, absorbed / is needed / used up ;<br>**4** more carbon dioxide, produced ;<br>**5** more gas exchange ;<br>**6** more <u>respiration</u> ; **R** more anaerobic respiration<br>**7** more energy required ;<br>**8** repaying / AW, oxygen debt ; | [max 3] | **MP2**<br>oxygen – 17.2 to 15.3% / 1.9%<br>carbon dioxide – 3.6 to 5.5% / 1.9%<br><br>**R** inhaled<br>**R** exhaled<br>**R** produce energy |

| Question | | | E Answers | Marks | Additional Guidance |
|---|---|---|---|---|---|
| 3 | (a) | | <table><tr><td>cell</td><td colspan="2">end products of respiration</td></tr><tr><td></td><td>aerobic</td><td>an</td></tr><tr><td>yeast</td><td>c dioxide/$CO_2$ + water/$H_2O$ ;</td><td>carbon dioxide/$CO_2$ + alcohol/ethanol/$C_2H_5OH$ ;</td></tr><tr><td>human muscle cell</td><td>carbon dioxide/$CO_2$ + water/$H_2O$ ;</td><td>lactic acid lactate/ $C_3H_6O_3$/$CH_3CH(OH)COOH$ / $CH_3CH(OH)COO^-$ ;</td></tr></table> | [4] | ***ignore*** ATP/energy |
| | (b) | **1** muscles <u>contract</u> ;<br>**2** need more energy ;<br>**3** increase in need for oxygen ; **ORA**<br>**4** removal of (more) carbon dioxide ;<br>**5** (increase in) <u>aerobic</u> respiration ;<br>**6** <u>anaerobic</u> respiration also occurs ;<br>**7** developing <u>oxygen debt</u>,/oxygen not supplied fast enough ;<br>**8** (production of) lactate/lactic acid ;<br>**9** increase in stroke volume (of heart) ;<br>**10** increase in, blood flow/glucose/oxygen, to muscles ;<br>**11** blood pressure increase because heart rate/stroke volume increases ;<br>**12** removal of heat ;<br>**13** ref to adrenaline ; | [max 5] | ***ignore*** 'breathing rate', 'ventilation rate', 'oxygen absorption', 'heart rate', 'blood pressure' (all are in the Table)<br><br>**R** repaying oxygen debt (occurs after exercise) |
| | | | | **[Total: 9]** | |

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| **4** | **(a)** | | $C_6H_{12}O_6$<br>2 $C_3H_6O_3$ | [2] | ***ignore*** word equation<br>***ignore*** energy / ATP<br>**R** if 2 is not included for $C_3H_6O_3$<br>**R** $O_2$, $CO_2$, $H_2O$ on either side |
| | **(b)** | | biceps contracts<br>triceps relaxes | [2] | **accept** ref to <u>antagonistic</u> pair of muscles |
| | **(c)** | | *During:*<br>**1** oxygen consumption increases as exercise starts<br>**2** levels off / increase slows down during the race<br>**3** data quote for consumption during the race<br><br>*After:*<br>**4** starts to decrease, immediately at the end of the race / at 18 minutes<br>**5** gradually decreases after exercise<br>**6** rate returns to original / resting level<br>**7** data quote for consumption after exercise | [max 4] | Units must be stated at least once<br><br>e.g. of Mpt 3: **A** plateaus between 2.1 – 2.4 $dm^3$ $min^{-1}$<br>Maximum is 2.4 $dm^3$ $min^{-1}$,<br>3 – 4 mins /at start / 5 to 8 or 9 mins to reach maximum<br><br>e.g. of Mpt 7: **A** Resting rate at 0.25 $dm^3$ $min^{-1}$,<br>9 – 10 mins / at 18 to 27 or 28 min to reach original level |
| | **(d)** | | **1** <u>oxygen debt</u><br>**2** not enough oxygen supplied (to muscles) during exercise<br>**3** to muscles<br>**4** anaerobic respiration<br>**5** lactic acid produced<br>**6** lactic acid, broken down / respired / converted to glucose / $CO_2$ and water / oxidized<br>**7** requires (extra) oxygen<br>**8** oxygen restored to haemoglobin<br>**9** AVP. e.g. restored to myoglobin (in muscles) | [max 5] | **A** lactate for lactic acid throughout the answer<br><br><br><br><br>Mpt 6 **R** removed<br><br><br><br>**Ig** lowers pH, muscles stiff / cramps |
| | | | **[Total: 13]** | | |