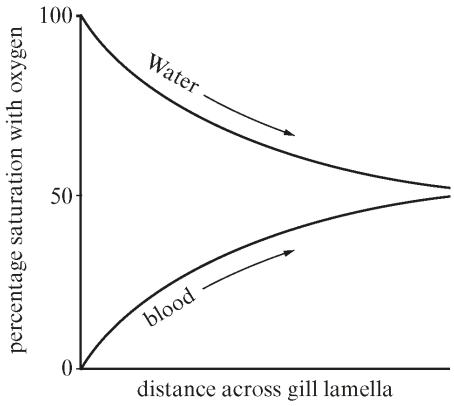
My Question Paper

1. *(a)* Describe and explain the process of **inspiration** in a mammal. [4]

(b) (i) Explain how counter current flow works in the gills of bony fish. [4]

The graph below shows another type of flow.



(ii) Name the type of flow shown in the graph above. [1]

.....

(iii) Explain why this is less efficient than counter current flow. [2]

.....

.....

.....

.....

.....

(c) Suggest why gill filaments/ lamellae would not provide an efficient gas exchange surface on land. [2]

.....

.....

.....

.....

.....

2. The photograph below shows a scanning electron micrograph of fish gills.

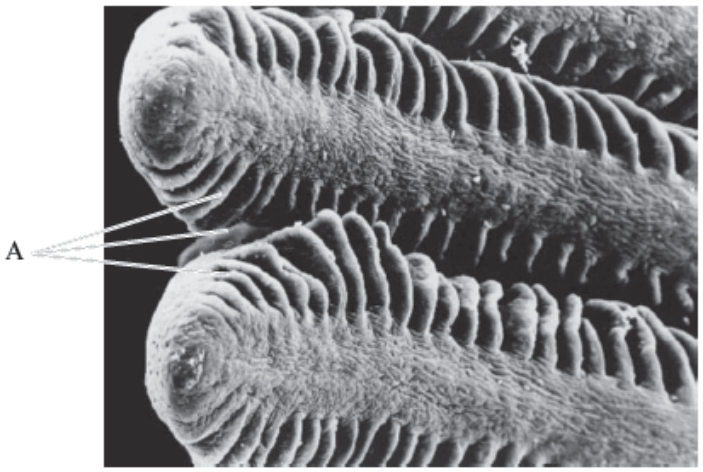


Photo courtesy of Electron Microscopy Unit, Royal Holloway University of London

(a) Identify structures A.

[1]

.....

(b) Using the photograph above and your own knowledge, describe three features of fish gills which allow them to achieve efficient gas exchange.

[3]

1

.....

2

.....

3

.....

(c) Water is a dense medium with a low oxygen content. Explain how bony fish have overcome the problems of oxygen uptake in water.

[4]

.....

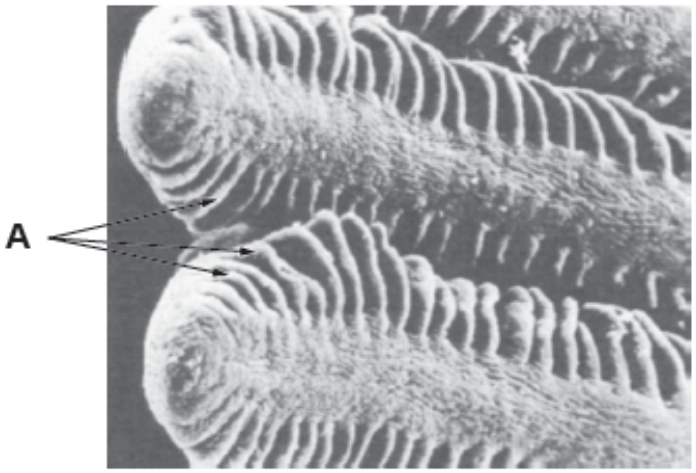
.....

.....

.....

.....

3. The photograph below shows a scanning electron micrograph of fish gills.



http://ars.els-cdn.com/content/image

(a) Name the structures labelled A in the photograph above.

[1]

(b) Describe how a bony fish ventilates its gills and absorbs oxygen from water.

[4]

(c) Using the photograph above and your own knowledge, describe four similarities in the adaptations of the gill for gaseous exchange and a mammalian villus for the absorption of digested products.

[4]

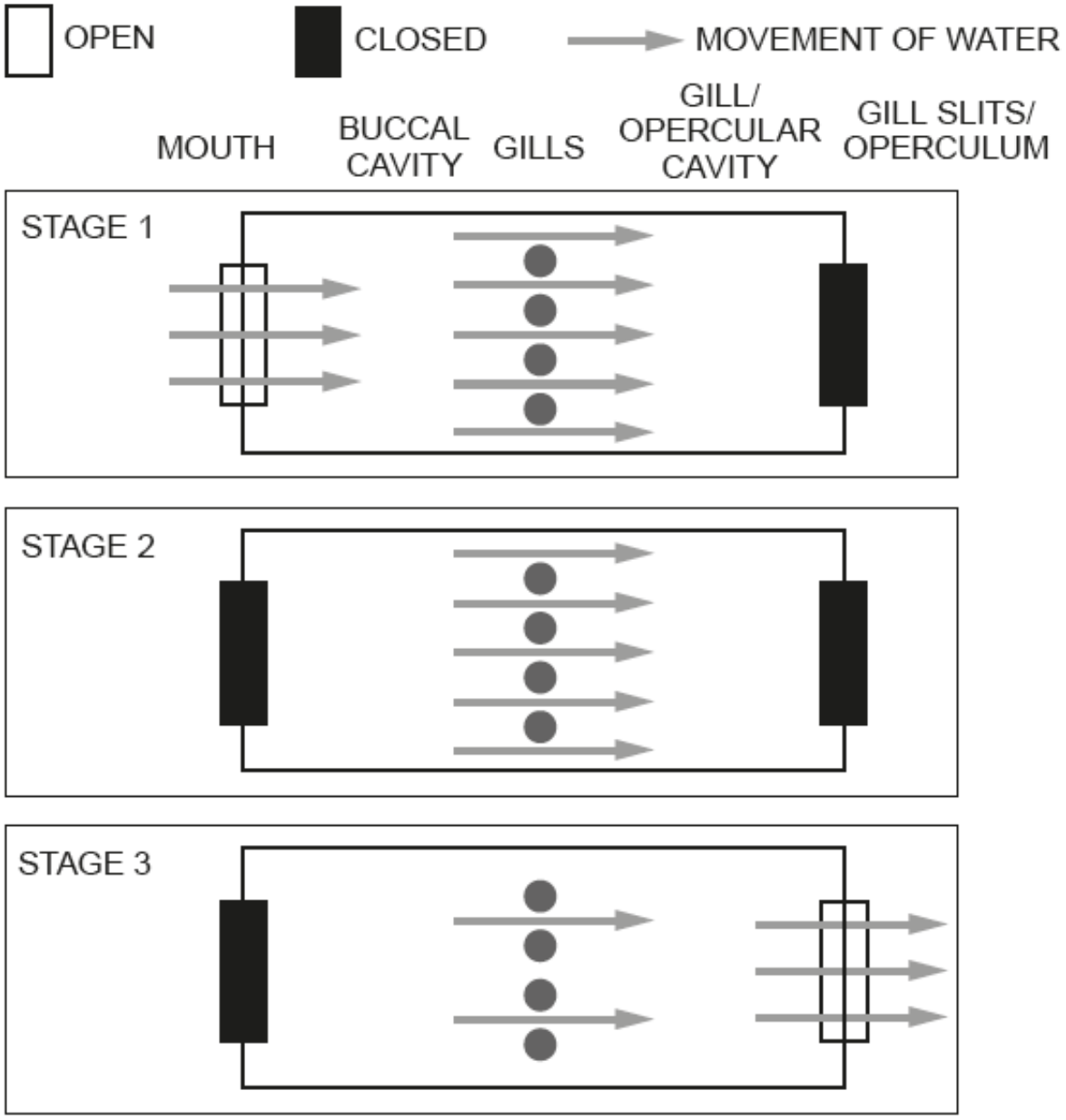
4.

(a) Bony fish rely on gills and gill filaments for gaseous exchange. Explain how the presence of gill filaments is an adaptation to gaseous exchange.

[2]

(b) The system of ventilation in a bony fish enables water to be passed continuously over its gills whilst the fish is at rest.

The diagrams below show three stages in the process of ventilation.



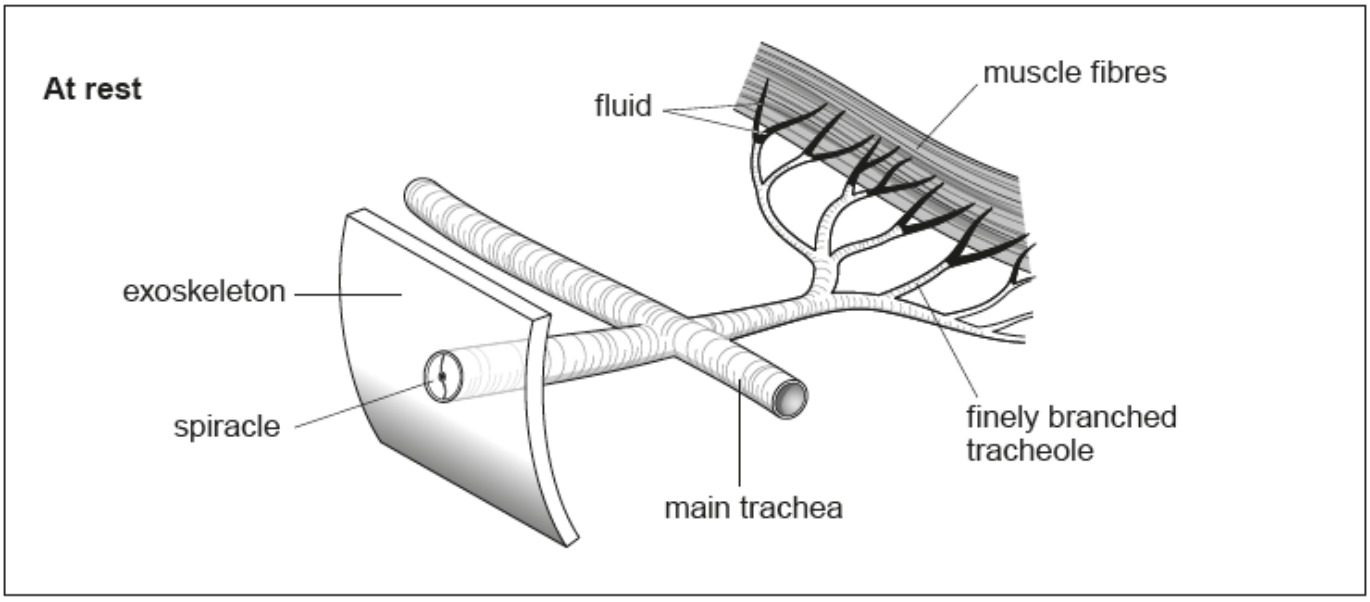
(i) Ventilation of the gills is achieved by pressure changes in the buccal and gill/ opercular cavities. Using information from the diagram opposite and your own knowledge describe the process of ventilation in a bony fish.

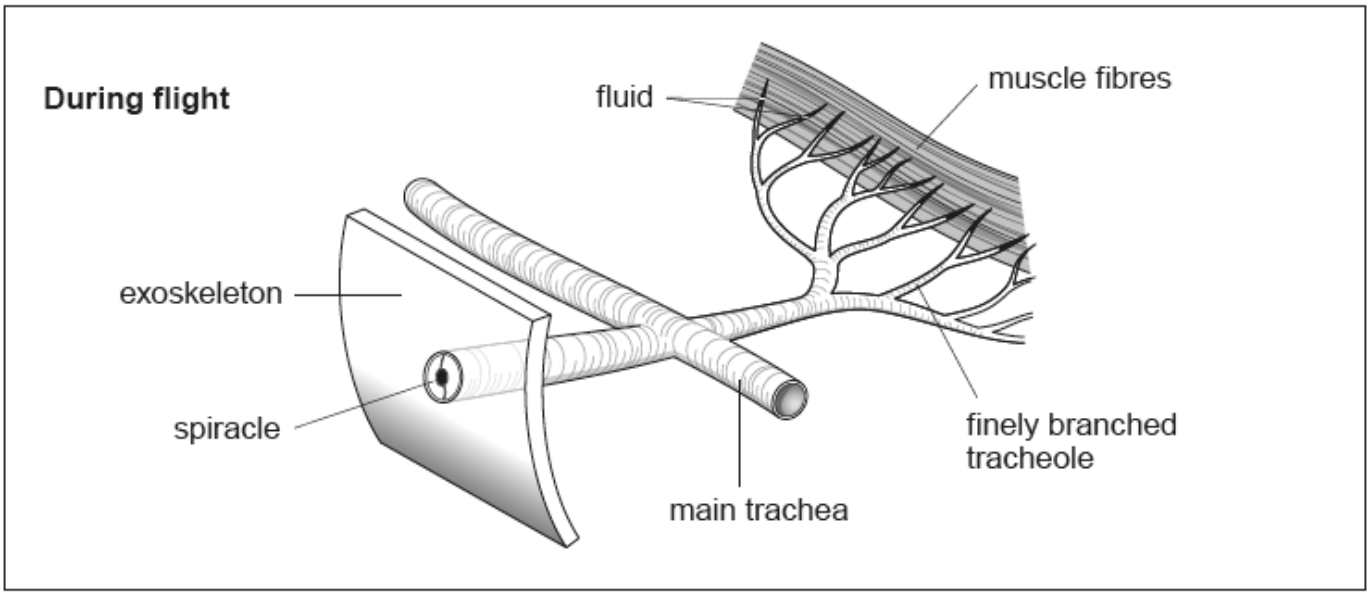
[4]

(ii) In order to further increase the efficiency of gas exchange, bony fish use a counter current flow. State what is meant by counter current flow and explain how this increases the efficiency of gas exchange in the bony fish.

[3]

(c) The diagrams below show insect tracheoles supplying muscle fibres at rest and during flight.





(i) The tracheoles are found on the outside of the muscle fibres. Suggest why the maximum diameter of a muscle fibre never exceeds 20 μm in diameter.

[2]

.....

.....

.....

.....

(ii) Describe the change in fluid level in the tracheoles during flight. Suggest how this change benefits gaseous exchange during flight.

[2]

Marking Scheme

1.

(a) Plants carry out the process of transpiration.

State what is meant by the term *transpiration*. [2]

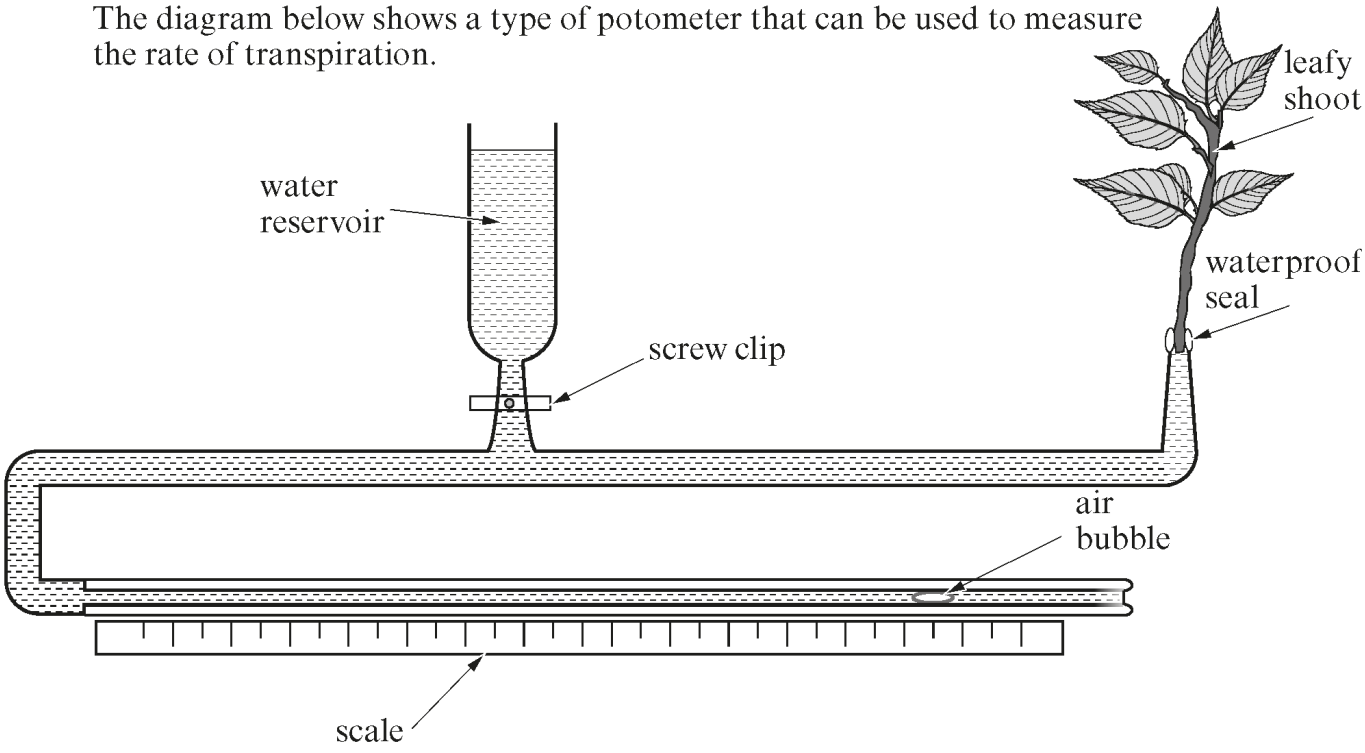
.....

.....

.....

.....

The diagram below shows a type of potometer that can be used to measure the rate of transpiration.



(b) State **two** practical measures which should be taken when setting up the apparatus to ensure the potometer functions correctly. Give reasons for your answers. [4]

.....

.....

.....

.....

.....

.....

2. (a)
(Gill) lamellae / filaments / plates; [1]

(b)
Any 3 [3]
Large surface area (for diffusion); (volume neutral)
Thin / short diffusion pathway;
Permeable;
Good blood supply or implied; NOT transport system
NOT moist.

(c)
Water is forced over the gill by {ventilation mechanisms / pressure differences / continuous swimming}; [4]
Unidirectionally / one way flow;
Countercurrent flow of blood and water / or description of;
{Diffusion / concentration} gradient is maintained or description of;
over the entire gill surface;
High affinity Hb;

Question total [8]

3.

Question		Marking details	Marks Available
6	*(a)*	lamellae/gill plates;	1
	(b)	water {forced/ flows} over gill (filaments); by pressure changes/ OWTTE; (pumping) action of mouth and operculum/ OWTTE; water flows in opposite direction to blood/counter-current mechanism; maintains {diffusion/ concentration} gradient across {entire/ whole} gill (filament); as blood always meets water with a higher oxygen concentration/ equilibrium is never reached;	max 4
	(c)	Any four large surface area; {(dense) network/ large number} of capillaries; NOT good blood supply {thin/permeable} epithelium; moist; short diffusion pathway;	max 4
		Question 6 Total	**[9]**

4.

Question			Marking details	Marks Available
4	(a)		Increases surface area; Diffusion takes place (over whole area);	2
	(b)	(i)	Mouth opens/floor of buccal cavity lowered; Volume of {buccal cavity/inside the mouth} increases/pressure lowered inside {buccal cavity/mouth}; Water {pulled in from outside/ enters due to pressure difference}; Mouth closes **and** {buccal cavity then contracts/ floor of buccal cavity raises}; Water forced {across/through} gills (into gill cavity); Pressure in gill cavity increases; Forces open the operculum / gill slits;	Max 4
		(ii)	Blood flows across (gills/ filaments/ lamellae/ gill plates) in opposite direction to water; Blood always meets water containing a higher oxygen concentration/{diffusion/ concentration} gradient maintained/ equilibrium is never reached; Across entire {gill/ gas exchange surface}; Higher saturation of blood with oxygen achieved;	Max 3
	(c)	(i)	Diffusion pathway would be too long/ ensures a short diffusion pathway; Speed of diffusion too slow; To supply sufficient oxygen;	Max 2
		(ii)	Less fluid/ fluid moves into muscle fibres/ fluid level decreases; More area for gaseous exchange/ shorter diffusion pathway;	2
			Question 4 Total	**[13]**

Examiner's Comments

1. The answers to part (a) overall were good. However, a common mistake was to suggest that a reduction of pressure in the thorax caused an increase in the volume of the lungs and a number of candidates failed to mention the difference in air pressure between the atmosphere and inside the lungs. The explanations of counter current were usually good with the only omission being a failure to state unequivocally that oxygen moved from the water to the blood and there was a high saturation of the blood with oxygen. The rest of the question was well answered but often in part (b)*(iii)* there was a failure to mention the lower level of oxygen saturation of the blood.

   *This comment originally referred to question **3** on paper **1702/01 (03/06/2013)***

2. This question was generally well done. Candidates had learnt the work and were able to recall it correctly. Better responses gained all 8 marks. Most marks were lost in c) where many got carried away with a detailed description of counter-current flow (often including diagrams), but forgot to mention any kind of ventilation mechanism or that the flow of water is unidirectional.

   *This comment originally referred to question **5** on paper **1072/01 (21/05/2012)***

3. The mechanism of ventilation was well known but candidates often failed to give full details. For example they mentioned a diffusion/concentration gradient being maintained but failed to state that it was across the whole length of the gill filament.

   The answers to part (c) often failed to give sufficient detail to allow the award of a mark. For example, candidates often referred to blood capillaries but failed to mention that it was a dense network. Also, there were often descriptions of gill filaments and microvilli without making a statement that these provided a large surface area.

   *This comment originally referred to question **6** on paper **1072/01 (14/01/2014)***

4. Most candidates gave a satisfactory evaluation of the role of gill filaments.

   The ventilation of gills was often well answered with detailed comments, however, in a significant number of cases there were vague references to an increase in volume or a decrease in pressure without any direct reference to where these changes occurred.

   The counter current mechanism is well understood and many candidates gave a very full description of the process, though a minority did confuse it with parallel flow.

   The processes in the operation of insect tracheoles were not as well understood. Whilst many candidates recognised that an increase the diameter of the muscle fibre would lead to insufficient oxygen reaching the muscles, few could relate this to a longer diffusion pathway or speed of diffusion.

   Whilst most candidates recognised that the level of fluid would decrease during flight, (though a minority did say that it would increase) few could extend their answers by correct references to surface area or short diffusion pathways.

   *This comment originally referred to question **4** on paper **1072/01 (02/06/2014)***