

Model Answers: Easy

1

The correct answer is **C** as **goblet** and **ciliated cells** are found throughout the **trachea**, **bronchi** and **bronchioles**. **Squamous epithelial cells** are flattened cells that make up the walls of the **alveoli** (and also the walls of **capillaries**).

Goblet cells and **ciliated cells** work together to keep the respiratory tract free of dirt and pathogens. The goblet cells secrete mucus and the mucus traps inhaled particulate matter. The ciliated cells have tiny, hair like projections (called cilia) that beat rhythmically and sweep the mucus (and trapped dirt) up and out of the respiratory tract.

The flattened shape of **squamous epithelial cells** ensures that the diffusion distance is small and therefore allows for more efficient gas exchange.

2

The correct answer is **A** as only the **alveoli** have surfactant present. Additionally, the surfactant does not lead to an increased efficiency of gaseous exchange, instead, its role is to lower **surface tension**. The surface of the alveoli is moist (which does improve gas exchange) and this is why surfactant is needed. By reducing surface tension, it prevents the walls of the alveoli from sticking together during exhalation.

3

The correct answer is **D** as goblet cells and ciliated cells are only present in the larger airways (namely the bronchi and trachea).

There are actually some ciliated cells present in the larger bronchioles, however, there are no goblet cells in any bronchioles (so **A** and **B** are wrong). While there are no goblet cells in bronchioles, there are other cells present that release **pulmonary surfactant**. Pulmonary surfactant helps to lower **surface tension** and thus prevents the walls of the respiratory system from sticking together.

4

The correct answer is **D** as the order of the airways from large to small (also from mouth/nose to blood stream) is **trachea**, **bronchus**, **bronchiole** and, finally, **alveoli**.

5

The correct answer is **C**. **Elastic recoil** refers to the lung's intrinsic tendency to deflate following inflation and is an important part of ensuring a full exhalation. Some of this elasticity is lost as part of aging, hence why lung capacity is typically decreased in older people.

A is incorrect as the enzyme **elastase** breaks down elastic fibres and would therefore lead to a decrease in elastic fibre abundance

B is incorrect as elastic fibres allow the walls to **expand** as air is breathed in

D is incorrect as destruction of elastic fibres **reduces** the lung capacity of emphysema sufferers

6

The correct answer is **C** as the pulmonary artery carries **deoxygenated** blood **away** from the heart. Like all arteries, the pulmonary artery has a **small** lumen and **thick** muscular wall.

The pulmonary artery is unusual in the fact that it carries **deoxygenated** blood. In all other aspects the vessel resembles a typical artery:

- The **lumen** is **narrow** to ensure high blood pressure is maintained
- There is elastic tissue to allow **elastic recoil** (which also helps ensure high blood pressure is maintained between heart beats)
- The blood flow direction is **away** from the heart
- The **walls** are **thick** to prevent rupture from the high pressure

Students frequently get the pulmonary artery and pulmonary vein mixed up - just remember that: **A**rteries **A**lways (go) **A**way (from the heart)

7

The correct answer is **B** as the order of the airways from large to small (and from mouth/nose to blood stream) is **trachea**, **bronchus**, **bronchiole** and, finally, **alveoli**.

You are not expected to memorise the diameters. You just need to be aware that the diameter of the **trachea** is greater than that of the **bronchus**, which, in turn, is wider than the **bronchioles**, and the **alveoli** have the smallest diameter.

8

The correct answer is **A** as while **goblet cells** produce mucus which traps bacteria (as well as other respiratory pathogens and dirt), this mucus does not contain hydrolytic enzymes to break bacteria down. Instead, the mucus (containing the trapped substances) is wafted up and out of the respiratory system by the **ciliated epithelial cells**.

The mucus (and trapped dirt and pathogens) produced by the **goblet cells** is eventually swallowed when it reaches the top of the respiratory system. The acid in the stomach will normally destroy any pathogens, so there is little chance of the pathogens infecting the digestive system.

9

The correct answer is **C** as:

- **Smooth muscle** allows changes in the **diameter** of bronchioles (similar to how smooth muscle in the arteries allows for changes in arterial lumen diameter)
- **Cartilage rings** provide a **structural support** that helps to keep the airways open (without these the airways could collapse from the low pressure caused by inhalation).
- **Ciliated epithelial cells** use hair like structures (called cilia) to **waft mucus** out of airways.
- **Elastic fibres** allow the alveoli expand during inhalation which, in turn, allows for **elastic recoil**. Elastic recoil refers to the lung's intrinsic tendency to deflate following inflation and is an important part of ensuring a full exhalation.

10

The correct answer is **B**. Labels **3** and **4** are the easiest to recognise, so starting from there and working back is a logical way to get to the answer. The cell in label **3** is producing **mucus** (therefore must be a **goblet cell**) and the cell in label **4** has **cilia** (therefore must be a **ciliated epithelial cell**). Just identifying these two would be enough to get the correct answer, however, the **cartilage** in label **1** and **smooth muscle** in label **2** are also recognisable. Multiple smooth muscle cells join together to make fibres and therefore there are multiple nuclei in one fibre.