

AS Level Biology A
H020/02 Depth in biology

Question Set 3

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]

Use fine scissors to remove the operculum of the fish. Use a scalpel to remove a section of the gill filament from the gill arch and mount it in the centre of a microscope slide. Observe the gill filament using the $\times 4$ and $\times 10$ objective lenses and identify the gill lamellae.

- (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 1.

Temperature ($^{\circ}\text{C}$)	Number of times beetle resurfaced in one hour			
	Beetle A	Beetle B	Beetle C	Mean
10	10	12	8	10
20	18	22	18	<u>20</u> 19
30	44	48	38	43

Table 1

The student made an error in their working.

- (i) Put a ring around the error in **Table 1** and write the correct answer next to it. Use the space below to show your working.

$$20^{\circ}\text{C} : \frac{18 + 22 + 18}{3} = 19 \cdot \dot{3} = 19$$

[2]

- (ii) Fig. 1 shows a diagram of part of the gas exchange system of an insect.

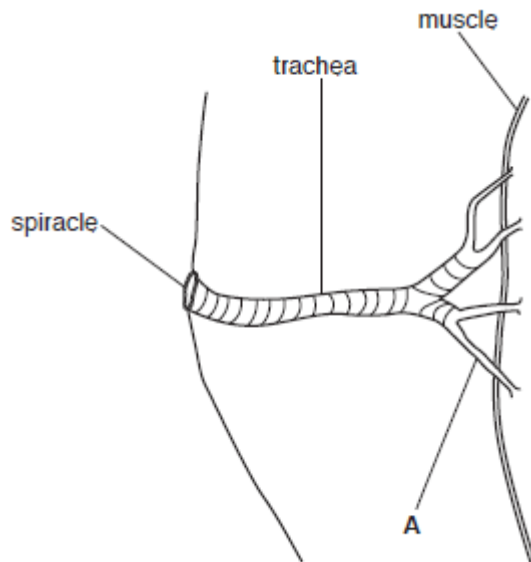


Fig. 1

Name the structure labelled A. **Tracheole**

[1]

- (iii) Describe how the trachea of a mammal is different from the trachea shown in Fig. 1.

[2]

Mammals possess a single trachea whereas insects possess numerous tracheae. The trachea of mammals branches into bronchi whereas the tracheae of insects branch into tracheoles.

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

Explain how alveoli are adapted for efficient gas exchange.

[6]

Alveoli provide a large surface area for gas exchange. There are large numbers of alveoli which allow many molecules to cross into the blood stream simultaneously. This enables a high rate of diffusion of respiratory gases. Elastic fibres within the walls of alveoli, which expand during inhalation, also increase the surface area further. Elastin fibres stretch and recoil. This 'recoil' motion helps to expel air out of the alveoli rapidly, aiding exhalation. The alveoli also provide a short diffusion distance for respiratory gases. The squamous epithelial layer of the alveoli is made up of a single layer of flattened cells. This provides a short distance between the air in the alveoli and blood in the capillary, enabling molecules to cross in less time. The capillaries are also positioned close to the wall of the alveoli, further decreasing the diffusion distance. The alveoli are adapted to maintain a steep diffusion gradient. They are highly vascularised allowing constant blood replenishment. They are also well ventilated, aided by the 'recoil' of elastic fibres, enabling rapid replacement of CO₂ rich air with O₂ rich air. This ensure CO₂ concentration in the blood is higher than in the alveoli, and O₂ concentration in the blood is lower than in the alveoli.

Total Marks for Question Set 3: 13

OCR

Oxford Cambridge and RSA

Copyright Information

OCR is committed to seeking permission to reproduce all third-party content that it uses in its assessment materials. OCR has attempted to identify and contact all copyright holders whose work is used in this paper. To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced in the OCR Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download from our public website (www.ocr.org.uk) after the live examination series.

If OCR has unwittingly failed to correctly acknowledge or clear any third-party content in this assessment material, OCR will be happy to correct its mistake at the earliest possible opportunity.

For queries or further information please contact The OCR Copyright Team, The Triangle Building, Shaftesbury Road, Cambridge CB2 8EA.

OCR is part of the Cambridge Assessment Group; Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge