# 11. Gas exchange in humans

## 11.1 Gas exchange in humans

## Paper 1 and 2

Question Paper

# Paper 1

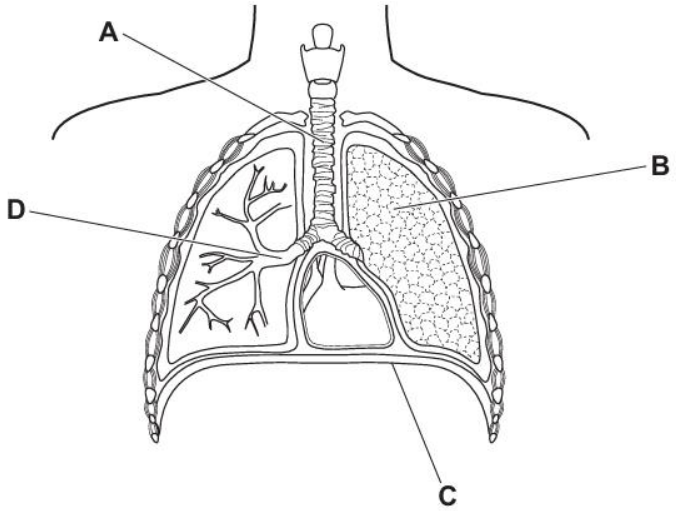
**Questions are applicable for both core and extended candidates**

1 Which row matches a gas in expired air with a substance that can be used to test for the presence of that gas?

| | gas present in expired air | test substance |
|---|---|---|
| **A** | carbon dioxide | DCPIP |
| **B** | carbon dioxide | limewater |
| **C** | oxygen | DCPIP |
| **D** | oxygen | limewater |

2 The diagram shows the breathing system.

Which structure is the diaphragm?



3 Which colour does hydrogencarbonate indicator turn if the carbon dioxide concentration is increased?

**A** green

**B** red

**C** violet

**D** yellow

4 Which table correctly shows the difference in composition of inspired air compared with expired air?

**A**

| | inspired air | expired air |
|---|---|---|
| oxygen | less | more |
| carbon dioxide | less | more |

**B**

| | inspired air | expired air |
|---|---|---|
| oxygen | less | more |
| carbon dioxide | more | less |

**C**

| | inspired air | expired air |
|---|---|---|
| oxygen | more | less |
| carbon dioxide | less | more |

**D**

| | inspired air | expired air |
|---|---|---|
| oxygen | more | less |
| carbon dioxide | more | less |

5 What is the site of gas exchange in humans?

**A** nose

**B** alveoli

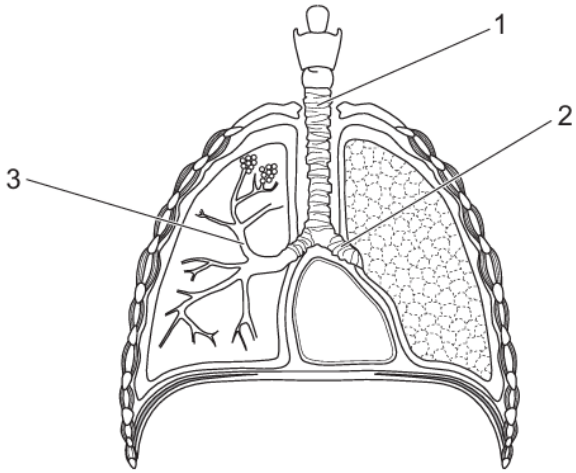
**C** bronchus

**D** trachea

6 What is the composition of expired air compared with inspired air?

| | carbon dioxide | oxygen | water vapour |
|---|---|---|---|
| **A** | decreased | increased | increased |
| **B** | decreased | decreased | increased |
| **C** | increased | decreased | decreased |
| **D** | increased | decreased | increased |

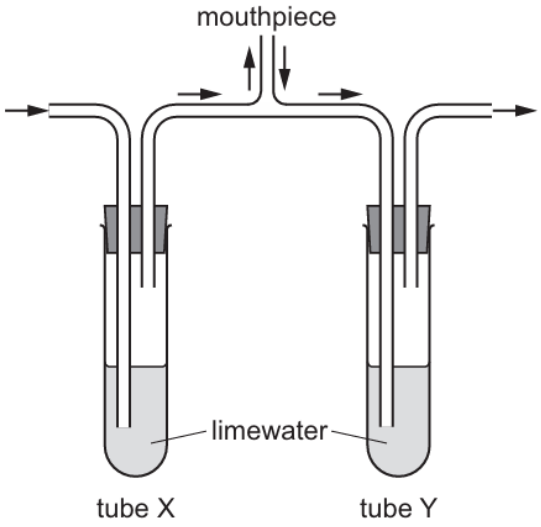
7 The diagram shows the human breathing system.




What are the labelled structures?

| | 1 | 2 | 3 |
|---|---|---|---|
| **A** | bronchus | bronchiole | trachea |
| **B** | bronchiole | bronchus | trachea |
| **C** | trachea | bronchus | bronchiole |
| **D** | trachea | diaphragm | bronchus |

8 A student investigated gas exchange using the apparatus shown.




What would be the appearance of the limewater in tube X and tube Y after breathing in and out of the mouthpiece for one minute?

| | tube X | tube Y |
|---|---|---|
| **A** | clear | clear |
| **B** | clear | cloudy |
| **C** | cloudy | clear |
| **D** | cloudy | cloudy |

9 What is the pathway of expired air as it travels out of the body?

**A** alveoli → trachea → bronchiole → bronchi

**B** alveoli → bronchiole → bronchi → trachea

**C** trachea → alveoli → bronchiole → bronchi

**D** trachea → bronchi → bronchiole → alveoli

10 What are features of gas exchange surfaces in animals?

**A** thick-walled and large surface area

**B** thick-walled and small surface area

**C** thin-walled and small surface area

**D** thin-walled and large surface area

11 Which chemical can be used to show the presence of carbon dioxide gas?

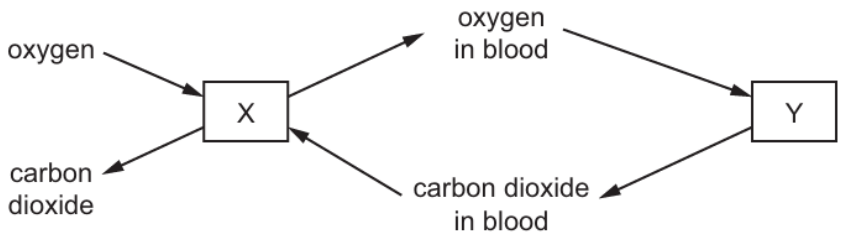
**A** Benedict's solution

**B** biuret solution

**C** ethanol

**D** limewater

12 The diagram represents the exchange of gases during breathing and during respiration in the body.




What is represented by X?

**A** heart

**B** kidneys

**C** liver

**D** lungs

13 What is the approximate percentage of oxygen in expired air?

**A** 0.04% **B** 4% **C** 16% **D** 21%

14 A person lives in a climate where the air is very dry.

Which row correctly compares inspired air with expired air for this person?

| | inspired air | expired air |
|---|---|---|
| **A** | higher carbon dioxide concentration | higher oxygen concentration |
| **B** | lower water vapour concentration | higher carbon dioxide concentration |
| **C** | lower oxygen concentration | higher water vapour concentration |
| **D** | lower carbon dioxide concentration | lower water vapour concentration |

15 The photographs show a positive test for the presence of carbon dioxide gas.

test-tube at the start

test-tube at the end

Which reagent is being used in the test-tube?

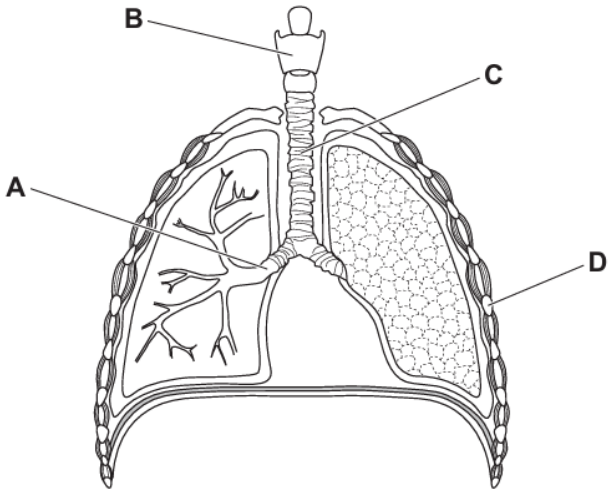
**A** Benedict's

**B** biuret

**C** DCPIP

**D** limewater

16 Which structure is a bronchus?




17 Which shows the correct order of structures that air travels through when a human breathes in?

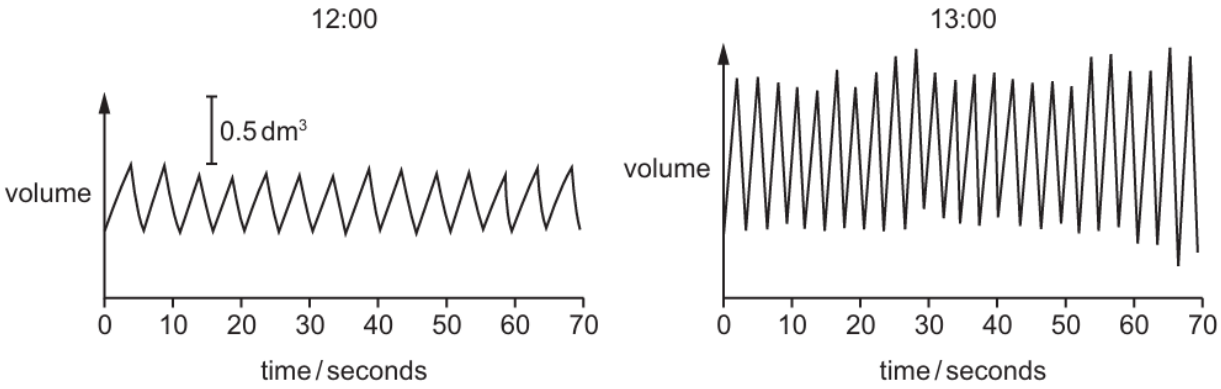
**A** alveoli → trachea → bronchioles → bronchi

**B** trachea → bronchi → bronchioles → alveoli

**C** alveoli → bronchioles → bronchi → trachea

**D** trachea → bronchioles → bronchi → alveoli

18 The diagrams show the depth and rate of breathing in a person at 12:00 and 13:00.

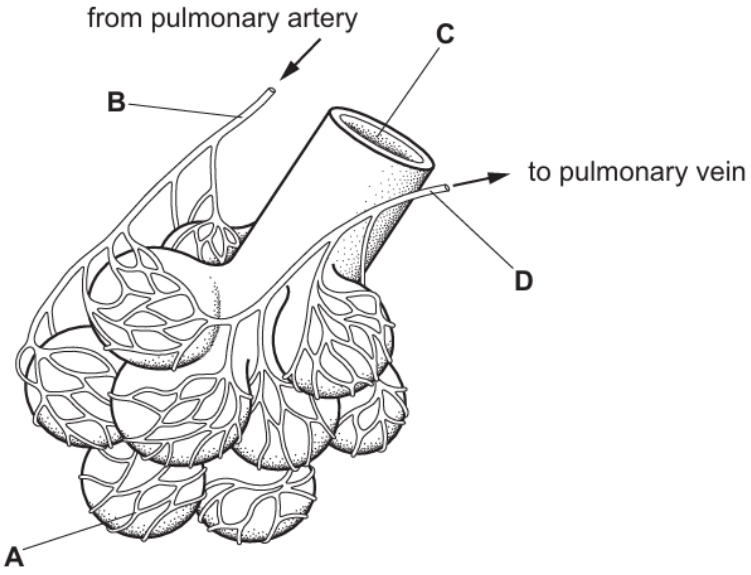



What happens to the person's breathing between 12:00 and 13:00?

| | depth of breathing | rate of breathing |
|---|---|---|
| **A** | decreases | decreases |
| **B** | decreases | increases |
| **C** | increases | decreases |
| **D** | increases | increases |

19 The diagram shows some of the structures in a human lung.

Where is the carbon dioxide concentration highest?



20 What is the approximate percentage of oxygen contained in the air breathed out of the lungs?

**A** 0% **B** 4% **C** 16% **D** 20%

21 What is the site of gas exchange in humans?

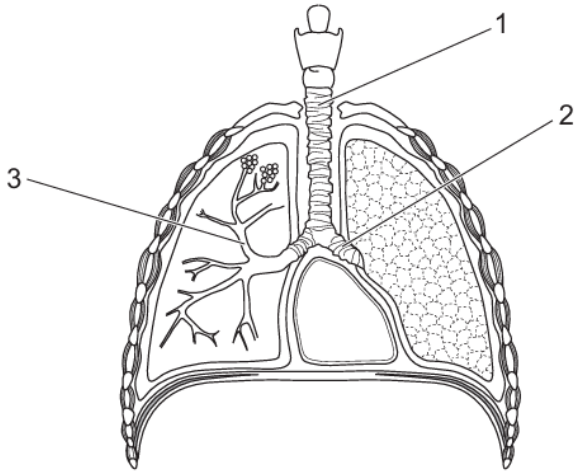
**A** nose

**B** alveoli

**C** bronchus

**D** trachea

22 The diagram shows the breathing system.



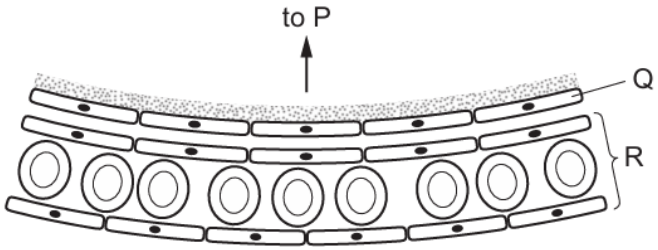

What are the labelled structures?

| | 1 | 2 | 3 |
|---|---|---|---|
| **A** | bronchus | bronchiole | trachea |
| **B** | bronchiole | bronchus | trachea |
| **C** | trachea | bronchus | bronchiole |
| **D** | trachea | diaphragm | bronchus |

23 Which row shows the approximate percentage of gases in expired air?

| | percentage of carbon dioxide | percentage of oxygen |
|---|---|---|
| **A** | 12 | 9 |
| **B** | 4 | 16 |
| **C** | 24 | 24 |
| **D** | 27 | 20 |

24 The diagram shows part of the human gas exchange system.




Which row identifies P, Q and R?

| | P | Q | R |
|---|---|---|---|
| **A** | alveolus wall | capillary wall | vein |
| **B** | bronchiole | alveolus wall | capillary |
| **C** | capillary | layer of moisture | bronchiole |
| **D** | alveolus wall | bronchiole | capillary |

# Paper 2

**Questions are applicable for both core and extended candidates unless indicated in the question**

25 What are the functions of the diaphragm and the cilia in the human gas exchange system? **(extended only)**

| | diaphragm | cilia |
|---|---|---|
| **A** | contracts to cause breathing in | carry mucus to the throat |
| **B** | contracts to cause breathing out | trap bacteria from the air |
| **C** | relaxes to cause breathing in | filter dust from the air |
| **D** | relaxes to cause breathing out | produce mucus |

26 These changes occur in the human body during exercise.

1 breathing rate increases

2 the rate of respiration increases

3 nerve impulses sent from the brain to the intercostal muscles and diaphragm

4 receptors in the brain detect increased concentration of carbon dioxide in the blood

What is the correct order for these changes? **(extended only)**

**A** $1 \rightarrow 2 \rightarrow 4 \rightarrow 3$

**B** $1 \rightarrow 3 \rightarrow 4 \rightarrow 2$

**C** $2 \rightarrow 1 \rightarrow 4 \rightarrow 3$

**D** $2 \rightarrow 4 \rightarrow 3 \rightarrow 1$

27 What causes air to enter the lungs? **(extended only)**

| | external intercostal muscles | volume of thorax | air pressure in thorax |
|---|---|---|---|
| **A** | contract | decreases | decreases |
| **B** | relax | decreases | increases |
| **C** | contract | increases | decreases |
| **D** | relax | increases | increases |

28 The intercostal muscles and diaphragm contract and relax during ventilation.

Which row shows the actions of muscles that result in the largest volume inside the thorax? **(extended only)**

| | internal intercostal muscles | diaphragm |
|---|---|---|
| **A** | relax | contract |
| **B** | relax | relax |
| **C** | contract | contract |
| **D** | contract | relax |

29 Which table correctly shows the difference in composition of inspired air compared with expired air?

**A**

| | inspired air | expired air |
|---|---|---|
| oxygen | less | more |
| carbon dioxide | less | more |

**B**

| | inspired air | expired air |
|---|---|---|
| oxygen | less | more |
| carbon dioxide | more | less |

**C**

| | inspired air | expired air |
|---|---|---|
| oxygen | more | less |
| carbon dioxide | less | more |

**D**

| | inspired air | expired air |
|---|---|---|
| oxygen | more | less |
| carbon dioxide | more | less |

30 Which row shows the correct combination of muscle contractions and the pressure in the thorax when breathing out? **(extended only)**

| | internal intercostal muscles | external intercostal muscles | diaphragm | pressure in thorax |
|---|---|---|---|---|
| **A** | contracted | contracted | contracted | high |
| **B** | contracted | relaxed | relaxed | high |
| **C** | relaxed | contracted | contracted | high |
| **D** | relaxed | relaxed | relaxed | low |

31 What is the composition of expired air compared with inspired air?

| | carbon dioxide | oxygen | water vapour |
|---|---|---|---|
| **A** | decreased | increased | increased |
| **B** | decreased | decreased | increased |
| **C** | increased | decreased | decreased |
| **D** | increased | decreased | increased |

32 During exercise, receptors detect a change in the blood and cause the breathing rate to increase.

Which change do the receptors detect and where are they found in the body? **(extended only)**

| | change detected in the blood | location of receptors |
|---|---|---|
| **A** | carbon dioxide increases | brain |
| **B** | carbon dioxide increases | lung |
| **C** | carbon dioxide decreases | brain |
| **D** | carbon dioxide decreases | lung |

33 During inspiration, the processes listed take place.

P volume of the thorax increases

Q air rushes into the lungs

R pressure in the thorax decreases

S external intercostal muscles contract

T diaphragm moves down, ribs move upwards and outwards

What is the correct sequence for these processes? **(extended only)**

**A** Q → P → S → R → T

**B** S → T → P → R → Q

**C** Q → P → S → T → R

**D** S → Q → R → P → T

34 Different stages in the process of expiration are listed.

1 Rib cage moves downwards and inwards.

2 Volume of thorax decreases and pressure in lungs increases.

3 Air is pushed out of lungs.

4 Diaphragm and external intercostal muscles relax.

What is the correct order of these stages? **(extended only)**

**A** 1 → 2 → 3 → 4

**B** 1 → 4 → 2 → 3

**C** 4 → 3 → 2 → 1

**D** 4 → 1 → 2 → 3

35 What causes the air pressure in the lungs to decrease during breathing in? **(extended only)**

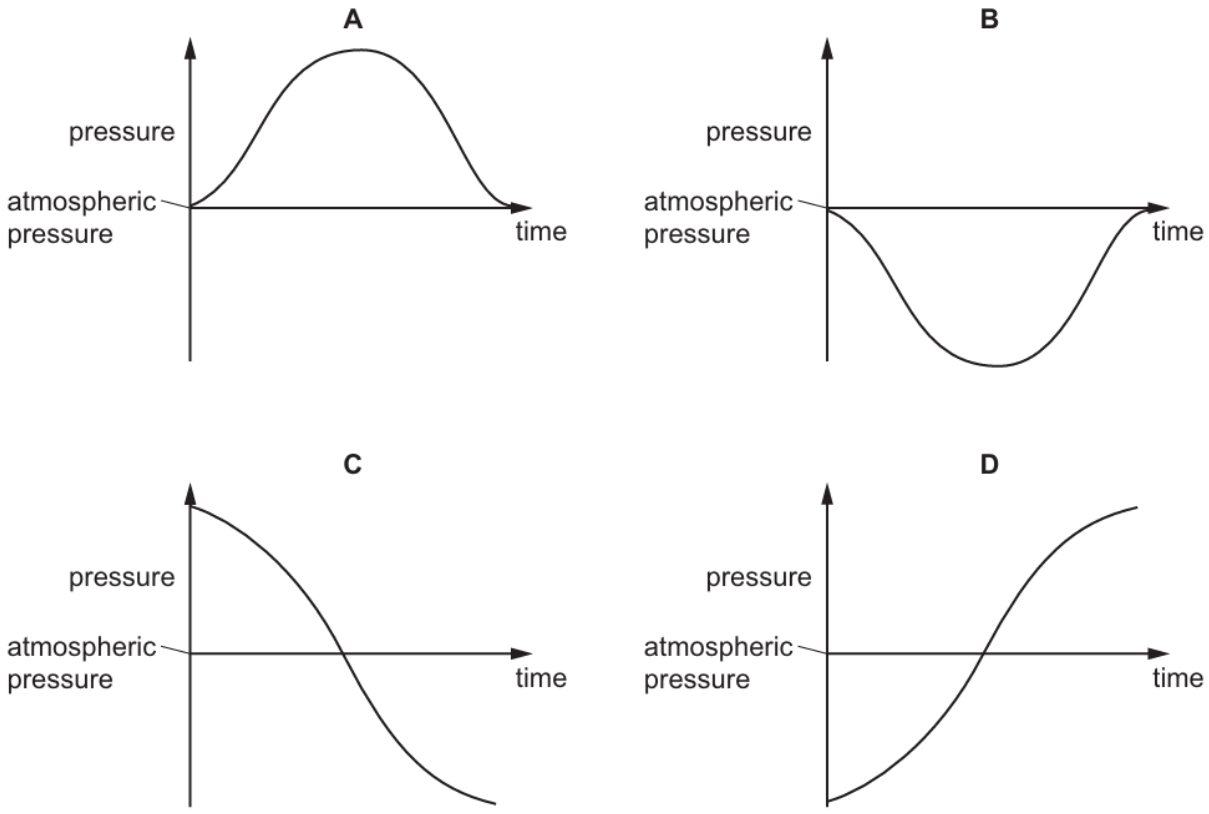
**A** contraction of the external intercostal muscles and diaphragm

**B** expansion of the lungs causing a decrease in the volume of the alveoli

**C** outward movement of the ribs and upward movement of the diaphragm

**D** higher pressure in the atmosphere than in the lungs causing the alveoli to expand

36 Which graph shows how the pressure inside the lungs changes when taking one breath in? **(extended only)**




37 Which sequence of changes takes place when we breathe in? **(extended only)**

**A** diaphragm contracts → volume of thorax increases → pressure in lungs decreases

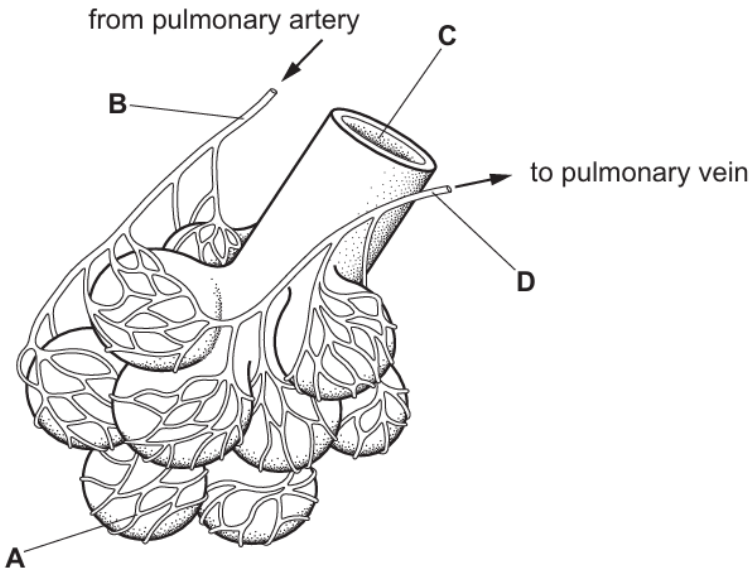
**B** diaphragm contracts → volume of thorax increases → pressure in lungs increases

**C** diaphragm relaxes → volume of thorax increases → pressure in lungs decreases

**D** diaphragm relaxes → volume of thorax increases → pressure in lungs increases

38 The diagram shows some of the structures in a human lung.

Where is the carbon dioxide concentration highest?




39 What is the approximate percentage of oxygen contained in the air breathed out of the lungs?

**A** 0% **B** 4% **C** 16% **D** 20%

40 What is the site of gas exchange in humans?

**A** nose

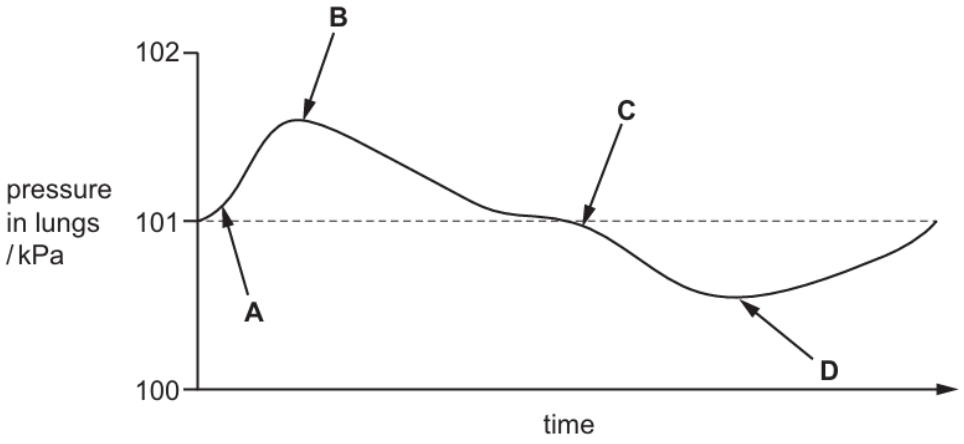
**B** alveoli

**C** bronchus

**D** trachea

41 The diagram illustrates changes in air pressure taking place inside the lungs during a complete cycle of breathing. Atmospheric pressure is 101 kPa.

At which point on the diagram are the ribs beginning to be lowered? **(extended only)**




42 Which row shows the approximate percentage of gases in expired air?

| | percentage of carbon dioxide | percentage of oxygen |
|---|---|---|
| **A** | 12 | 9 |
| **B** | 4 | 16 |
| **C** | 24 | 24 |
| **D** | 27 | 20 |