Exchange Surfaces

Model Answers 2

Level	A Level
Subject	Biology
Exam Board	OCR
Module	Exchange and transport
Topic	Exchange Surfaces
Booklet	Model Answers 2

Time allowed: **42 minutes**

Score: **/31**

Percentage: **/100**

Grade Boundaries:

A*	A	B	C	D	E
>69%	56%	50%	42%	34%	26%

Question 1

(a) (i) Name the **two** types of epithelial tissue found in the lungs and airways. **[2]**

- **Squamous** epithelium
- **Columnar** epithelium

Squamous cells and flat and smooth. Columnar cells can be ciliated or non-ciliated.

(ii) The epithelial cells in the lungs are arranged into structures called alveoli.
Explain how the alveoli create a surface for efficient gaseous exchange.

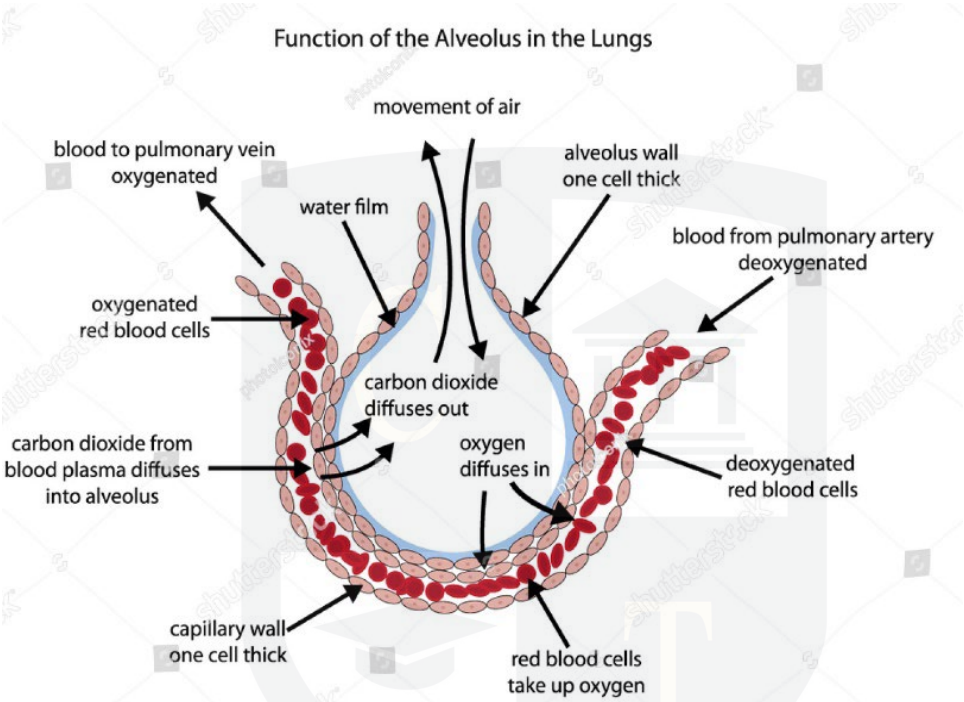
In your answer you should use appropriate technical terms, spelled correctly.

[6]

- Alveoli create a surface for efficient gas exchange because there are a **large number of them** so together they have a large **surface area** for gas exchange to take place
- Alveoli also have **walls** that are **one cell thick**, so create a **short diffusion distance** for efficient gas exchange
- Alveoli walls are made of **squamous epithelium** which provides a **short diffusion distance**
- Alveoli also have **elastic** which allows them to **recoil**, helping ventilation

Exam tip: *examiners will be looking for a description of a feature, followed by an explanation of how this feature improves gas exchange. Ensure you also use your key words (shown here in bold)*

Diagram to show the structure of an alveolus, with adaptations to make it an efficient exchange system:



(b) To improve gaseous exchange, the air in the alveoli is refreshed by ventilation. The air movement created by ventilation can be recorded using suitable apparatus.

(i) Name the apparatus used to record these air movements. **[1]**

- **Spirometer**

Note: do not confuse this with a 'potometer', which measures the rate of transpiration in plants.

Fig. 3.1 shows a trace recorded from this apparatus.

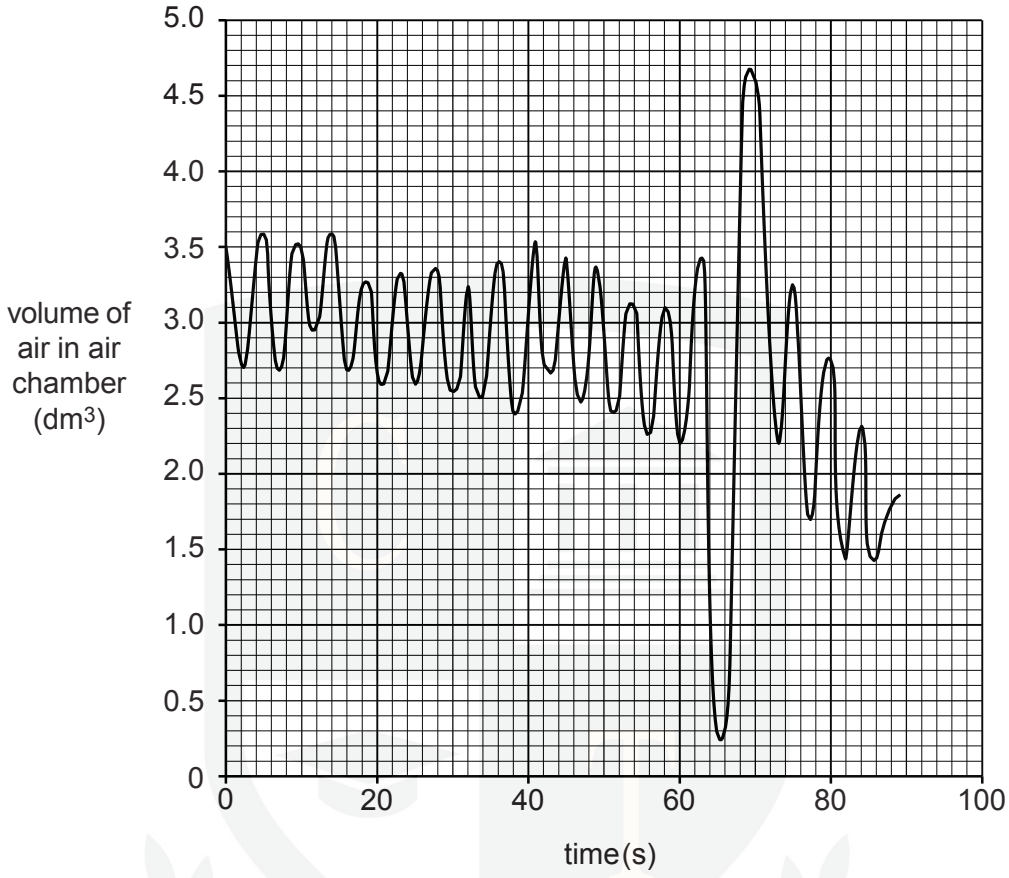


Fig. 3.1

(ii) Calculate the rate of breathing over the first minute from the trace. **[1]**

- 13.5 BPM

Count the number of peak and troughs within 60 seconds. This is between 13 and 14 beats per minute. Therefore 13.5 is the most accurate response.

(iii) Using the trace, calculate the rate of oxygen consumption over the first minute.

Show your working. **[2]**

- *3.6 – 3.1 =*
- **0.5** dm^3. Min^{-1}

Measure the decrease in the volume of air in the air chamber from the first **peak** to the last **peak** before 60 seconds.

***Exam tip**: Draw on the graph to help you read off more accurately.*

[Total: 11]

Question 2

Many teachers use models to demonstrate and explain breathing and lung function in mammals.

Fig. 2.1 is a model of the mammalian chest.

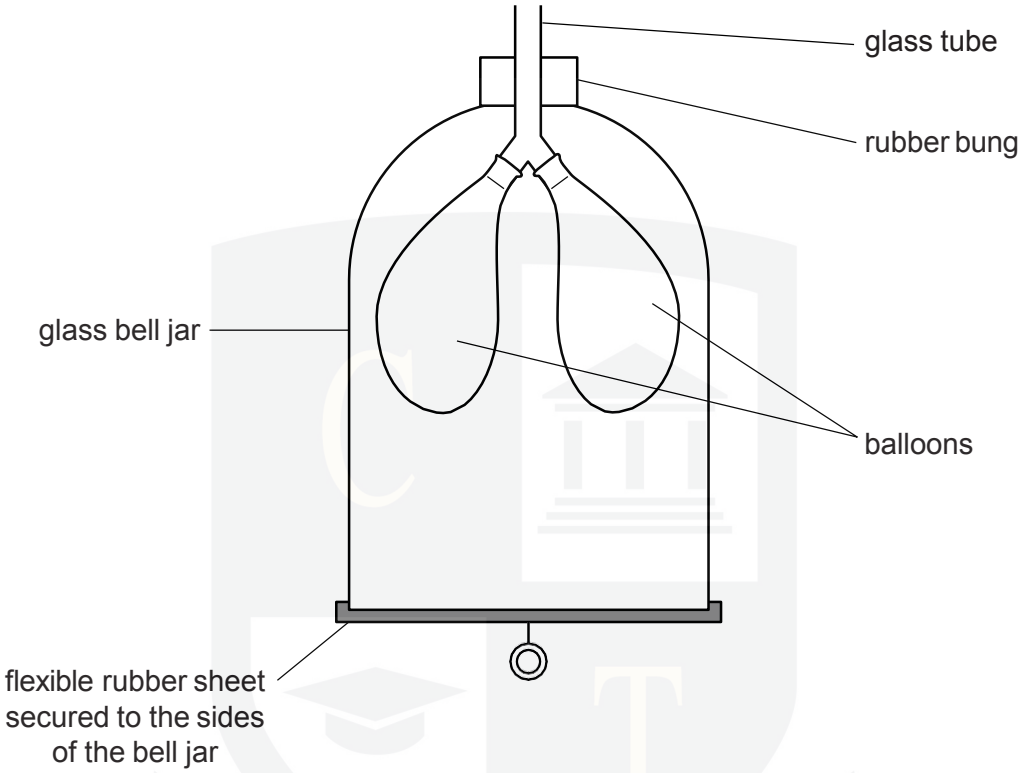


Fig. 2.1

(a) When the rubber sheet is pulled down the balloons expand.

Explain why the balloons expand. **[3]**

- The volume inside the jar increases
- Therefore the overall pressure inside will decrease
- The relative pressure on the inside is now lower than atmospheric pressure
- Therefore the air is forced into the balloons

Note: *here you must talk about 'air', rather than specifically oxygen*

(b) A teacher used the model in Fig. 2.1 to demonstrate the difference between tidal volume and vital capacity.

(i) Explain the meaning of the term *tidal volume*. **[2]**

Tidal volume is:

- The volume of air inhaled or exhaled
- In one breath
- During regular breathing

Exam tip: learn this definition!

(ii) Suggest how the teacher may have used the model to demonstrate tidal volume. **[2]**

You could use the model to show tidal volume by:

- Moving the rubber sheet up and down
- In small, steady movements

I.e. in a way that replicates steady breathing

(iii) Explain the meaning of the term *vital capacity*. **[2]**

Vital capacity is:

- The **maximum volume** of air
- Inhaled or exhaled in one breath

***Exam tip:** learn this definition!*

(iv) Suggest how the teacher may have used the model to demonstrate vital capacity. **[1]**

This could be modelled by:

- Pulling down and pushing up the rubber sheet **as far as possible**

[Total: 10]

Question 3

Fig. 5.1 shows the changes in the volume of air in the lungs of a student at rest during one breath.

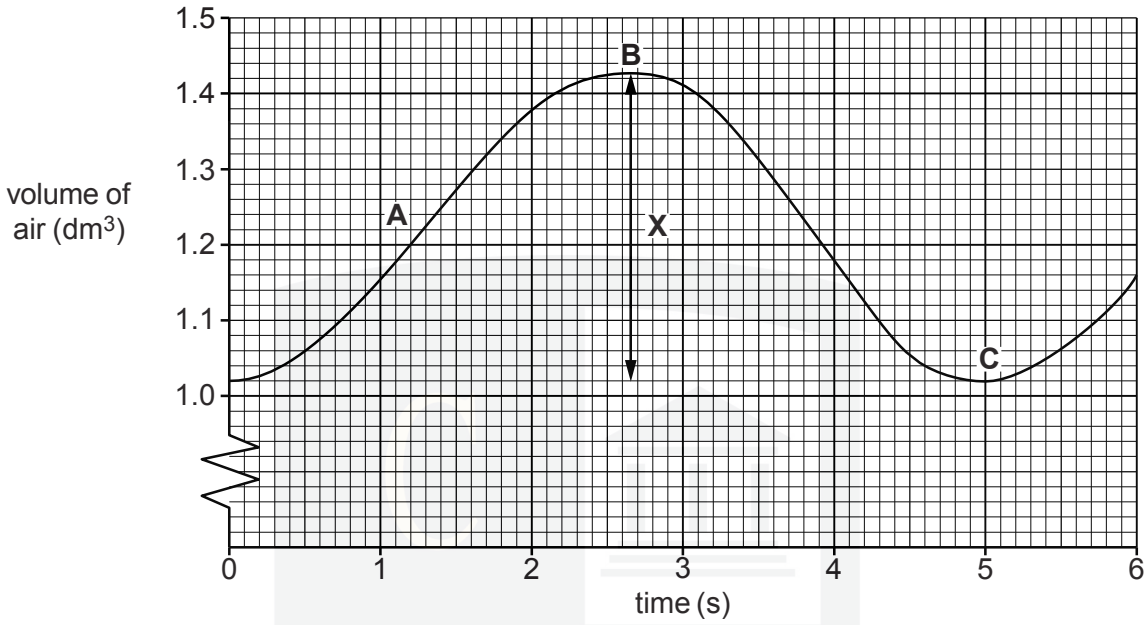


Fig. 5.1

(a) (i) Name the measurement represented by the line **X**. **[1]**

X shows

- **Tidal volume**

This is the volume of air breathed in or out per normal breath. Usually this is approximately 0.5 dm^3

(ii) What is happening to the elastic fibres in the walls of the alveoli at point **A**? **[1]**

At point A, the elastic fibres are

- **Stretching**

This is inspiration.

(b) Explain what causes the change in the volume of air between points **B** and **C** on Fig. 5.1.

In your answer you should use appropriate technical terms, spelt correctly. **[4]**

Between points B and C:

- External intercostal muscles and diaphragm relax
- Rib cage moves down and diaphragm moves up
- Volume of thorax decreases
- Pressure inside thorax increases
- Above atmospheric pressure
- Air leaves down pressure gradient
- Elastic recoil of alveoli

***Exam tip**: ensure you use your key words, shown here in bold, to gain the QWC mark.*

This is a description of expiration. See diagram below:

(c) Using Fig. 5.1, calculate the breathing rate of this student in breaths per minute. **[2]**

1 breath in 5 seconds. Therefore 60 seconds in 1 minute:

- 60/5 =
- **12 breaths per minute**

(d) About 1 dm^3 of air cannot be expelled from the lungs. This is known as the residual volume.

Suggest why it is **not** possible to expel all the air from the lungs. **[2]**

It is not possible to expel all the air from the lungs because

- the thorax cannot be completely compressed
- the trachea and bronchi are held open by **cartilage**
- the bronchioles and alveoli are held open by **elastic fibres**

[Total: 10]