

## Model Answers: Medium

### Q1

The correct answer is **D** because blood passing through through the lungs in the capillary at **Q** is deoxygenated (as blood is moving right to left through the image), therefore there is a concentration gradient for oxygen; there is a **higher** concentration of **oxygen** in the **air** in the alveolus **compared** to the **blood** which leads to **diffusion** of oxygen into the blood. Oxygen binds reversibly to haemoglobin in the red blood cells to be transported around the body.

<b>A</b> Is incorrect as	the movement of oxygen is not affected by the concentration gradient for carbon dioxide.
<b>B</b> Is incorrect as	there is no air in the capillary, the air is in the alveolus.
<b>C</b> Is incorrect as	the movement of each gas (carbon dioxide and oxygen) is only dependent on the concentration gradient of each gas, not on each other.

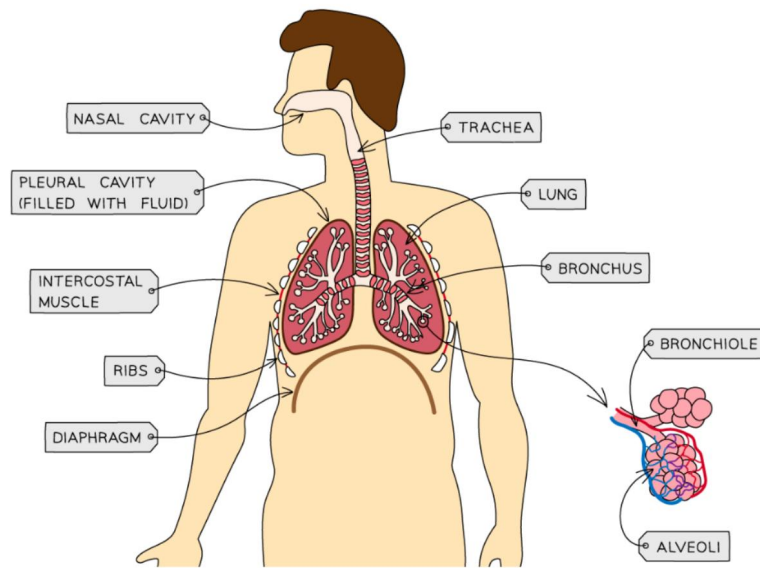
### Q2

The correct answer is **D** because a **good gas exchange surface** has a **large surface area** for **efficient** exchange of gases.

It also maintains a **high diffusion gradient**, usually by having a good blood supply. This means that diffusion of oxygen into the blood occurs continuously and at a faster rate as blood saturated with oxygen is quickly carried away from the alveoli back towards the heart.

### Q3

The correct answer is **B** because air containing oxygen is inhaled through the mouth or nose, moving down the **trachea** which branches into the left bronchus and right bronchus (plural **bronchi**), the bronchi then divide into smaller branches (or airways) called **bronchioles** which eventually lead to a cluster of alveoli (singular alveolus).



Q4

The correct answer is **D** because gas exchange surface have the following requirements:

- A large surface area so that as much diffusion as possible can happen in the shortest amount of time.
- They are thin, so that **diffusion distances are short**.

Thick skin would increase the distance over which gases had to be exchanged between the air through the skin of the amphibian, reducing the rate of diffusion. A smaller surface area would provide less area for diffusion to occur.

To maximise diffusion efficiency gas exchange surfaces must also:

- be able to **maintain a diffusion gradient** so that diffusion continually happens
- be able to maintain a good supply of air containing oxygen

Q5

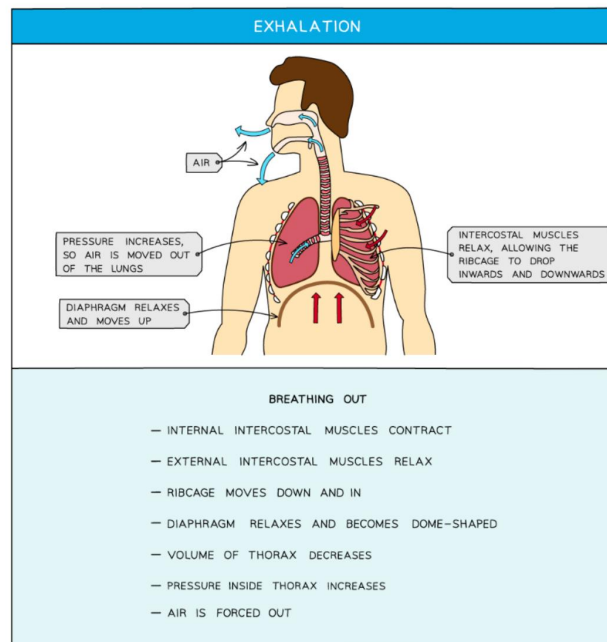
The correct answer is **C** because the normal **carbon dioxide** content of **air** is around **0.04%** and, as carbon dioxide diffuses out of the blood into the alveoli in the lung, the concentration of carbon dioxide in the air increases so that the air we **breathe out** contains around **4%** carbon dioxide.

<b>A</b> is incorrect as	16% is the approximate figure for the percentage of oxygen in expired air – we only absorb around 4 to 5% of the oxygen in atmospheric air (which contains around 20 to 21% oxygen).
<b>B</b> is incorrect as	0.04% is the approximate percentage of carbon dioxide in inspired atmospheric air.
<b>D</b> is incorrect as	21% is the approximate percentage of oxygen in atmospheric air.

Q6

The correct answer is **C** because:

- When the **diaphragm relaxes** and the **internal** intercostal muscles **contract**, a person is forcibly **exhaling air**.
- During **exhalation** the **volume** of the thorax needs to get **smaller** so that **pressure** inside will **increase** relative to the pressure of atmospheric air, forcing air out of the lungs. This means that the ribs must move down, contraction of the internal intercostal muscles aids this process.



Q7

The correct answer is **A** because:

- **Carbon dioxide** and **water** are products of **respiration** in cells which are transferred to the blood (due to diffusion / osmosis). Both can be **excreted** from the body by the lungs when we breathe out.
- This means that air exhaled by a human will contain more water vapour and more carbon dioxide than atmospheric air.

Q8

The correct answer is **A** because:

- Atmospheric air contains around 20 – 21% **oxygen**, of which we only **absorb around 4 – 5%**, breathing out air containing around 16% oxygen.
- Normal **carbon dioxide** content of air is around **0.04%** and, as carbon dioxide diffuses into the alveoli from the blood, we breathe out air containing around **4%** carbon dioxide.
- The percentage of nitrogen in inspired and expired air is around 79 – 80% and does not change as nitrogen is not able to be utilized by the body in the form of nitrogen gas.

Q9

The correct answer is **C** because the function of ciliated cells is the waft and push mucus that has trapped dust and other particles in it towards the throat.

<b>A</b> is incorrect as	the cells lining the trachea do not need to have a large surface area. Their role is to move mucus up away from the lungs.
<b>B</b> is incorrect as	gas exchange happens in the alveoli between air and the blood, not in the trachea.
<b>D</b> is incorrect as	bacteria is trapped by mucus which is sticky, not the cilia themselves.