

# Exchange Surfaces

## Question Paper 1

Level	A Level
Subject	Biology
Exam Board	OCR
Module	Exchange and transport
Topic	Exchange Surfaces
Booklet	Question Paper 1

**Time allowed:** 42 minutes

**Score:** /31

**Percentage:** /100

### Grade Boundaries:

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

## Question 1

Bony fish and insects have different gas exchange systems. Both can be observed by dissection.

- (a) Describe how you would carry out the dissection to display maximum detail of either gas exchange system. [2]

- (b) Insects, such as beetles, obtain oxygen by drawing air in through holes in their exoskeleton, called spiracles. Pairs of spiracles on each abdominal segment connect to air tubes that take the air deep into the tissues of the insect for gas exchange.

Diving beetles live in ponds. They carry an air bubble under their wing when they swim underwater. The bubble supplies air to the spiracles. When the bubble has been used up, the beetle comes to the surface to collect a new bubble.

A student carried out an investigation into the effect of temperature on three diving beetles.

- Three beetles (A, B and C) from the same species were used in the investigation.
- They were placed in thermostatically controlled water baths at 10 °C, 20 °C and 30 °C respectively.
- They were observed for one hour.
- The number of times the beetle surfaced to renew its air bubble was recorded.
- Mean values for each temperature were calculated and recorded to the nearest whole number.
- The results are shown in Table 3.

Temperature (°C)	Number of times beetle resurfaced in one hour			
	Beetle A	Beetle B	Beetle C	Mean
10	10	12	8	10
20	18	22	18	20
30	44	48	38	43

**Table 3**

The student made an error in their working.

- (i) Put a ring around the error in **Table 3** and write the correct answer next to it. Use the space below to show your working. [2]

(ii) Fig. 3 shows a diagram of part of the gas exchange system of an insect.

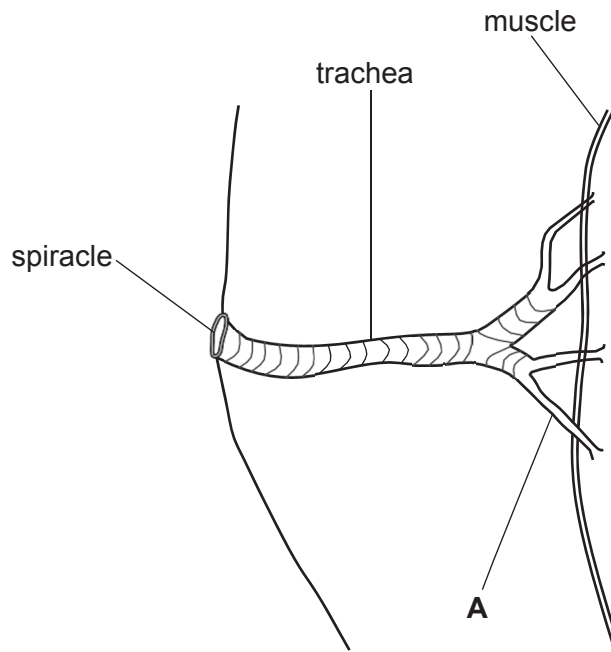


Fig. 3

Name the structure labelled A.

. [1]

(iii) Describe how the trachea of a mammal is different from the trachea shown in Fig. 3.

[2]

(c)\* Alveoli are located in the lungs of mammals.

Explain how **alveoli** are adapted for efficient gas exchange.

**[6]**

**[Total: 13]**

## Question 2

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. [2]

- (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]

(b) Mammals use lungs for gas exchange. The following passage describes how gases are moved in and out of the lungs.

Complete the passage using the most appropriate words or phrases.

When air enters the trachea, mucus secreted by ..... cells traps dust and microorganisms. Air diffuses through the bronchi and the bronchioles. Smooth muscle in the bronchioles relaxes during the 'fight or flight' response. This response is produced by the sympathetic nervous system, which contains neurones that secrete the neurotransmitter ..... . During inspiration, both the ..... and external intercostal muscles contract. The internal intercostal muscles only contract when expiration is .....

[4]

[Total: 7]

### Question 3

(a) Fig. 1.1 is a diagram that represents inspiration and expiration in a human.

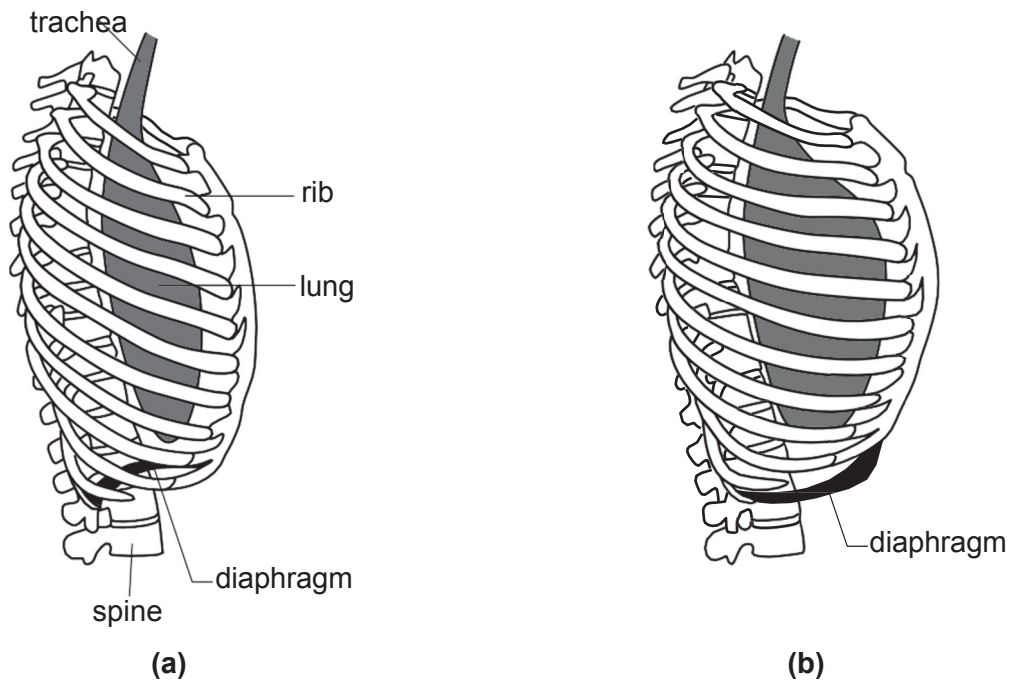


Fig. 1.1

(i) Which of the two diagrams, (a) or (b), represents the body **immediately after** expiration?  
Describe how this diagram justifies your choice. [2]

(ii) Why can expiration be a passive process? [1]

- (iii) Some chemicals can act as allergens. If these allergens are inhaled, they can cause breathing problems. Allergens cause the smooth muscle in the walls of the airways to contract.

Suggest the effects that this muscle contraction has on ventilation.

[2]

(b) Fig. 1.2 represents the volume changes in the lung of a human.

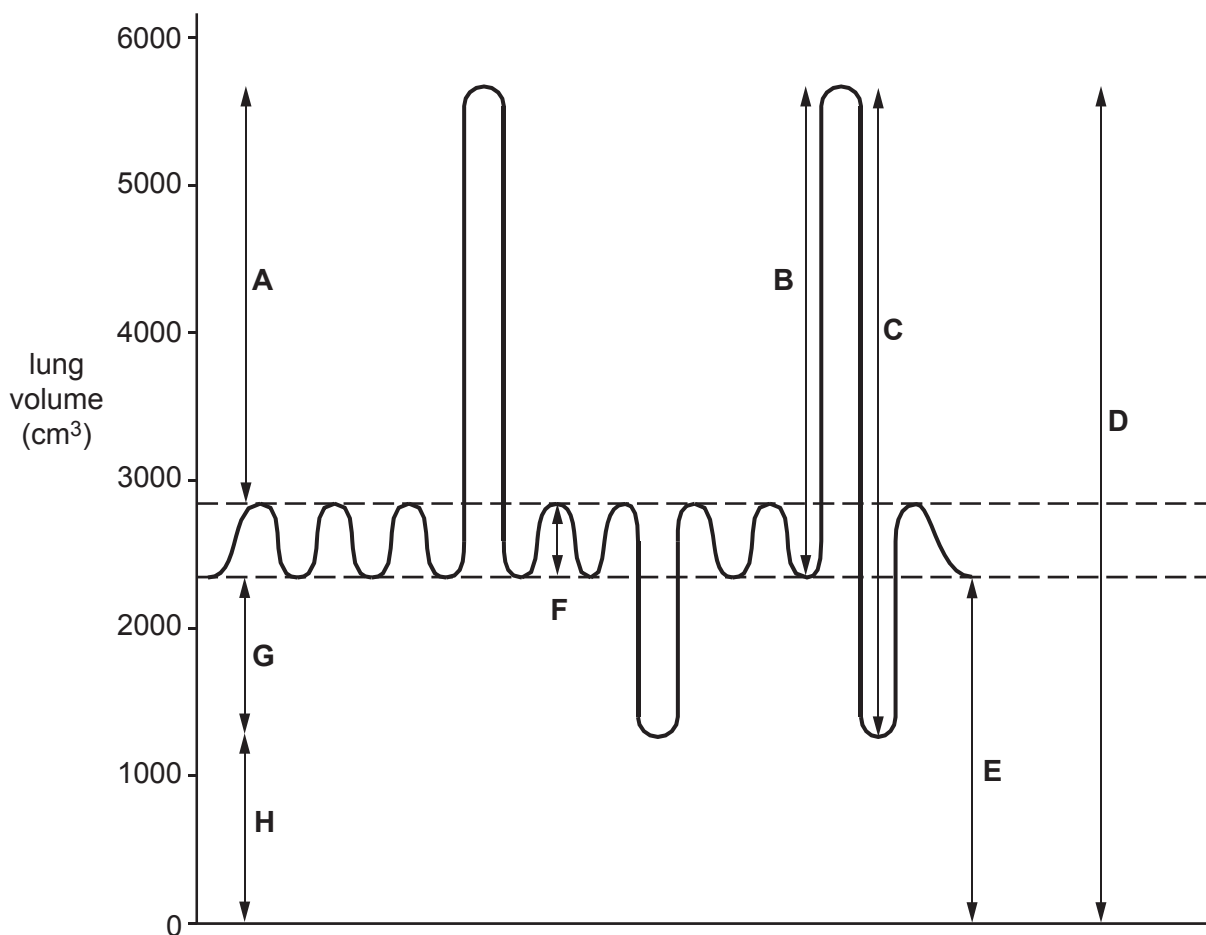


Fig. 1.2



- (i) Select the letter, **A** to **H**, that corresponds to each of the following lung volumes.

The first one has been done for you.

Lung volume	Letter
Inspiratory reserve volume	A
Residual volume	
Total lung capacity	
Tidal volume	
Vital capacity	

[4]

- (ii) Volume **C** can be measured using an instrument such as a spirometer.  
What **breathing** instructions would be given to a person whose volume **C** was being measured?

[2]

[Total: 11]