A Level AQA Biology

9 Gas exchange – answers

Question	Answers	Extra information	Mark	AO Spec reference
01.1	large surface area to volume ratio; thin / short diffusion pathway / faster (rate of) diffusion;	Ignore reference to "flat"	2	AO2 3.3.1 3.2.3
01.2	inversely related / solubility of oxygen in the blood decreases as the temperature increases; correct manipulation of figures, such as 55% decrease in solubility from 10 °C to 40 °C;		2	AO2 3.3.1
01.3	vena cava;		1	AO1 3.3.4.1
01.4	decreased blood supply to the heart; decreased stroke volume; decreased cardiac output;		3	AO3 3.3.4.1
02.1	Any four from: high surface area to volume ratio; so, more oxygen into blood / more carbon dioxide out of the blood; one cell thick; short diffusion distance; (excellent) capillary blood supply; (ventilation) maintain concentration gradient;		4 max	AO1 3.3.2
02.2	$\frac{495}{33}$; $= 15\ cm^3$;		2	AO2 3.3.1 MS2.2
02.3	PVR at 10s = 495 $cm^3\ min^{-1}$ (from question) PVR at 20s = $15 \times 57 = 855\ cm^3\ min^{-1}$; 855 – 495 = 360; $\frac{360}{495} \times 100$; = 72% (2 s.f);	Allow errors carried forward	4	AO3 3.3.1 MS 2.3

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02.4	difficulty inhaling/exhaling (ignore breathing); reduced O_2 / CO_2 capacity when inhaling / exhaling;		2	AO2 3.3.2
03.1	*Puntigrus;*		1	AO2 3.4.5
03.2	Any four from: large surface area to volume ratio; (many) gill filaments stacked with (many) lamellae; short diffusion distance / one cell thick; good blood supply through capillary network; counter current mechanism / blood and water flowing in opposite directions; to maintain a concentration gradient;		4 max	AO1 AO2 3.3.2
03.3	lamellae have less water flow over them; less gas exchange / diffusion of oxygen; concentration gradient not maintained;		3	AO3 3.3.2
04.1	mouse: $\left(\frac{1279}{13.2}\right) = 96.9$; elephant: $\left(\frac{3.7 \times 10^5}{2.4 \times 10^6}\right) = 0.15$;	Allow 97	2	AO2 3.3.1 MS 4.1
04.2	metabolic rate is lower in the elephant; due to lower surface area to volume ratio; less heat generated to stay warm / less heat loss due to smaller surface area;	Accept reverse argument for the house mouse	3	AO3 3.3.1
04.3	SAN spreads across (the surface of) the atria / atrial systole; delay at the AVN; to purkyne fibres / bundle of His; enables the ventricle muscles to contract from the apex upwards;	Allow “through artial walls” but not “through atria”	4	AO1 3.6.1.3

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Question	Answers	Extra information	Mark	AO Spec reference
05.1	Any four from: oxygen diffuses down a concentration gradient to outside the bubble; oxygen used in aerobic respiration; oxygen diffuses out of the bubble into the water; bubble becomes smaller; less oxygen diffuses into the bubble;		4 max	AO2 3.3.2 3.2.3
05.2	Any three from: *Yes, because:* there is an overall trend that increased temperature (generally) leads to increased metabolic rate (in giant green water beetles); *No, because:* at 23.5 °C, the metabolic rate was lower compared to 23 °C; no evidence of the investigation being repeated/reproduced; no error bars; no statistical test carried out; correlation does not (necessarily) mean causation;	Allow a comparison (quoting correct figures) between an increase in temperature leading to an increased metabolic rate Allow correct alternative data patterns	3 max	AO3 3.3.2
05.3	Any one from: surface area to volume ratio; age of the beetle; activity level of the beetle;		1	AO1 3.3.1
06.1	reduce the risk of disability; by about 30 years;	Allow increased life expectancy if qualified Allow a suitable timeframe if qualified	2	AO3 3.3.2

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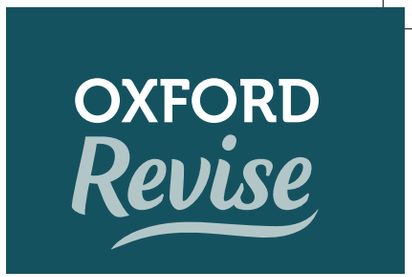

<table>
<tr><th>Question</th><th>Answers</th><th>Extra information</th><th>Mark</th><th>AO
Spec reference</th></tr>
<tr><td>06.2</td><td>Any four from:
less oxygen diffused into the blood from the alveoli;
(because) more alveoli damaged by (many) years of cigarette smoke;
less carbon dioxide diffused into the alveoli from the blood;
breathlessness;
irritation of trachea / larynx;</td><td></td><td>4 max</td><td>AO2
AO3
3.3.2</td></tr>
<tr><td>06.3</td><td>unable to stimulate cytotoxic T cells;
unable to stimulate B cells so no plasma cells produced;
no antibodies secreted to form antigen-antibody complex;</td><td>Allow T_c cells</td><td>3</td><td>AO2
3.2.4</td></tr>
<tr><td>07</td><td>The following are suitable topic areas from the specification that could be used to compare the uses of diffusion in organisms.

In order to fully address the question and reach the highest mark bands students must also include at least five topics in their answer, to demonstrate a synoptic approach to the essay.

<table><tr><th>Specification reference</th><th>Topic area</th></tr><tr><td>3.1.7 and 3.1.8</td><td>Water and inorganic ions</td></tr><tr><td>3.2.3</td><td>Transport across membranes</td></tr><tr><td>3.3.2</td><td>Gas exchange</td></tr><tr><td>3.3.3</td><td>Digestion and absorption</td></tr><tr><td>3.3.4.1</td><td>Mass transport in animals</td></tr><tr><td>3.3.4.2</td><td>Mass transport in plants</td></tr><tr><td>3.5.1</td><td>Photosynthesis</td></tr><tr><td>3.5.2</td><td>Respiration</td></tr></table></td><td></td><td>25</td><td>AO1
3.1.7
3.1.8
3.2.3
3.3.2
3.3.3
3.3.4.1
3.3.4.2
3.5.1
3.5.2
3.5.4
3.6.1.1
3.6.1.2
3.6.2.1
3.6.2.2
3.6.3
3.6.4.1
3.6.4.2
3.6.4.3</td></tr>
</table>

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Question	Answers	Extra information	Mark	AO Spec reference
	3.5.4 Nutrient cycles 3.6.1.1 Plant responses to stimuli 3.6.1.2 Receptors 3.6.2.1 Nerve impulses 3.6.2.2 Synaptic transmission 3.6.3 Muscle contraction 3.6.4.1 and 3.6.4.2 Control of blood glucose concentration 3.6.4.3 Control of blood water potential Students may be able to show the relevance of other topics from the specification. **Note:** other topics from beyond the specification can be used, providing they relate to the title and contain factually correct material of at least an A-level standard. Credit should not be given for topics beyond the specification which are below A-level standard.			

Skills box answers

Question	Answer
1	Organism **A** = 6.3 m^{-1} (an elephant) Organism **B** = 400 m^{-1} (a mouse) Organism **C** = 6000 m^{-1} (an amoeba)
2	$\frac{6\,000}{6.3} = 9.52$
3	Alveoli, ventilation, blood supply