Exchange Surfaces (3.1.1): OCR A Level Biology Exam Questions by Top

17 questions · 33 marks · about 40 minutes. Answer in the spaces, then check the mark schemes at the end.

Question 1 · AS Paper 2 · June 2025 · Q5(b) · 2 marks

(b) Clownfish are multicellular bony fish.

Explain why multicellular organisms need a specialised exchange surface.

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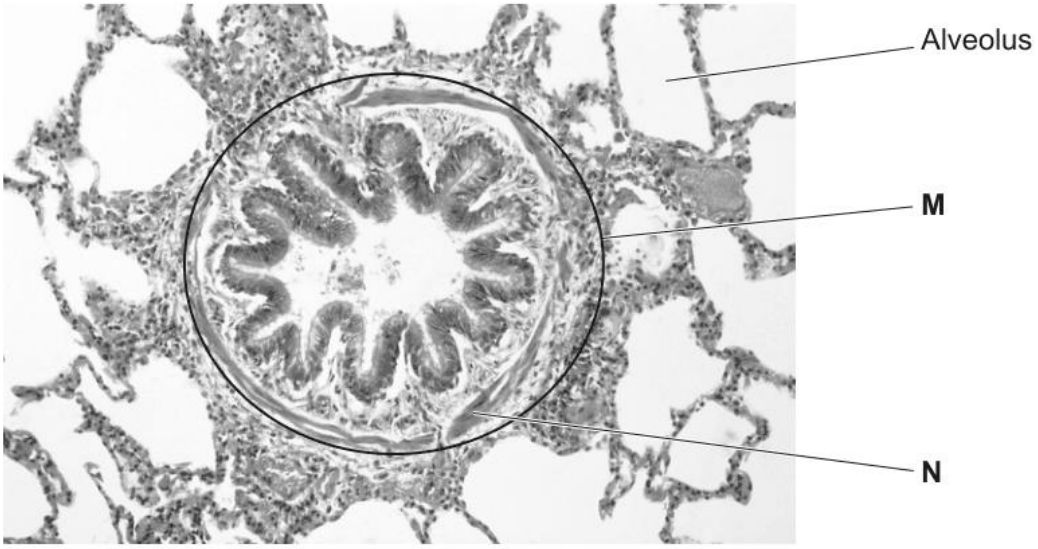
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..... **[2]**

Question 2 · AS Paper 1 · June 2023 · Q21(a) · 1 mark

21 The light micrograph shows a transverse section through human lung tissue.



(a) Alveoli provide an efficient gas exchange surface because of their large surface area.

State **one other** feature of alveoli that provides an efficient gas exchange surface.

.....

..... **[1]**

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Question 3 · AS Paper 1 · June 2023 · Q21(c) · 2 marks

(c) Name the tissue labelled **N** in the light micrograph **and** outline its function in component **M**.

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..... **[2]**

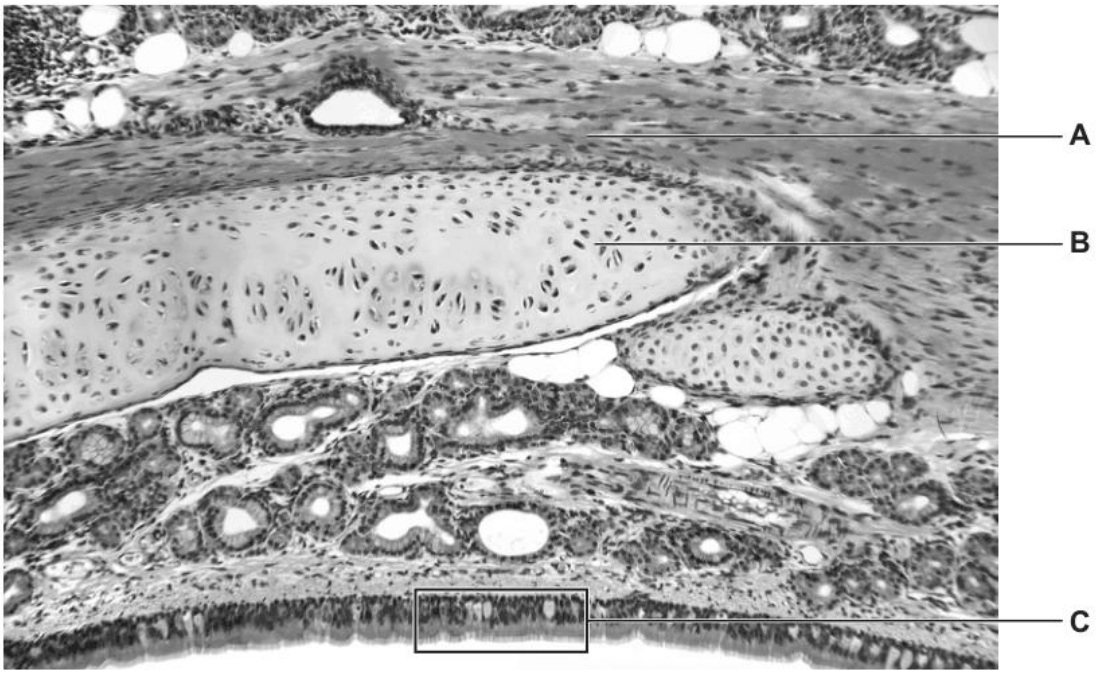
Turn over

Question 4 · A level Paper 3 · June 2023 · Q1(a)(i) · 2 marks

1 Cats are mammals.

(a) A light micrograph of a section through the trachea of a cat is shown in **Fig. 1.1**.

Fig. 1.1



(i) Name the tissues labelled **A** and **B** in **Fig. 1.1**.

A .....

B .....

[2]

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Question 5 · A level Paper 3 · June 2023 · Q1(a)(ii) · 2 marks

(ii) Name the **two** types of cell in the box labelled **C** in **Fig. 1.1 and** outline their functions.

1 Name .....

Function .....

2 Name .....

Function .....

[2]

Question 6 · A level Paper 1 · June 2025 · Q21(a)(i) · 3 marks

21
(a)
(i) Describe **three** ways fish gills are adapted for efficient gas exchange.

1 .....

.....

2 .....

.....

3 .....

.....

[3]

Question 7 · A level Paper 3 · June 2017 · Q7(a)(i) · 2 marks

7 Many organisms have evolved specialised gas exchange surfaces. One feature of these structures is their large surface area to volume ratio.

(a) (i) Describe how the structures of the insect tracheal system and fish gills provide a large surface area for gas exchange.

insect tracheal system .....

.....

.....

fish gills .....

.....

.....

[2]

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Question 8 · A level Paper 3 · November 2021 · Q1(a) · 2 marks

1 **(a)** The figure below shows a light micrograph of an insect's gas exchange system.



Name the structures labelled **A** and **B** in the figure.

A .....

B .....

[2]

Question 9 · A level Paper 3 · June 2017 · Q7(a)(ii) · 1 mark

(ii) The lugworm, *Arenicola marina*, is a species of segmented worm that lives in burrows in damp sand. They have hair-like external gills that increase the surface area available for gas exchange.

Many other species of segmented worm do not have external gills.

Suggest why lugworms have evolved external gills

.....

.....

..... **[1]**

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Question 10 · AS Paper 1 · June 2018 · Q21(c)(ii) · 2 marks

(ii) When out of the water, the Titicaca water frog is able to use its lungs to absorb oxygen.

Lungs contain specialised gaseous exchange surfaces.

Describe and explain how **one** feature of the lungs provides an efficient gas exchange surface.

.....

.....

.....

.....

..... **[2]**

Question 11 · A level Paper 1 · June 2018 · Q21(a)(ii) · 2 marks

(ii) A common cause of death from TTX poisoning is suffocation (not getting enough oxygen) as a result of paralysis of the diaphragm.

Explain how paralysis of the diaphragm could lead to suffocation.

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.....

.....

.....

..... **[2]**

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Question 12 · AS Paper 2 · June 2025 · Q5(d) · 4 marks

(d) Explain why bony fish need water to flow over their gills for gaseous exchange to take place.

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..... **[4]**

Turn over

Questions, mark schemes and examiners' report extracts © OCR.

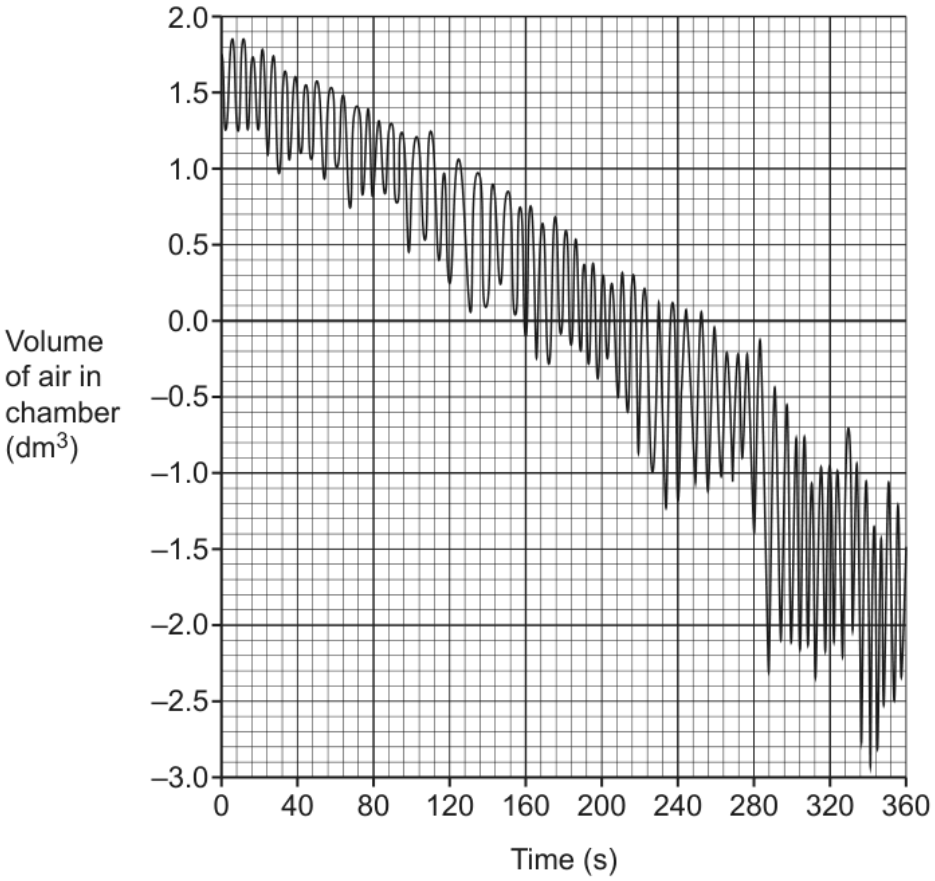
20 A student investigated ventilation and heart rate in a resting subject.

The subject breathed in and out through a spirometer.

The spirometer chamber was filled with room air. Soda lime was present to absorb carbon dioxide.

The results are shown in **Fig. 20.1**.

Fig. 20.1



(a)

(i) The downward slope of the spirometer trace in **Fig. 20.1** is due to oxygen consumption.

The subject exhales the same volume of air as they inhale.

State why the trace slopes downwards.

.....

.....

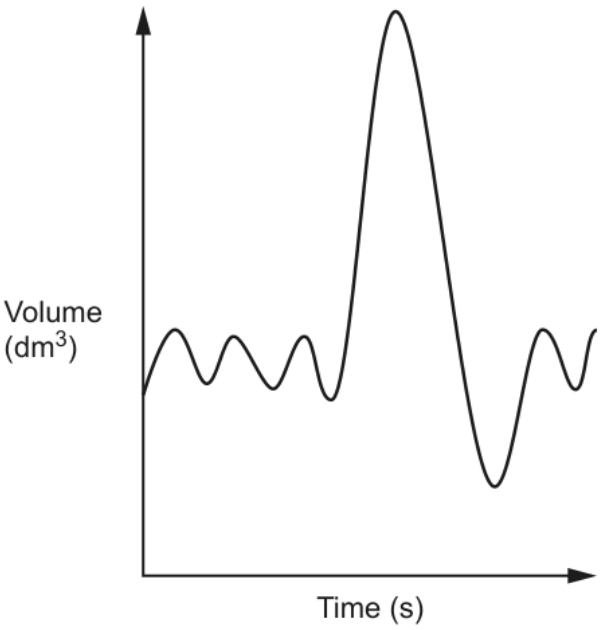
..... **[1]**

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Question 14 · AS Paper 2 · June 2025 · Q6(b) · 1 mark

(b) A study shows that long term exposure to dust affects a person's lung function by reducing their vital capacity.

The graph shows a spirometer trace for a person with healthy lung function.



Suggest how a spirometer trace would be different for a person with long term exposure to dust.

.....

.....

..... **[1]**

Questions, mark schemes and examiners' report extracts © OCR.

Question 15 · AS Paper 2 · June 2025 · Q6(c) · 2 marks

(c) A student makes the following statement about ventilation in humans:

"During inspiration the diaphragm contracts and flattens. Internal intercostal muscles contract, moving the ribs upwards. The volume of the thorax increases, so the pressure in the thorax is now higher than atmospheric pressure. This forces air into the lungs."

Identify **and** correct the **two** errors in this statement.

Error and correction 1 .....

.....

.....

Error and correction 2 .....

.....

.....

[2]

Turn over

Question 16 · AS Paper 2 · June 2025 · Q6(d) · 3 marks

(d) The table shows components in the mammalian gaseous exchange system.

Complete the table by stating **one** role of each component.

Components	Role
Incomplete rings of cartilage in the trachea	
Smooth muscle in the bronchioles	
Elastic fibres in the alveoli	

[3]

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Question 17 · A level Paper 3 · November 2021 · Q1(b)(ii) · 1 mark

(ii) A student described how they dissected a fish to view the gills:

'I held the fish on a cutting board with one hand. I used scissors and a scalpel to carefully cut from the mouth to the tail, down the ventral side of the fish. I was able to split the fish into two halves and view the gills on the inside of the mouth.'

Suggest **one** improvement to the student's method that would allow them to observe the gills more easily.

.....

.....

..... **[1]**

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Mark schemes

Question 1 · AS Paper 2 · June 2025 · Q5(b) · 2 marks

	(b)		diffusion, distance / pathway, is (too) large ✓ (due to) a low surface area to volume ratio ✓ *ref to* rate of diffusion is too slow to meet demand ✓

2 max	**1.1**	**ALLOW** 'SA:vol ratio' and 'SA:V ratio' **IGNORE** reference to 'high metabolic demand' unqualified

Question 2 · AS Paper 1 · June 2023 · Q21(a) · 1 mark

21	**(a)**		thin layer / flattened cells / single layer of (epithelium) cells ✓ *idea of* close to many capillaries ✓

1 max	**MARK FIRST ANSWER ONLY** **IGNORE** short diffusion distance (as not a feature but a property) **ALLOW** alveolar wall, one cell thick / thin **ALLOW** alveoli 1 cell thick **ALLOW** squamous, epithelium / cells **DO NOT ALLOW** 'thin cell wall' or 'thin membrane' **ALLOW** e.g. 'surrounded by capillary network' / good blood supply

Questions, mark schemes and examiners' report extracts © OCR.

Question 3 · AS Paper 1 · June 2023 · Q21(c) · 2 marks

	(c)		smooth muscle ✓ contracts to , constrict / close / AW , bronchiole **OR** relaxes to , dilate / open , bronchiole ✓
			Total

Question	Answer
2	**ALLOW** involuntary muscle **IGNORE** contraction / relaxation of bronchiole
4	

Marks	Guidance

Question 4 · A level Paper 3 · June 2023 · Q1(a)(i) · 2 marks

1	**(a)**	**(i)**	(A =) smooth muscle ✓ (B =) cartilage ✓	**2**	2.3	**ALLOW** 'involuntary muscle' **IGNORE** elastic fibres / elastin

Question 5 · A level Paper 3 · June 2023 · Q1(a)(ii) · 2 marks

1	**(a)**	**(ii)**	goblet (cells) **and** secrete mucus (to trap microorganisms) ✓ ciliated epithelial (cells) **and** (beat to) move mucus / AW ✓	**2**	2.3

ALLOW produces, mucus / mucin
DO NOT ALLOW excrete mucus

ALLOW ciliated epithelium
e.g. 'to, waft mucus / push mucus (upwards / towards throat) / remove mucus'
IGNORE 'waft / move, dust/ microbes / particles'

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Question 6 · A level Paper 1 · June 2025 · Q21(a)(i) · 3 marks

21	**(a)**	**(i)**	
		1.	gill filaments / lamellae , provide large / increases, surface area ✓
		2.	thin walls (of lamellae / capillaries) provide short diffusion distance ✓
		3.	extensive blood supply for increased (rate of), gas exchange / diffusion ✓
		4.	counter-current flow maintains (concentration) gradient ✓
		5.	gill filament tips, overlap / interlock, so more time for gaseous exchange ✓

max 3	1.1	**read as prose** **1 ALLOW** gill plates **1 ALLOW SA:V** for 'surface area' **2 ALLOW** 'only one cell thick' for 'thin walls' **4 ALLOW** 'counter-current, exchange/system' for 'counter-current flow' **4 ALLOW** description for 'counter current' *e.g. water and blood flow in different directions*

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Question 7 · A level Paper 3 · June 2017 · Q7(a)(i) · 2 marks

7	a	i	*Insects* many / branched, tracheae / tracheoles / tubes ✓ *Fish* many / AW , filaments / lamellae / plates✓	2

IGNORE many spiracles
ACCEPT many / branched,vessels

ACCEPT feathery filaments
IGNORE folding with no reference to an increase in number e.g. primary lamellae folded
but ACCEPT if primary lamellae, folded into / covered with, secondary lamellae / plates

Question 8 · A level Paper 3 · November 2021 · Q1(a) · 2 marks

1	a	(A =) spiracle ✓ (B =) trachea ✓	2	2.3	**ALLOW** spiracles **DO NOT ALLOW** tracheoles **ALLOW** chitin (rings) / taenidia / tracheal tube / tracheae

Question 9 · A level Paper 3 · June 2017 · Q7(a)(ii) · 1 mark

ii	oxygen is in short supply (in lugworm habitat) ✓ rate of diffusion is, insufficient / too slow (to meet needs) ✓ lugworms have a smaller surface area to volume ratio (than some worms) ✓ lugworms have a high(er) <u>metabol</u>ic rate ✓

1 max	**IGNORE** Live in habitat where gas exchange difficult **DO NOT ACCEPT** no oxygen **ACCEPT** harder to get oxygen

Questions, mark schemes and examiners' report extracts © OCR.

Question 10 · AS Paper 1 · June 2018 · Q21(c)(ii) · 2 marks

	(ii)	**D** large surface area ✓ **E** for (maximum) diffusion ✓ **D** squamous, epithelium / cells OR alveolar wall, only 1 cell thick / thin ✓ **E** (providing) a short diffusion distance ✓ **D** good, blood supply / ventilation ✓ **E** maintaining / creating a (steep) concentration gradient ✓

2 max	Mark first **D** response or **E** response only For two marks the **E** mark must be linked to the **D** mark **IGNORE** increase surface area, ref to SA:Vol ratio **ALLOW** idea of more or faster diffusion

Question 11 · A level Paper 1 · June 2018 · Q21(a)(ii) · 2 marks

(ii)	*diaphragm is paralysed so:* no / little , change / increase , in volume of thorax ✓ no / little , change / decrease , in pressure in thorax ✓ no / little / less , air drawn into lungs ✓	**2 max**

Award 1 max if explanation refers to what would normally happen rather than if diaphragm is paralysed
ALLOW chest cavity / lungs for thorax throughout
IGNORE oxygen

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Question 12 · AS Paper 2 · June 2025 · Q5(d) · 4 marks

(d)	to, maintain / create, (a steep) concentration gradient ✓ to maximise / for higher / the faster, rate of diffusion ✓ blood (in efferent blood vessels) flows in opposite direction to water (entering gills) ✓ *ref to* counter current (flow / system / mechanism) ✓ gill <u>filaments</u> need a flow of water, to keep them apart / AW ✓	
		Total

Max 4	**2.1**	**IGNORE** contraflow system
9		

Question 13 · A level Paper 1 · June 2024 · Q20(a)(i) · 1 mark

20	**(a)**	**(i)**	(inhaled) oxygen is , being used / removed ✓	**1**

ALLOW (exhaled) carbon dioxide , absorbed / removed
ALLOW less oxygen in exhaled air

Question 14 · AS Paper 2 · June 2025 · Q6(b) · 1 mark

	(b)	**1**	**2.3**
		the large peak, will be lower / AW **AND** trough, will be smaller ✓	

IGNORE references to vital capacity being lower as the Q asks for how the ***trace*** will be different

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Question 15 · AS Paper 2 · June 2025 · Q6(c) · 2 marks

(c)	*In any order:* *Error 1 and correction* external intercostal muscle (contract), not internal ✓ *Error 2 and correction* pressure in the thorax is now lower (than atmospheric pressure), not higher ✓	**2**	**3.1**

Both error **and** correction are needed for the mark.
Correction must be matched with the appropriate error.

IGNORE references to internal intercostal muscles relax (as that would not bring about the ribcage moving upwards)

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Question 16 · AS Paper 2 · June 2025 · Q6(d) · 3 marks

(d)

Components	Role	
Incomplete rings of cartilage in the trachea	stop trachea from collapsing **OR** (incomplete) to allow food to move down (the oesophagus)	✓
Smooth muscle in the bronchioles	contract and relax to control the size of the lumen (of the bronchioles) **OR** controls / changes, volume of air reaching lungs	✓
Elastic fibres in the alveoli	enables alveoli to <u>stretch</u>, and <u>recoil</u> **OR** recoils to force the air out **OR** prevent alveoli, collapsing / over expanding	✓

Total

3 1.1	**IGNORE** support / strengthens trachea **IGNORE** 'keeps trachea open' **ALLOW** 'flexibility during swallowing' **IGNORE** references to dilation and constriction of lumen unqualified **IGNORE** 'controls air flow' unqualified **DO NOT ALLOW** 'alveoli contract and relax'
9	

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Question 17 · A level Paper 3 · November 2021 · Q1(b)(ii) · 1 mark

ii	remove operculum / described (rather than cutting up the ventral side) ✓ use pins to hold fish (rather than a hand) ✓ remove gills and observe under a microscope ✓

1 max	3.3	**IGNORE** 'remove gills' unqualified **IGNORE** 'use a microscope' unqualified

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