Gas Exchange

(Past Year Topical Questions 2010-2015)

May/June 2010 (21)/Q2

(b) (i) Describe the role of elastic fibres in the wall of the alveolus.

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.....[2]

(ii) With reference to Fig. 2.1, explain how alveoli are adapted for gas exchange.

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.....[4]

May/June 2010 (22)

5 Fig. 5.1 is a diagram of part of the human gas exchange system.

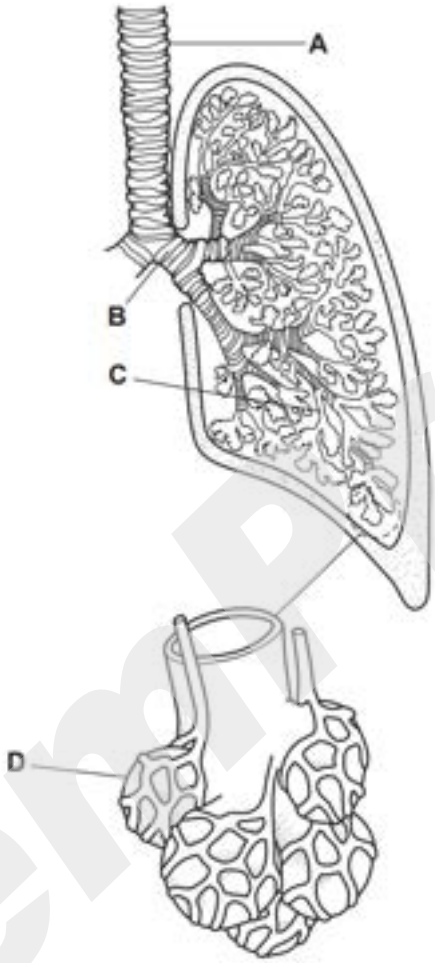

Fig. 5.1

(a) Complete the table to show the distribution of the structural features within the parts of the gas exchange system, **A** to **D**, shown in Fig. 5.1.

Use a tick (✓) if the feature is present and a cross (✗) if the feature is absent. Some of the boxes have been completed for you.

structure	features				
	cartilage	ciliated epithelium	elastic fibres	goblet cells	smooth muscle
A		✓		✓	
B			✓		
C				✓	✓
D	✗				✗

[4]

+6018 – 375 2833

(b) Explain the role of goblet cells and cilia in the maintenance of a healthy gas exchange system.

goblet cells .....

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cilia .....

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.....[4]

May/June 2010 (23)

6 Various structures in the human gas exchange system are adapted in different ways to perform their specific functions.

(a) Complete the table below using a tick ✓ or cross ✗ in each box to show whether or not the structure shows the particular feature.

Two boxes have been completed for you.

	lined with cilia	reinforced with cartilage	site of gas exchange	contains smooth muscle
trachea			✗	
bronchus				
bronchiole				✓
alveolus				

[4]

(b) State the two ways in which the concentration gradients of oxygen and carbon dioxide are maintained for efficient gas exchange.

1. .....

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2. .....

.....[2]

(c) The alveoli in the lungs have elastic fibres in their walls.

(i) State **one** function of the elastic fibres.

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.....[1]

Oct/Nov 2010 (21)

2 **(a)** Table 2.1 shows some of the structures in different parts of the gas exchange system.

Complete Table 2.1 by indicating with a tick (✓) if the structure is present in each part of the gas exchange system or a cross (✗) if it is not.

Table 2.1

structure	trachea	bronchus	bronchiole	alveolus
ciliated epithelium				
goblet cells				
cartilage				
smooth muscle				

[4]

Oct/Nov 2010 (22)

6 Fig. 6.1 is a section through lung tissue showing an alveolus and its blood supply.

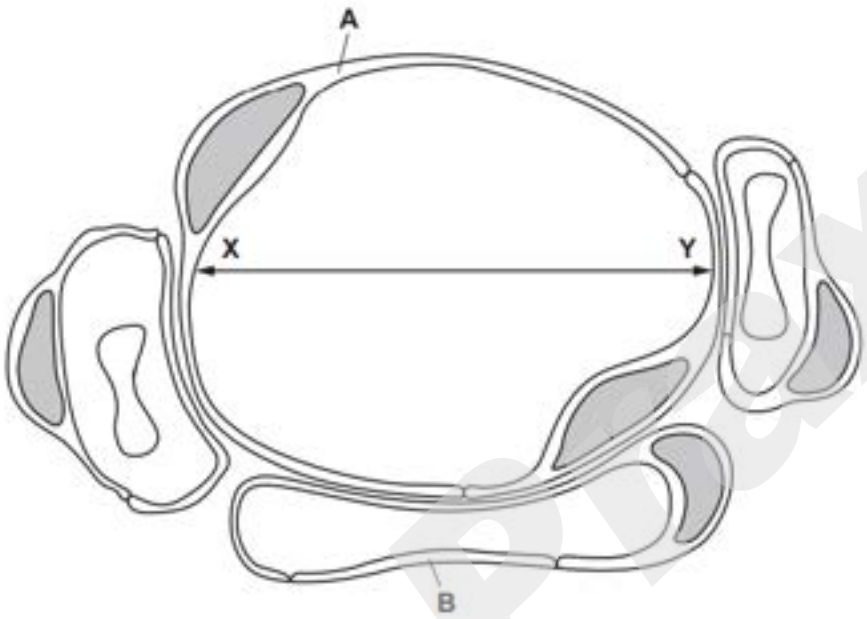

Fig. 6.1

(a) (i) Name the type of epithelial cell shown by label lines **A** and **B**.

..... [1]

(ii) Describe how the elastic fibres of the alveoli contribute to the healthy functioning of the lungs.

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..... [2]

(c) Outline two features of a gas exchange surface **that are shown on Fig. 6.1**.

1. .....

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2. .....

..... [2]

(d) Fig. 6.2 is a simplified diagram of the circulatory system of a human, showing gas exchange in the lungs and in respiring tissue. The partial pressures of oxygen (pO_2) and carbon dioxide (pCO_2) at four locations are also shown.

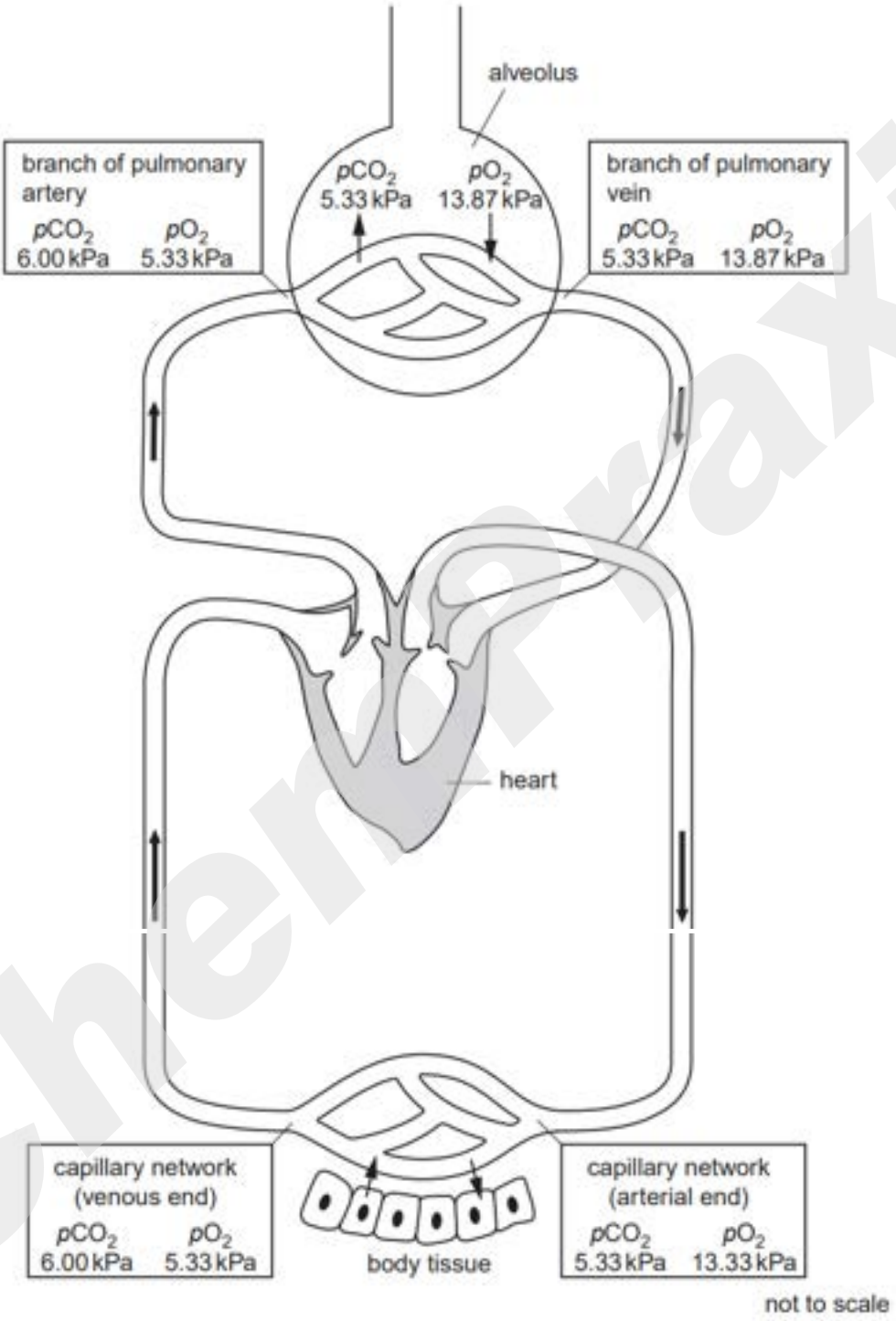
alveolus
branch of pulmonary artery
pCO_2 6.00 kPa
pO_2 5.33 kPa
pCO_2 5.33 kPa
pO_2 13.87 kPa
branch of pulmonary vein
pCO_2 5.33 kPa
pO_2 13.87 kPa
heart
capillary network (venous end)
pCO_2 6.00 kPa
pO_2 5.33 kPa
body tissue
capillary network (arterial end)
pCO_2 5.33 kPa
pO_2 13.33 kPa
not to scale

Fig. 6.2

With reference to Fig. 6.2, explain how the differences in *p*O2 and pCO_2 in the alveolus and in blood enable gas exchange in the lungs **and** respiring tissue.

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..... [4]

Oct/Nov 2010 (23)

5 **(a)** Describe and explain how the structure of alveoli is adapted for efficient gas exchange.

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.....[3]

May/June 2011 (21)

1 Fig. 1.1 is an electron micrograph of cells from the ciliated epithelium of the trachea.

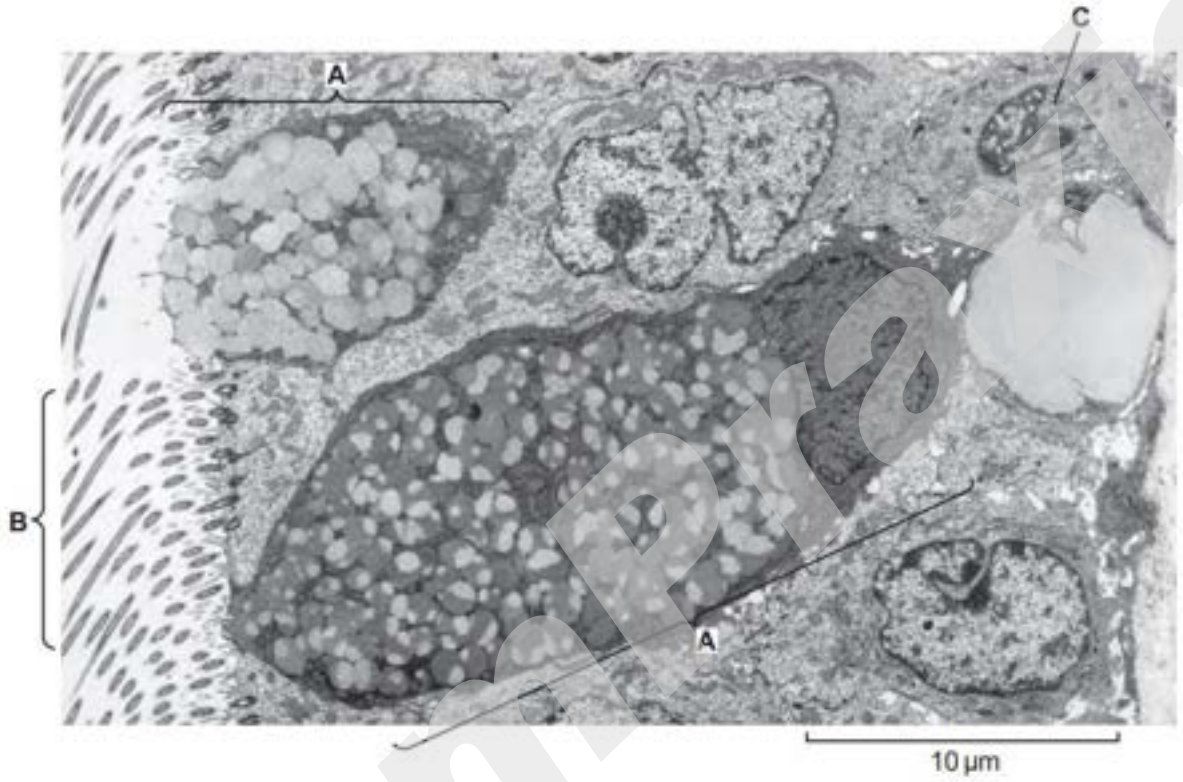

Fig. 1.1

(b) Explain how the cells labelled **A** and the structures labelled **B** in Fig. 1.1 protect the lining of the trachea.

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.....[4]

Oct/Nov 2011 (22)

1 Fig. 1.1 is a scanning electron micrograph of part of the wall of the bronchus of a healthy human.

Fig. 1.1

(a) (i) Name the structures labelled **A**.

.....[1]

(ii) State the function of the cells labelled **B**.

.....[1]

(b) Name two tissues found in the wall of the bronchus that are not visible in Fig. 1.1.

1. .....

2. .....[2]

May/June 2012 (21)

1 Name as precisely as you can the structure described in each of the following statements.

(d) The epithelial cell that secretes mucus in the trachea.

.....[1]

(e) The tissue that prevents the collapse of the trachea during inhalation.

.....[1]

Oct/Nov 2013 (21)/Q3

Macrophages are large phagocytic cells that are found in many tissues including alveolar tissue in the lungs. They provide the main means of defence against pathogens in this tissue.

Fig. 3.1 is a drawing made from an electron micrograph showing part of a capillary and two alveoli, with a macrophage.

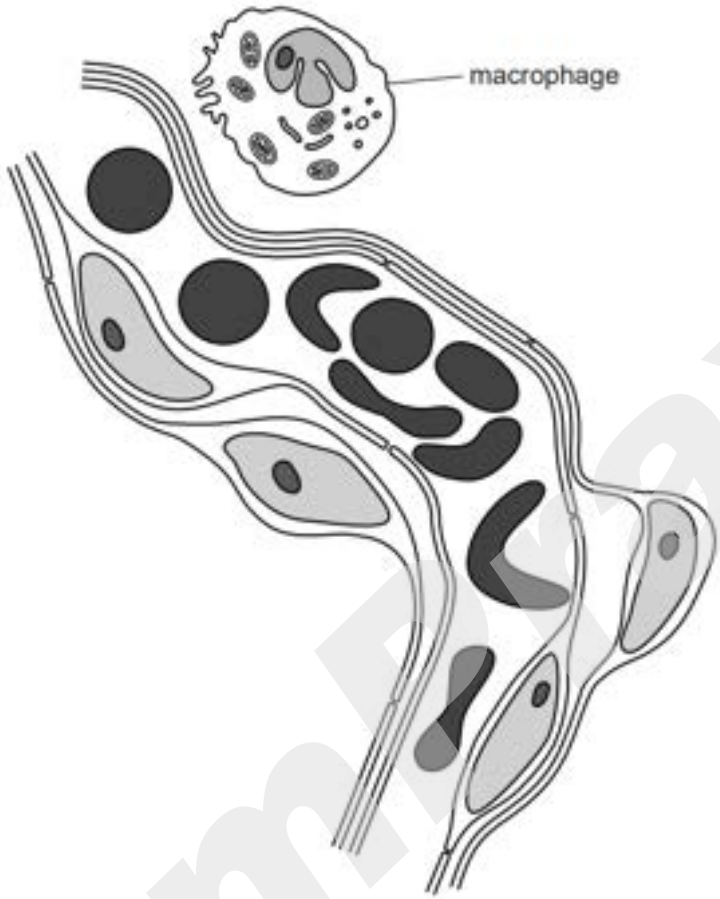

Fig. 3.1

(b) With reference to Fig. 3.1, explain:

(i) how alveoli are adapted for gaseous exchange

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.....[3]

May/June 2014 (22)

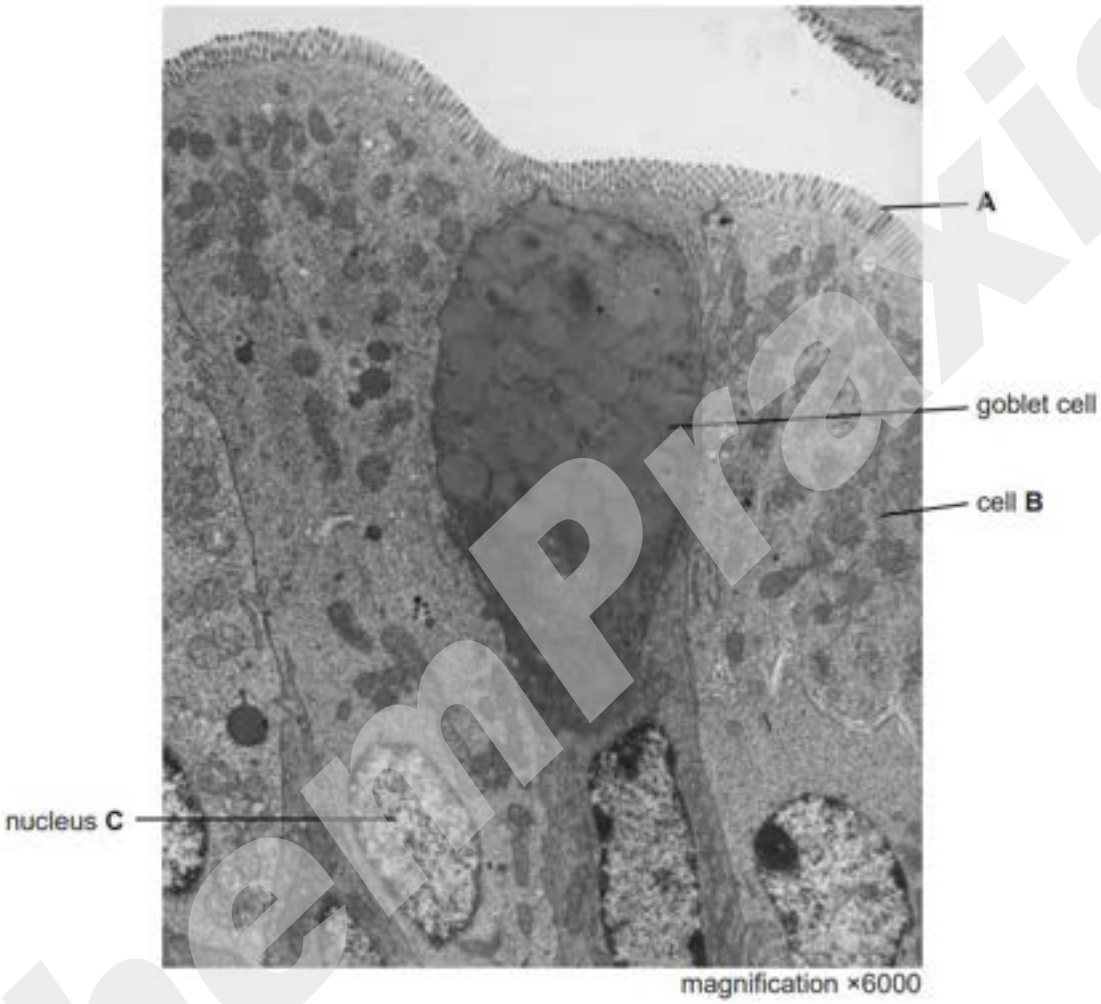
3 **(a)** Cartilage is present in some parts of the gas exchange system to prevent collapse due to pressure changes during inhalation.

State the parts of the gas exchange system in which cartilage is located.

.....[1]

Oct/Nov 2014 (21)

1 Fig. 1.1 is an electron micrograph of cells from the lining of the small intestine.



(d) There are many goblet cells within the epithelium lining the trachea and the bronchi in the gas exchange system.

Describe the role of goblet cells in the gas exchange system.

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..... [3]

(e) State two ways in which the cells lining the alveoli in the lungs differ from cell **B** shown in Fig. 1.1.

1. .....

2. .....

[2]

Oct/Nov 2014 (22)

1 Fig. 1.1 is a light micrograph of a section through part of the gas exchange system.

A, **B** and **C** are three different types of tissue.

Fig. 1.1

(a) The cell types in tissue **A** have different functions.

Describe how the cell types work together to maintain the health of the gas exchange system.

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.....[3]

(b) Suggest why the cells in tissue **B** have many mitochondria.

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.....[1]

(c) Name the parts of the gas exchange system where tissue **C** is distributed.

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.....[1]

May/June 2015 (21)

2 Pathogens enter the body in a variety of ways, including through the gas exchange system. The body has several defence mechanisms against the entry of pathogens and their spread throughout the body.

Fig. 2.1 is an electron micrograph of a cross section of the lining of a bronchiole.

Fig. 2.1

(a) (i) Name tissue **X** and cell **Y**.

X .....

Y .....[2]

(ii) With reference to the structures visible in Fig. 2.1, state three ways in which the lining of the trachea, bronchus and bronchioles provides protection against the entry of bacterial pathogens.

1 .....

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2 .....

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3 .....

.....[3]

May/June 2015 (22)

2 Fig. 2.1 is a scanning electron micrograph of an area of the trachea showing the presence of *Bordetella pertussis* bacteria.

B. pertussis is the causative organism of a respiratory disease in humans known as whooping cough. The disease is transmitted from person to person in a similar way to tuberculosis (TB).

A symptom that is common to TB and to whooping cough is the production of an excess of mucus.

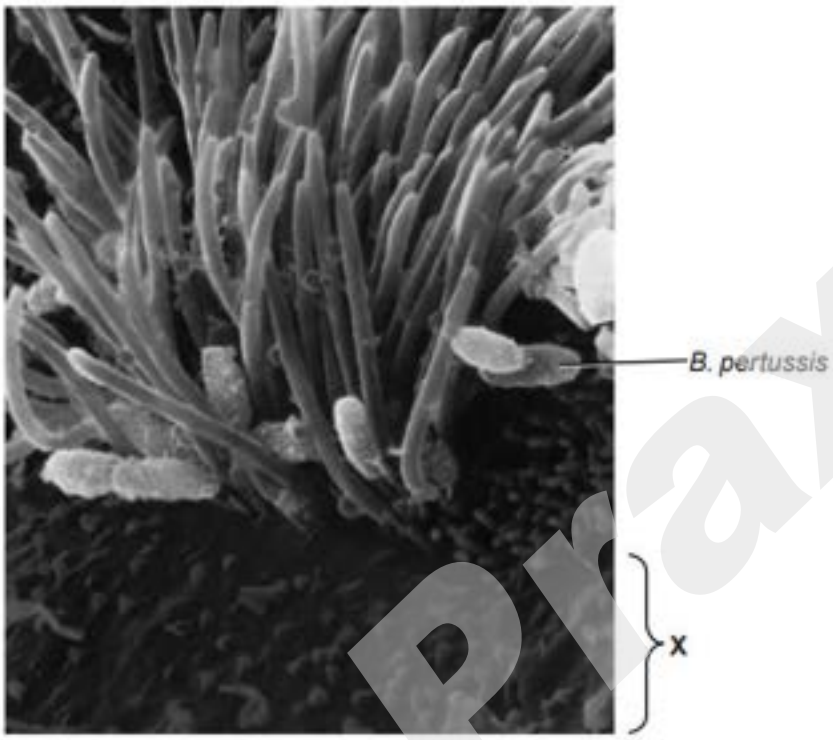

Fig. 2.1

(a) Describe the damage caused by *B. pertussis* that is shown in the area labelled **X** on Fig. 2.1 **and** explain how this will affect the functioning of the epithelial tissue of the trachea.

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.....[3]

(b) Goblet cells produce mucus. Name one other structure in the gas exchange system that also produces mucus.

.....[1]

Oct/Nov 2015 (22)/Q2

(b) Fig. 2.1 is a scan of the lungs of a person with emphysema. One common feature in the damaged areas labelled is a loss of the elastic fibres of the alveoli. Another feature is an increased number of macrophages and neutrophils.

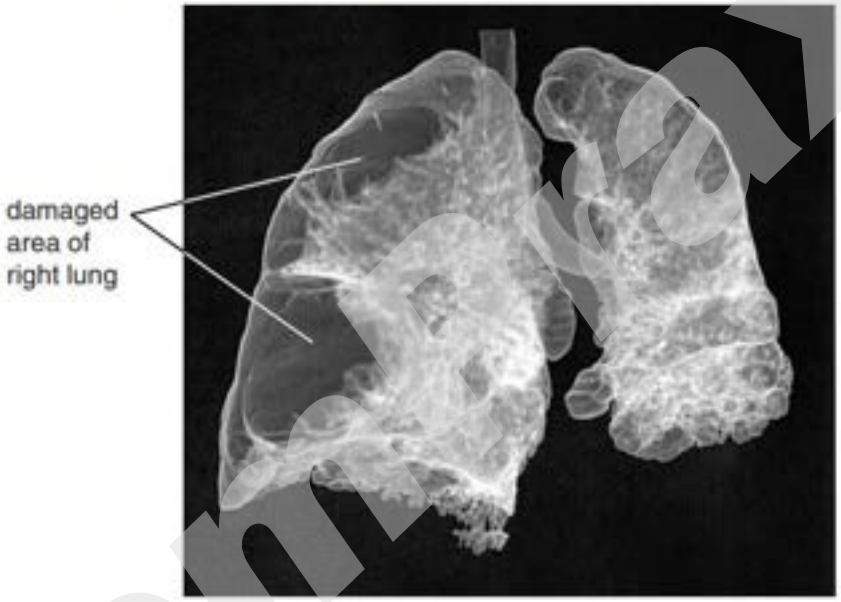

Fig. 2.1

(ii) Suggest how the loss of the elastic fibres would cause the enlargement of the lung shown in Fig. 2.1.

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..... [2]