

WJEC (Eduqas) Biology A-level
Topic 3.1: Adaptations for Gas
Exchange
Questions by Topic - Mark
Scheme

1.

Question		Marking details	Marks Available
1.	(a)	Any 4 Intercostal muscles <u>contract</u> <u>and</u> ribs move <u>up and out</u>; Diaphragm (muscles) <u>contract</u> <u>and</u> diaphragm <u>flattens</u>; (Internal) volume of <u>thorax</u> increases; accept chest reject lungs Pressure in lungs/ thorax decreases; {Higher/ <u>difference in</u>} air <u>pressure</u> outside {forces/ pushes/ moves/ drawn} air into lungs;	4
	(b)	(i) blood flows across (gills/ filaments/ lamellae/ gill plates) in opposite direction to water; water always has more oxygen than blood/ (oxygen) {diffusion/ concentration} gradient maintained; oxygen passes from water into blood; across entire {gill/ gas exchange} surface; NOT longer higher saturation of blood with oxygen/ more oxygen taken up; (ii) Parallel (flow); (iii) Equilibrium is reached (part way across the gill plates/ lamellae)/{diffusion/ concentration} gradient not maintained; {Lower percentage saturation with/ <u>only</u> 50% saturation} oxygen/ less oxygen uptake/ less diffusion of oxygen; NOT slower	4 1 2
	(c)	gills dry out; prevents oxygen from dissolving on surface of gills; gills may {stick together/not open as easily/ collapse}; decrease in surface area; (Explanation cannot be accepted alone)	2 max
Question 1 Total			[13]

2.

Question	Marking details	Marks Available
2	(a) Increases surface area; <u>Diffusion</u> takes place (over whole area); (b) (i) Mouth opens/floor of buccal cavity lowered; Volume of {buccal cavity/inside the mouth} increases/pressure lowered inside {buccal cavity/mouth}; Water {pulled in from outside/ enters due to pressure difference}; Mouth closes and {buccal cavity then contracts/ floor of buccal cavity raises}; Water forced {across/through} gills (into gill cavity); Pressure in gill cavity increases; Forces open the operculum / gill slits; (ii) Blood flows across (gills/ filaments/ lamellae/ gill plates) in <u>opposite</u> direction to water; Blood always meets water containing a <u>higher</u> oxygen concentration/{diffusion/ concentration} gradient maintained/ equilibrium is never reached; Across entire {gill/ gas exchange surface}; <u>Higher</u> saturation of blood with oxygen achieved; (c) (i) Diffusion pathway would be too long/ ensures a short diffusion pathway; Speed of diffusion too slow; To supply sufficient oxygen; (ii) Less fluid/ fluid moves into muscle fibres/ fluid level decreases; More area for gaseous exchange/ shorter diffusion pathway;	2
		Max 4
		Max 3
		Max 2
		2
Question 2 Total		[13]

3.

Question	Marking details	Marks Available
3 (a)	lamellae/gill plates;	1
(b)	water {forced/ flows} over gill (filaments); by pressure changes/ OWTTE; (pumping) action of mouth and operculum/ OWTTE; water flows in opposite direction to blood/counter-current mechanism; maintains {diffusion/ concentration} gradient across {entire/ whole} gill (filament); as blood always meets water with a higher oxygen concentration/ equilibrium is never reached;	max 4
(c)	Any four <u>large</u> surface area; {(dense) network/ large number} of <u>capillaries</u> ; NOT good blood supply {thin/permeable} <u>epithelium</u> , moist; short diffusion pathway;	max 4
Question 3 Total		[9]

4. (a)

(i)

A Alveoli/alveolar sacs; [1]

B Capillary (network);

Both for 1 mark.

(ii)

C Pulmonary artery; [1]

D Pulmonary vein;

Both for 1 mark.

(b)

Any 2 [2]

Thin alveolus (walls) /one cell thick;

NOT membrane or thin alone.

Large surface area / highly folded;

(volume - neutral)

Large number of capillaries (or implied);

(c)

Contraction of intercostal muscles and diaphragm OR ribcage moves up and out and diaphragm flattens / contract; [2]

Increased volume and decreased pressure so air moves in(to lungs);

Question total 6

5.

Question			Marking details	Marks Available
5	(a)		1. They have <u>many</u> alveoli; 2. Which increases / provides a large surface area (for gas exchange); 3. The {alveolar / capillary} <u>walls</u> are {thin / one cell thick} / capillaries are close to alveoli / alveoli are composed of squamous epithelial cells; 4. Providing a short diffusion {pathway / distance} (for oxygen to enter the blood); 5. Many blood {capillaries / vessels} / <u>{rich / good}</u> blood supply / capillary network; reject arteries / veins 6. To maintain (steep) concentration gradients; (Max 2 from 1,3 and 5 and Max 2 from 2,4 and 6)	Max 4
	(b)	(i)	1. The intercostal muscles relax allowing the ribcage to move downwards <u>and</u> inwards; (ignore reference to internal / external) 2. The diaphragm (muscles) relaxes <u>and</u> becomes dome shaped; 3. This decreases the volume of the {<u>thoracic cavity / thorax</u>}; NOT lungs 4. Which increases the pressure inside the {lungs / thoracic cavity}; 5. {Forcing / pushing} air out of the lungs / moving air out of the lungs down a pressure gradient; (NB must be reference to air moving from higher pressure to lower pressure not simply 'air moves out of lungs' unqualified)	Max 4
		(ii)	• Have high metabolic rates / are {homeothermic / endothermic}; • Ventilation maintains a (steep) concentration gradient (at the alveoli) / {sufficient / enough / more} <u>oxygen</u> supplied to the {alveoli / gas exchange surface};	2
			Question 5 total	[10]

6.

Question			Marking details	Marks Available
6	(a)		{minimise / reduce} heat <u>and</u> water loss Reject: prevent	1
	(b)		Any four from: • Intercostal muscles contract (and expand the ribcage); • (outer) pleural membranes pulled out (by expanding ribcage); • pleural pressure reduced; • (inner) pleural membrane pulls on lungs and expand alveoli; • alveolar pressure lowers; • air moves in {when alveolar pressure is lower than atmospheric pressure / and increases alveolar pressure}; • reference to data from graph;	4
	(c)		Premature babies / lung transplants / respiratory distress syndrome; lowers surface tension of the fluid in the alveoli / to prevent alveoli from collapsing;	2
			Question 6 Total	[7]

7. (a)

(Gill) lamellae / filaments / plates; [1]

(b)

Any 3 [3]

Large surface area (for diffusion); (volume neutral)

Thin / short diffusion pathway;

Permeable;

Good blood supply or implied; NOT transport system

NOT moist.

(c)

Water is forced over the gill by {ventilation mechanisms / pressure differences / continuous swimming}; [4]

Unidirectionally / one way flow;

Countercurrent flow of blood and water / or description of;

{Diffusion / concentration} gradient is maintained or description of;

over the entire gill surface;

High affinity Hb;

Question total [8]

8.

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
4	(a)	(i)		Both needed for one mark X = (gill) filaments Y = (gill) arch/bar	1			1		1
		(ii)		{Filter/sieve/remove/catch} {food/particles/solids NOT molecules} /protection from debris/preventing damage to the gill filaments (1)		1		1		
		(iii)		A. normally water separates {filaments/lamellae/plates/gills}/Gills dry out (when out of water) (1) B. {Filaments/lamellae/plates/gills} {stick together/collapse} (1) C. Reduced Surface Area for {diffusion/gas exchange} (1) D. Water needed for <u>diffusion</u> (of gases)/{oxygen/gases} need to be in solution to <u>diffuse</u> (1)	4			4		
	(b)			Accept reverse argument for any point A. Countercurrent more efficient (1) B. Maintains {diffusion/concentration} gradient/or description of/equilibrium not met (1) C. Across {entire/whole} {gill/filament/lamellae/plate} (1) D. {Higher/more} {saturation/oxygen absorbed} (1) Accept correct references to higher percentages in counter current/use of values e.g. 80% compared to 50%	4			4		
	(c)	(i)		C = parallel flow and A = countercurrent flow (1)		1		1		
		(ii)		Correct insertion of arrows on A <u>only</u> (1) NOT ECF	1			1		
				Question 4 total	10	2	0	12	0	1

9.	Question	Marking details	Marks Available
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3

FUNCTION	STRUCTURE
Flattens	H/ diaphragm
Become constricted	C/ bronchioles
Contain a surfactant	E/ alveoli

1

max 2

10. (a) Beat;

[2]

[2]

[2]

[2]

[1]

Total 5 marks

11.

Question			Marking details	Marks Available								
4	(a)		large surface area; thin walls; NOT cell wall {extensive/large} capillary network; (NOT good blood supply)	3								
	(b)		Any one from	1 max								
			<table><tr><th>Adaptation</th><th>Explanation</th></tr><tr><td>large surface area</td><td>increases area over which <u>diffusion</u> can occur;</td></tr><tr><td>thin walls</td><td>reduces <u>diffusion</u> distance/ short diffusion paths; Not diffusion occurs faster</td></tr><tr><td>extensive capillary network</td><td>maintains <u>diffusion</u> gradient;</td></tr></table>	Adaptation	Explanation	large surface area	increases area over which <u>diffusion</u> can occur;	thin walls	reduces <u>diffusion</u> distance/ short diffusion paths; Not diffusion occurs faster	extensive capillary network	maintains <u>diffusion</u> gradient;	
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		Question 4 Total	[4]									