Gas exchange – AS 9700 Biology Nov 2022

1. Nov/2022/Paper_11/No.35

Red blood cells may contain a molecule known as 2,3-bisphosphoglycerate (2,3-BPG).

When 2,3-BPG binds to haemoglobin, a higher partial pressure of oxygen is needed to bring about 50% saturation of haemoglobin with oxygen.

Which statements about the effect of 2,3-BPG are correct?

1 2,3-BPG in red blood cells causes the oxygen dissociation curve to shift to the right.

2 The binding of 2,3-BPG to haemoglobin reduces the Bohr effect.

3 The binding of 2,3-BPG to haemoglobin lowers the affinity of the haemoglobin for oxygen.

4 When 2,3-BPG is not present, oxyhaemoglobin is less likely to unload oxygen.

A 1 and 2 **B** 1 and 3 **C** 2 and 3 **D** 3 and 4

2. Nov/2022/Paper_11/No.36

Carbon dioxide is continually produced by respiring cells. It diffuses into red blood cells and dissociates into hydrogen ions (H^+) and hydrogen carbonate ions (HCO_3^-). HCO_3^- then diffuses out of the cell in exchange for chloride ions (Cl^-) in the chloride shift.

What is the importance of the chloride shift?

A It helps to maintain a neutral pH in the red blood cell by acting as a buffer.

B It maintains a balance of positive and negative charge between the cell and the plasma.

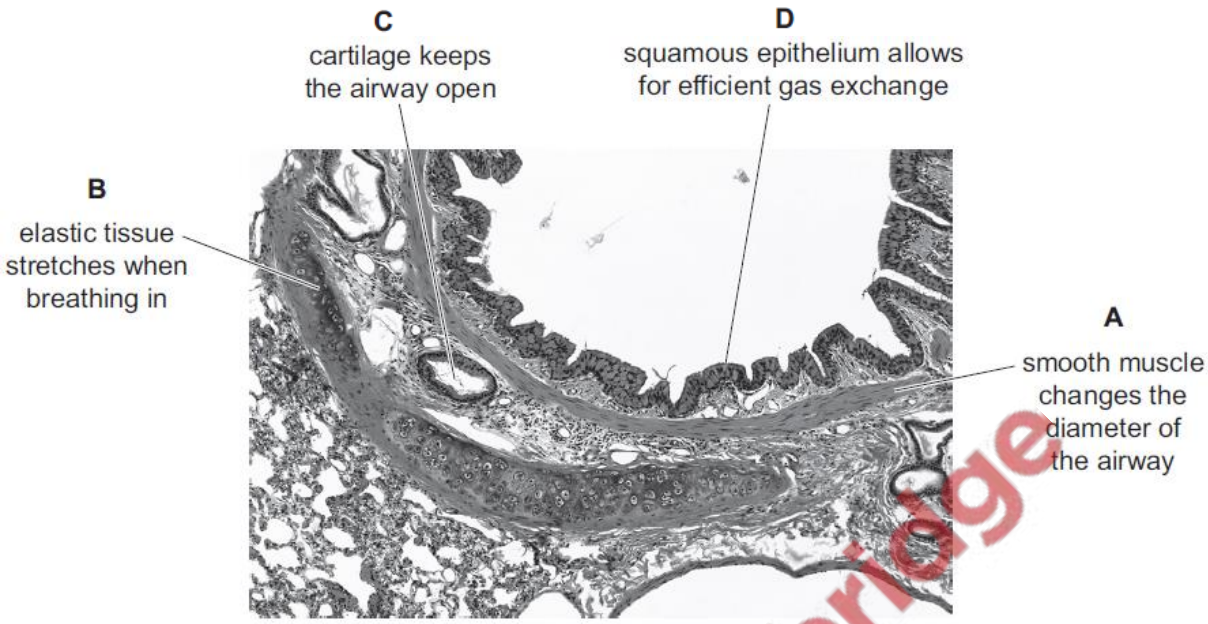
C It causes the oxygen dissociation curve to shift to the left, releasing more oxygen.

D It prevents carbon dioxide combining with haemoglobin, allowing haemoglobin to combine with oxygen.

3. Nov/2022/Paper_11/No.37

The photomicrograph shows a section through a bronchus.

Which annotated label is correct?



4. Nov/2022/Paper_12/No.36

What can be found in the wall of an alveolus in the lungs of a human?

	cartilage	cilia	elastic fibres
A	✓	✓	✗
B	✗	✗	✓
C	✓	✗	✗
D	✗	✓	✓

key

✓ = present

✗ = not present

5. Nov/2022/Paper_12/No.37

What are the functions of cilia in the gas exchange system?

1 to move mucus

2 to trap pathogens and dust

3 to increase the surface area

	1	2	3
A	✓	✗	✗
B	✓	✓	✗
C	✗	✓	✓
D	✗	✗	✓

key

✓ = a function

✗ = not a function

6. Nov/2022/Paper_13/No.35

Which statements about the formation of haemoglobinic acid are correct?

1 It is linked to the action of carbonic anhydrase.

2 It prevents blood from becoming too acidic by removing excess hydrogen ions.

3 It can only occur when oxygen associates with haemoglobin.

A 1, 2 and 3 **B** 1 and 2 only **C** 1 only **D** 2 and 3 only

7. Nov/2022/Paper_13/No.30

What would be changed if mitochondrial activity was inhibited by a metabolic poison acting on cells in the phloem tissue?

1 concentration of hydrogen ions in the cell wall of companion cells

2 concentration of sucrose in the cytoplasm of cells in a leaf

3 hydrostatic pressure gradient in the phloem sieve tube

A 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

8. Nov/2022/Paper_21/No.3(a)

Carbonic anhydrase is a globular protein found in red blood cells.

(a) (i) Explain why this protein is described as globular.

.....

.....

.....

.....

..... [2]

(ii) State the function of carbonic anhydrase in red blood cells.

.....

.....

.....

.....

..... [2]

9. Nov/2022/Paper_22/No.1(d)

(d) The entry of carbon dioxide into red blood cells results in the production of hydrogencarbonate ions. This involves the enzyme carbonic anhydrase.

Complete the passage summarising the production of hydrogencarbonate ions by:

- writing the correct biological term in the spaces provided
- writing the molecular formula for **two** of the terms in the spaces in brackets.

Carbonic anhydrase has an overall spherical shape and is known as a ..... protein. The enzyme acts within the cell so can be described as an ..... enzyme. When blood passes into the capillary network through actively respiring tissues, carbon dioxide (CO_2) diffuses into red blood cells and carbonic anhydrase catalyses a reaction where ..... (.....) is combined with CO_2 to form ..... (H_2CO_3), which rapidly forms ..... ions (.....) and hydrogencarbonate ions (HCO_3^-). [5]

10. Nov/2022/Paper_22/No.4(a, b)

The airways of the gas exchange system are lined with epithelium. Gradual changes in the structural features of this epithelium occur as the airways branch and become increasingly narrow.

(a) Table 4.1 shows the changes that occur in the number of goblet cells in the epithelium of the different structures of the gas exchange system.

Table 4.1

gas exchange structure	number of goblet cells in epithelium
trachea	many
bronchi	many
larger bronchioles	very few
smaller bronchioles	none
alveoli	none

Goblet cells produce mucus, which is important in maintaining the health of the airways.

The smallest bronchioles closest to the alveoli are known as respiratory bronchioles.

Suggest **and** explain why respiratory bronchioles do not have any goblet cells.

.....

.....

.....

.....

..... [2]

(b) Fig. 4.1 is a photomicrograph of a section through a bronchiole, which is surrounded by alveoli.

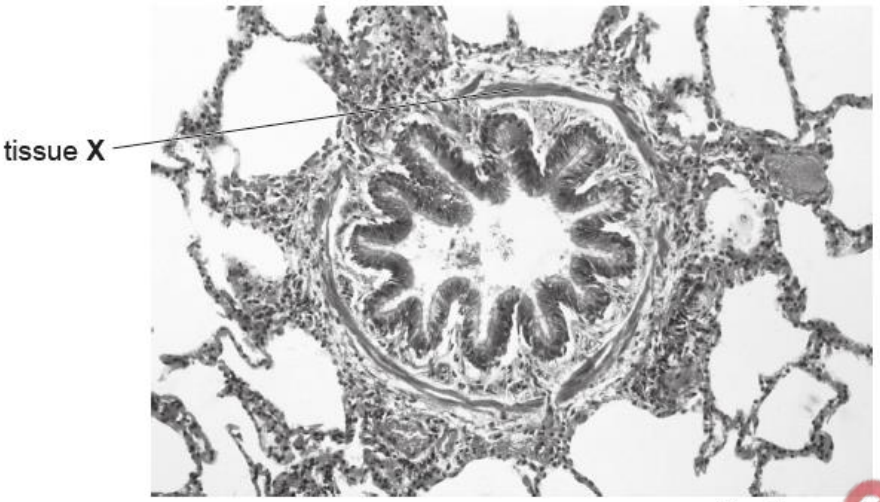


Fig. 4.1

(i) There are structural differences between the epithelium of the bronchiole and the epithelium of an alveolus.

Describe the differences between the epithelium of bronchioles and the epithelium of alveoli, **other than** differences in the number of goblet cells.

.....

.....

.....

.....

.....

.....

.....

..... [3]

(ii) Tissue **X**, shown in Fig. 4.1, is located in the wall of the bronchiole.

Name tissue **X and** outline the function of tissue **X** in the bronchiole.

tissue **X** = ...

.....

.....

.....

.....

.....

..... [3]

[Total: 8]

11. Nov/2022/Paper_23/No.6

Fig. 6.1 shows some of the events that occur when a red blood cell flows through a capillary in the lungs.

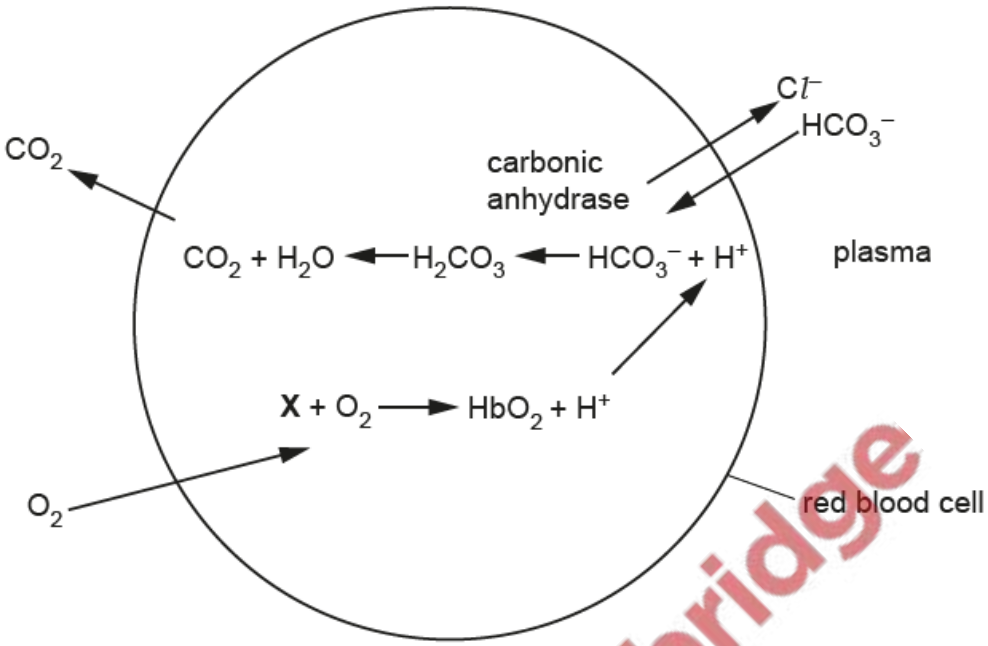


Fig. 6.1

(a) State why there are transport proteins in the membranes of red blood cells to allow the movement of hydrogencarbonate ions (HCO_3^-) and chloride ions (Cl^-).

.....

.....

..... [1]

(b) Fig. 6.1 shows that chloride ions move out of the red blood cells.

Explain why this movement is necessary when red blood cells flow through capillaries in the lungs.

.....

.....

..... [1]

(c) State why carbon dioxide molecules diffuse from the red blood cells into the plasma.

.....

..... [1]

(d) State the name of the compound indicated by **X**.

.....

..... [1]

[Total: 4]