

APOLLO

Gas exchange

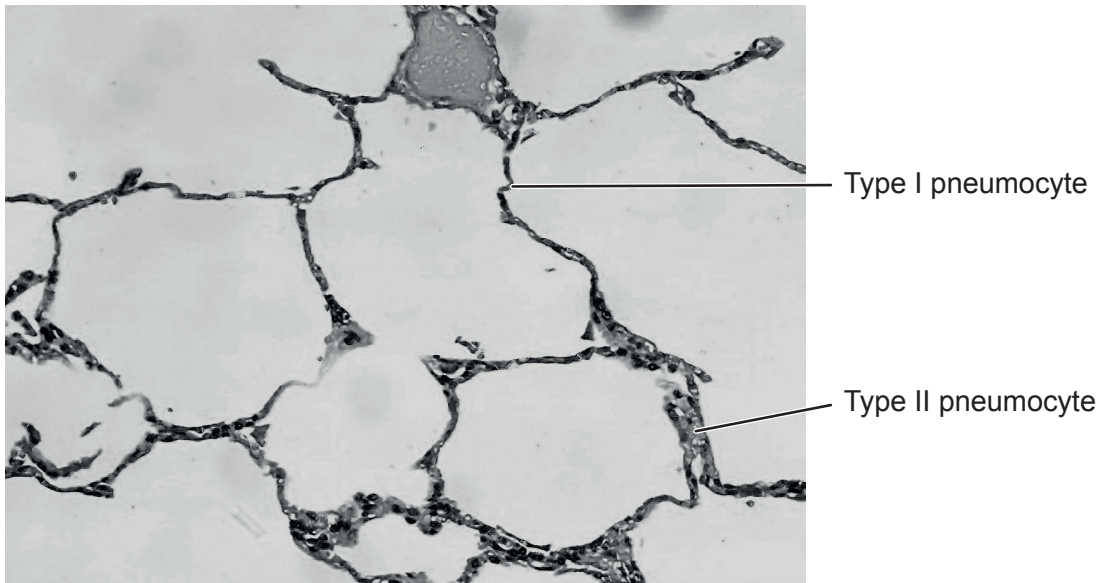
HL

Biology

First assessment 2025

9 questions | questions

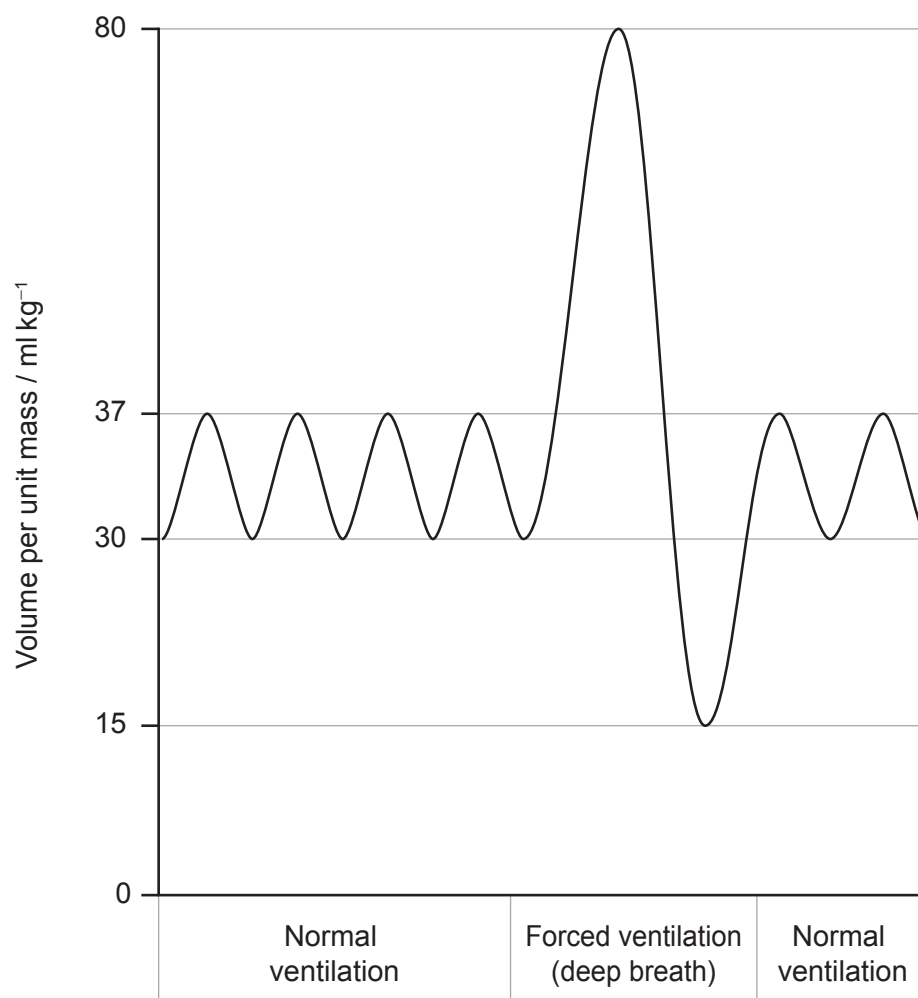
15. The micrograph shows alveoli in a human lung.



How are the pneumocytes adapted to their function?

	Type I pneumocytes	Type II pneumocytes
A.	many secretory vesicles (lamellar bodies)	many secretory vesicles (lamellar bodies)
B.	many secretory vesicles (lamellar bodies)	large number of mitochondria
C.	large number of mitochondria	extreme thinness
D.	extreme thinness	many secretory vesicles (lamellar bodies)

23. The graph shows changes in lung volume during normal ventilation and forced ventilation (taking a deep breath).

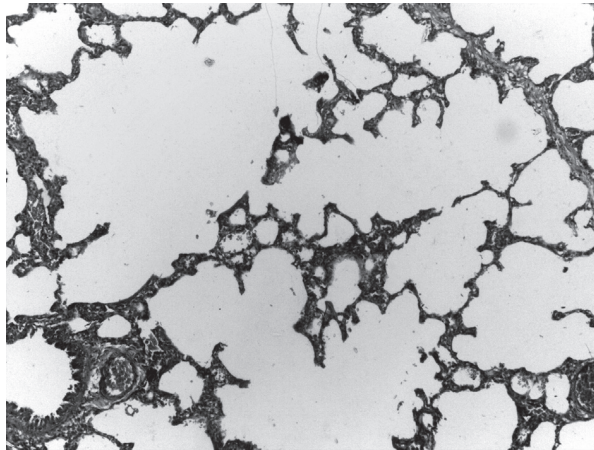


What is the vital capacity?

- A. 7 ml kg⁻¹
- B. 37 ml kg⁻¹
- C. 65 ml kg⁻¹
- D. 80 ml kg⁻¹

Turn over

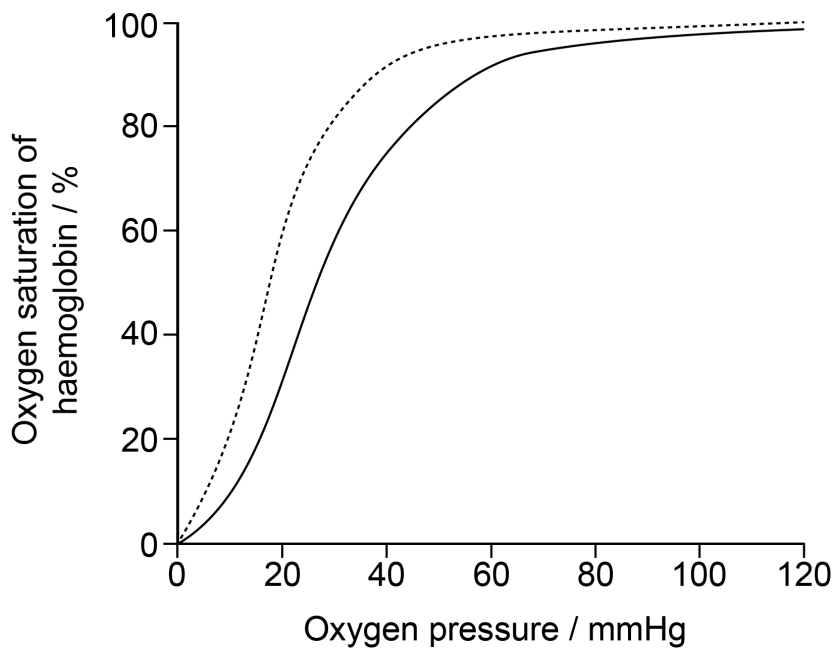
- 23.** Emphysema is a condition where the alveoli of the lungs are destroyed, resulting in patients feeling out of breath. The micrograph shows air pockets resulting from emphysema.



What is a direct consequence of the destruction of alveoli?

- A. Decrease in surface area for gas exchange
- B. Increased blood flow to the lungs
- C. Increase in pulmonary surfactant production
- D. Decrease in ventilation rate

25. Two oxygen dissociation curves in an adult human are shown.

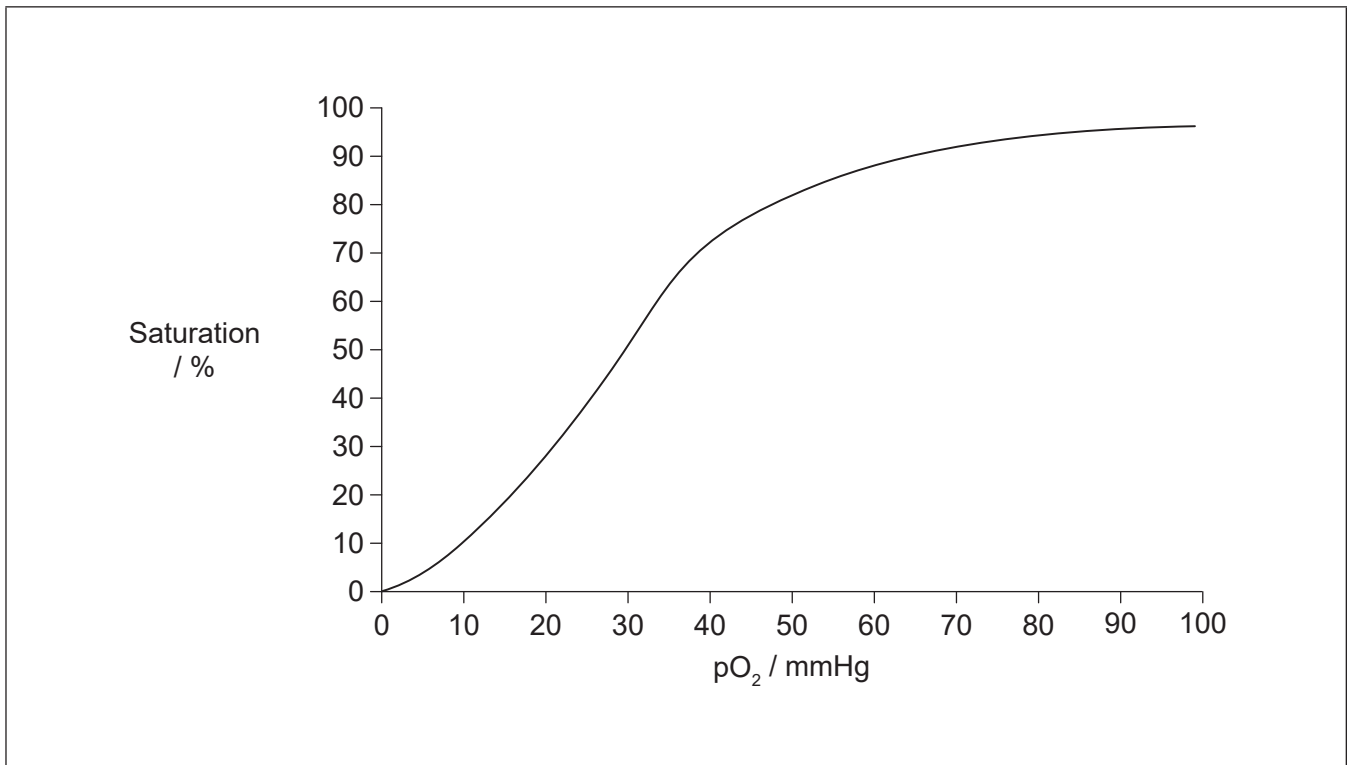


What is the explanation for the shift of the dissociation curve to the right-hand curve?

	Carbon dioxide	Affinity of haemoglobin for oxygen
A.	dissociates from haemoglobin	increases
B.	dissociates from haemoglobin	decreases
C.	associates with haemoglobin	increases
D.	associates with haemoglobin	decreases

Turn over

1. Oxygen dissociation curves show the percentage of oxygen saturation of adult haemoglobin (Hb) at different oxygen concentrations, as measured in partial pressure of oxygen (pO_2).



- (a) Identify the percentage of oxygen saturation of haemoglobin at a partial pressure of 40 mmHg.

[1]

.....

- (b) Describe the relationship between partial pressure of oxygen (pO_2) and percent saturation of haemoglobin.

[2]

.....

.....

.....

.....

- (c) On the graph, sketch an oxygen dissociation curve for foetal haemoglobin.

[1]

(This question continues on the following page)



(Question 1 continued)

(d) Describe an adaptation of haemoglobin for the transport of oxygen. [1]

.....

.....

(e) Describe how tidal volume can be measured in a human. [3]

.....

.....

.....

.....

.....

.....



Turn over

Section B

Answer **two** questions. One additional mark is available for the construction of your answers for each question. Answers must be written within the answer boxes provided.

10. There is a relationship between form and function in the diversity of molecules and of systems.

- (a) Describe the relationship between codons and polypeptide structure. [4]
- (b) Outline the relationship between structure and function in photosystems. [3]
- (c) Explain the causes of a decreased blood pH and its effects on the ventilation rate in humans. [8]



Disclaimer:

Content used in IB assessments is taken from authentic, third-party sources. The views expressed within them belong to their individual authors and/or publishers and do not necessarily reflect the views of the IB.

References:

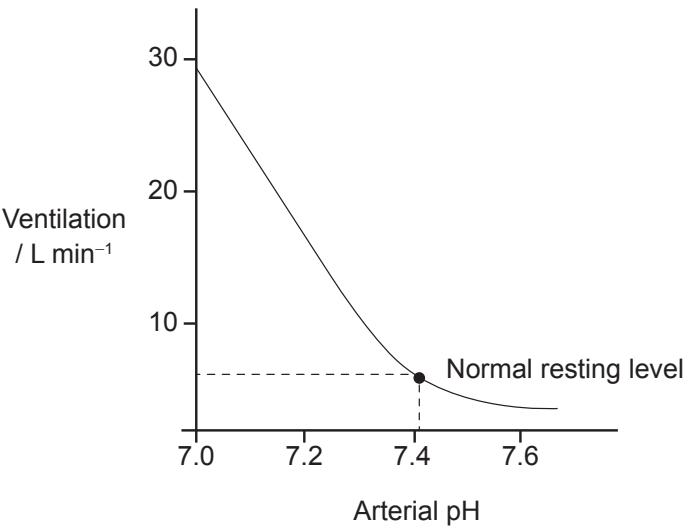
1. Images and graphs: Bridges, A.D., MaBouDi, H., Procenko, O., Lockwood, C., Mohammed, Y., Kowalewska, A., et al., 2023. *PLoS Bio* 21(3), e3002019. <https://doi.org/10.1371/journal.pbio.3002019>. Reference redacted. Source adapted.
2. NOAA Fisheries Plans Western Alaska Meetings on Ringed Seal “Critical Habitat”, 2015. *Pusa hispida hispida*. [image online] Available at: https://commons.wikimedia.org/wiki/File:Pusa_hispida_hispida_NOAA_2.jpg [Accessed 13 March 2024]. Source adapted.
3. Bezanilla, F., 2005. Voltage-gated ion channels. *IEEE Transactions On Nanobioscience* 4(1). <https://doi.org/10.1109/tnb.2004.842463>. Source adapted. Reprinted with permission from IEEE.
4. tonaquatic, 2021. *Dicot plants stem show plant vascular tissue under light microscope view for botany education*. [image online] Available at: <https://www.gettyimages.co.uk/detail/photo/dicot-plants-stem-show-plant-vascular-tissue-under-royalty-free-image/1326289492?phrase=xylem&adppopup=true> [Accessed 5 April 2024]. Source adapted.
5. Data from Jennifer L. Hope, Linda M. Bradley, Lessons in antiviral immunity. *Science* 371, 464–465 (2021). DOI: 10.1126/science.abf6446.
6. WWF. 2013. *Ecosystems in the Greater Mekong: Past trends, current status, possible futures*.
7. Reprinted with permission of AAAS from Fig 2a from Long et al *Science Advances*, 31 Jan 2018, Vol 4, Issue 1 DOI: 10.1126/sciadv.aap9004. © The Authors, some rights reserved; exclusive licensee AAAS. Distributed under a CC BY-NC 4.0 License (<http://creativecommons.org/licenses/by-nc/4.0/>).



Section A

Answer **all** questions. Answers must be written within the answer boxes provided.

4. The graph shows the relationship between blood pH in the arteries and volume of air inhaled and exhaled per minute.



- (a) State the effect of decreases in arterial pH on ventilation. [1]

.....

.....

- (b) Outline how the pH of arterial blood is monitored by the human body. [1]

.....

.....

(This question continues on the following page)



(Question 4 continued)

(c) Explain the main cause of pH changes in the blood. [2]

.....

.....

.....

.....

(d) State which muscles would contract more vigorously, or more frequently, to increase the volume of air inhaled per minute. [2]

.....

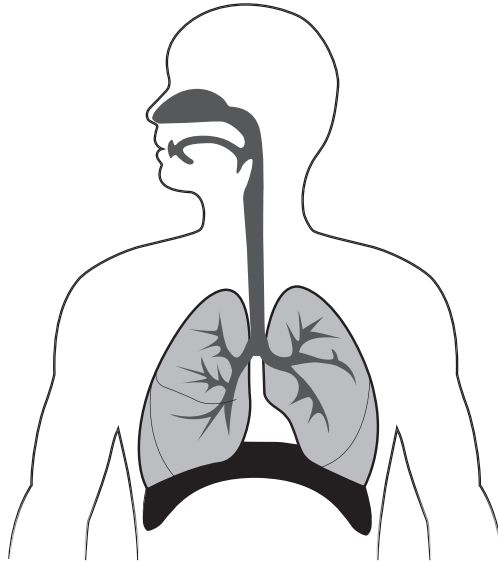
.....



Section A

Answer **all** questions. Answers must be written within the answer boxes provided.

5. The image shows the location of the lungs and diaphragm in a human.



- (a) Explain how contraction of the diaphragm causes air to enter the lungs.

[2]

.....

.....

.....

.....

- (b) State another muscle group that causes inspiration when it contracts.

[1]

.....

.....

- (c) Outline the role of surfactant in the mammalian lung.

[2]

.....

.....

.....

.....

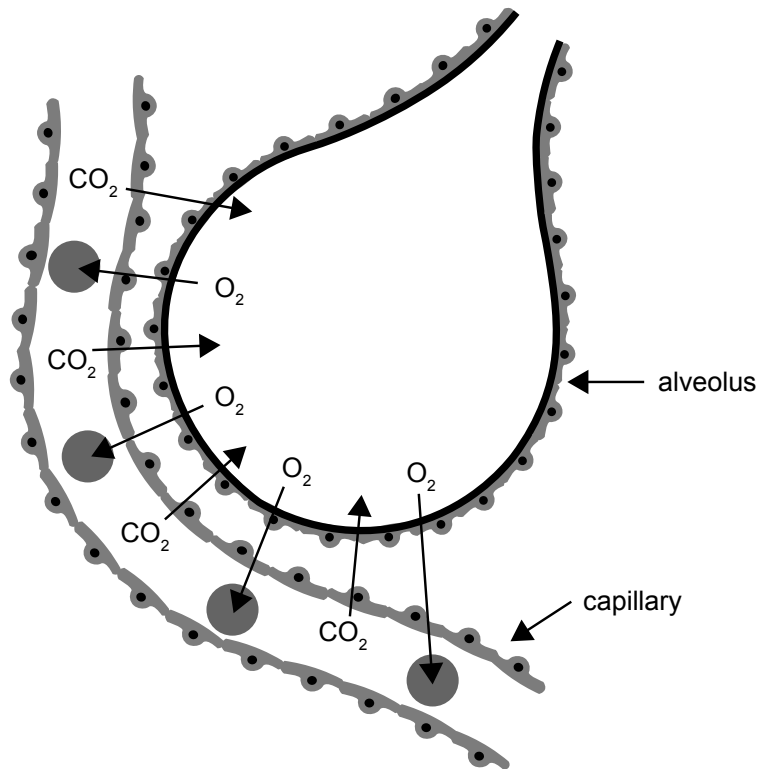


Turn over

Section A

Answer **all** questions. Answers must be written within the answer boxes provided.

4. Multicellular organisms need efficient exchange surfaces where molecules can move between tissues and their surroundings. In mammals, gas exchange takes place in the alveoli of the lungs.



- (a) Describe how the exchange of gases is brought about between the alveoli and the blood. [3]

.....

.....

.....

.....

.....

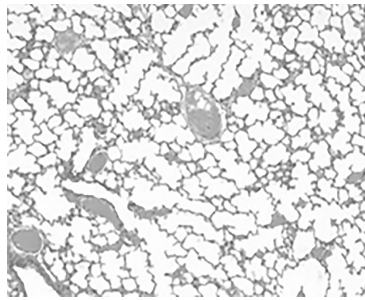
.....

(This question continues on the following page)

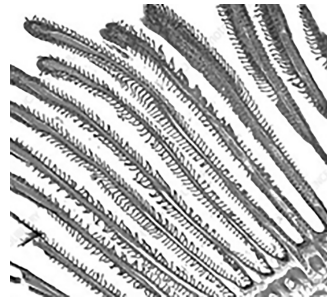


(Question 4 continued)

The images show the lungs of a human and the gills of a fish taken with a light microscope.



Alveoli in the lungs of a human



Gills from a fish

(b) Describe **two** features common to the exchange surfaces of alveoli and gills.

[2]

.....

.....

.....

.....

(This question continues on page 13)



Turn over

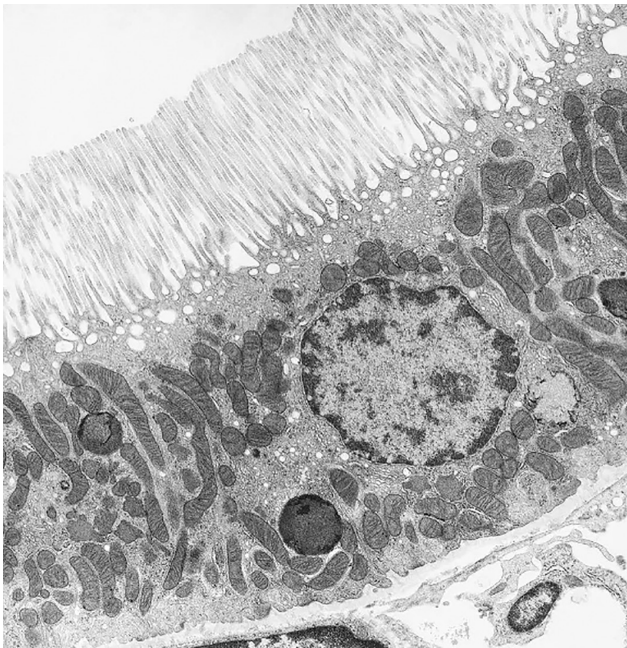
Please **do not** write on this page.

Answers written on this page
will not be marked.



(Question 4 continued)

The image shows cells from the wall of a proximal convoluted tubule of a rat kidney.



- (c) Outline the visible features of these cells that adapt them for reabsorption of materials from the glomerular filtrate.

[2]

.....

.....

.....

.....



Turn over