Please note – These are extracts from one student's response

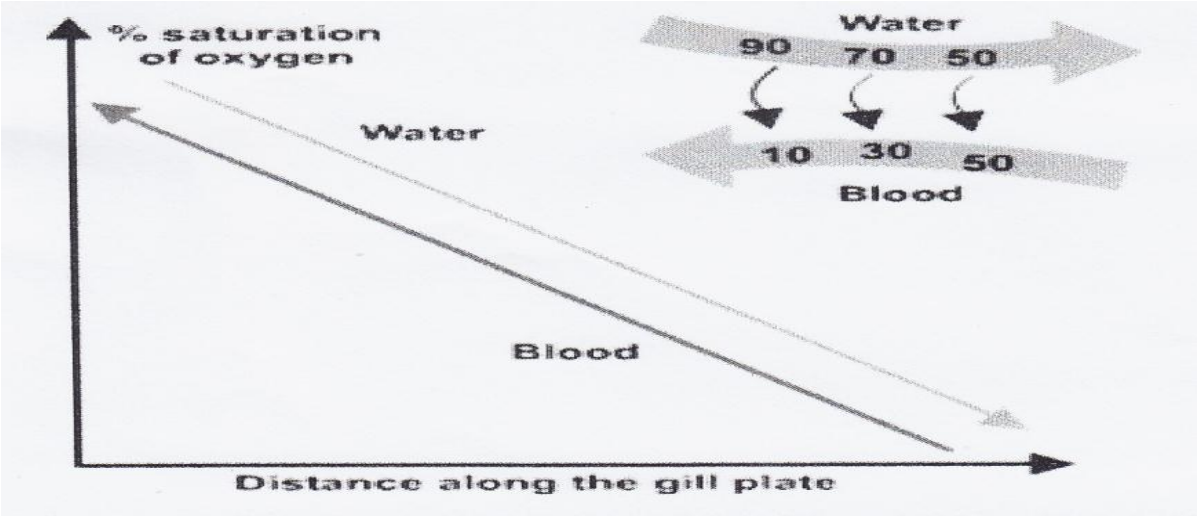
Gills - gas exchange system in fish

3 The solubility of the respiratory gases in water is very low. Gas exchange in water is more difficult for fish because the concentration of dissolved oxygen is said to be less than 1% compared to 20% that of carbon dioxide. Like humans though, fish require respiration and the process of gas exchange to survive. 4

3 Fish have adapted to live underwater. Over time they have evolved specialised organs known as gills, which are made of thousands of filaments, in turn are heavily covered in lamellae. A gill lamella is a plate structure that assists the increase of amount of oxygen intake of the blood in a fish, as it contains blood capillaries. This structure contributes to a large surface area and a short distance for gas exchange to take place, increasing the rate of diffusion. 2 1

1 Fish ventilate their gills by the action of two skeletal muscle pumps to maintain the gas concentration gradient, one in and through the mouth cavity, and the other in the operculum cavity. The water is drawn into the mouth where it remains until the mouth is closed. Once the mouth has shut, the water is pushed into the gill bars where it travels in and past the gill filaments. 2

(Counter current flow, Google images, 2012)



2 The counter current exchange system helps maximise the effectiveness and efficiency of gas exchange. Water flows over the gills so oxygen is removed and enters the blood.

The surface area of the gill filaments is an important factor in gas exchange. Water contains much less oxygen compared to air; therefore fish must have an organ (gills) with a large surface area to get enough oxygen from the water to survive. 4