

Human gas exchange

Question Paper

Level	O Level
Subject	Biology
Exam Board	Cambridge International Examinations
Topic	Respiration
Sub Topic	Human gas exchange
Booklet	Question Paper

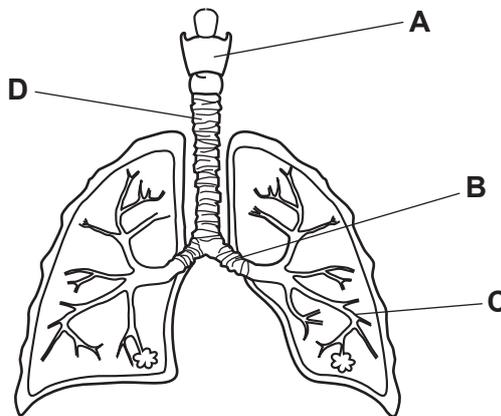
Time Allowed: 56 minutes

Score: /46

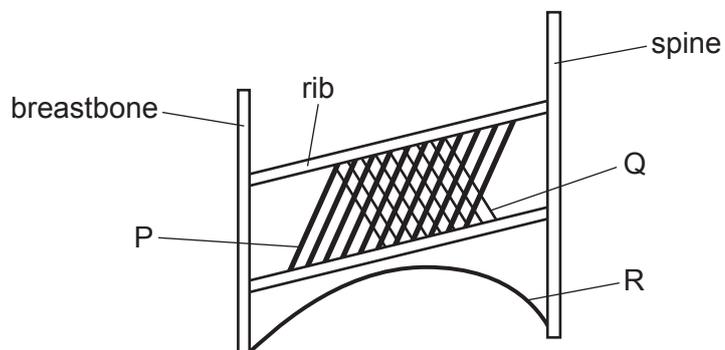
Percentage: /100

1 The diagram shows the human gas exchange system.

Which structure is the trachea?



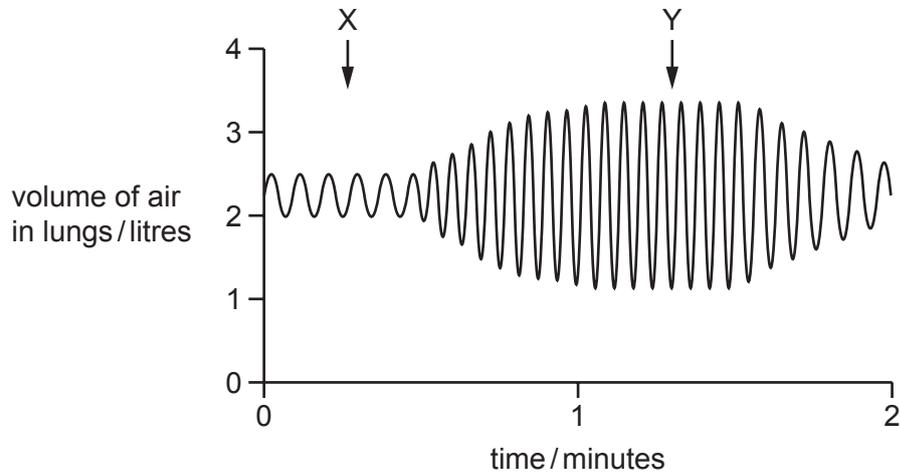
2 The diagram represents some of the muscles involved with breathing.



Which muscles are contracting during breathing in?

- A** P and Q **B** Q and R **C** P and R **D** P, Q and R

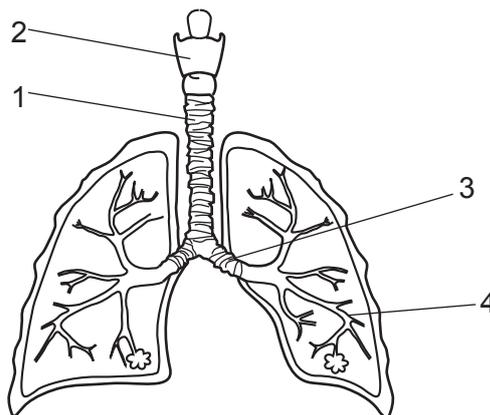
3 The diagram shows changes in the volume of a person’s lungs over a period of two minutes.



What could cause the change in the pattern of the graph between points X and Y?

- A changing from running to walking
- B changing from walking to running
- C increased frequency of contractions of the internal intercostal muscles
- D increased strength of contractions of the internal intercostal muscles

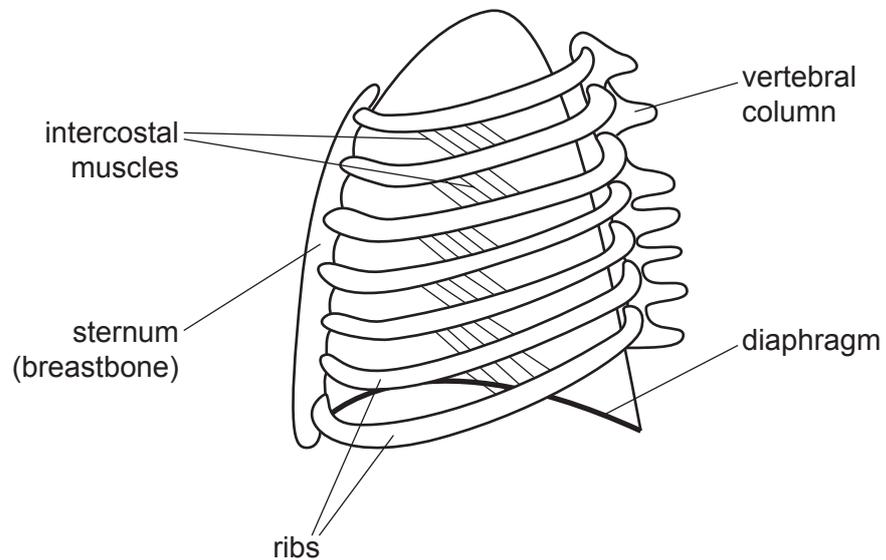
4 The diagram shows part of the human gas exchange system.



What are the labelled structures?

	larynx	trachea	bronchus	bronchiole
A	1	2	3	4
B	2	1	3	4
C	1	2	4	3
D	2	1	4	3

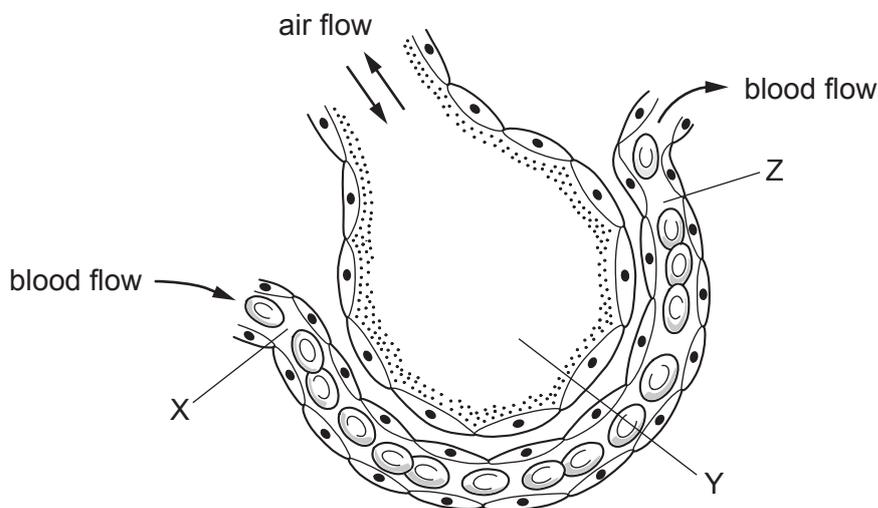
- 5 The diagram shows the rib cage and some of the muscles involved in breathing as seen from the side.



What happens when the intercostal muscles shown in the diagram contract?

- A** The diaphragm moves down.
- B** The lungs inflate.
- C** The pressure inside the lungs decreases.
- D** The ribs move down.

6 The diagram shows a section of an alveolus and a capillary in a lung.



What are the relative concentrations of **carbon dioxide** at X, Y and Z?

	X	Y	Z
A	high	high	high
B	high	low	low
C	low	high	high
D	low	high	low

7 The table shows the effect of exercise on the rate and depth of breathing.

	breathing rate / breaths per minute	volume of each breath / cm ³
at rest	12	500
after exercise	24	1000

What is the increase in the volume of air exchanged per minute after exercise, compared to at rest?

- A** 1000 cm³ **B** 6000 cm³ **C** 18000 cm³ **D** 24 000 cm³

8 What is the composition of expired air?

gas	composition (%)			
	A	B	C	D
oxygen	4	16	16	21
carbon dioxide	21	4	0.04	0.04
nitrogen	74	78	78	78
water vapour	variable	saturated	saturated	variable

9 What happens when we breathe out with force?

	diaphragm	external intercostal muscles	internal intercostal muscles
A	contracts	contract	relax
B	contracts	relax	relax
C	relaxes	contract	contract
D	relaxes	relax	contract

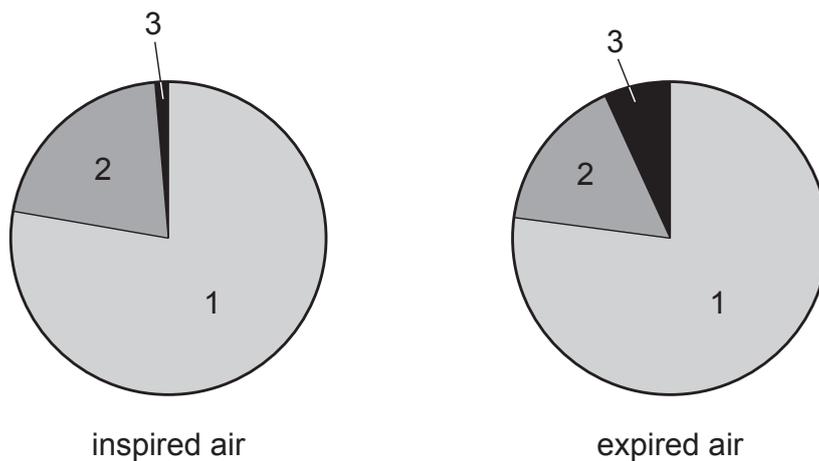
10 Which changes occur as a person exercises?

	depth of breathing	breathing rate
A	decreases	decreases
B	decreases	increases
C	increases	decreases
D	increases	increases

11 What happens to the diaphragm and the external intercostal muscles when breathing in?

	diaphragm	external intercostal muscles
A	contracts	contract
B	contracts	relax
C	relaxes	contract
D	relaxes	relax

12 The pie charts show the proportion of gases in samples of dried inspired and expired air.

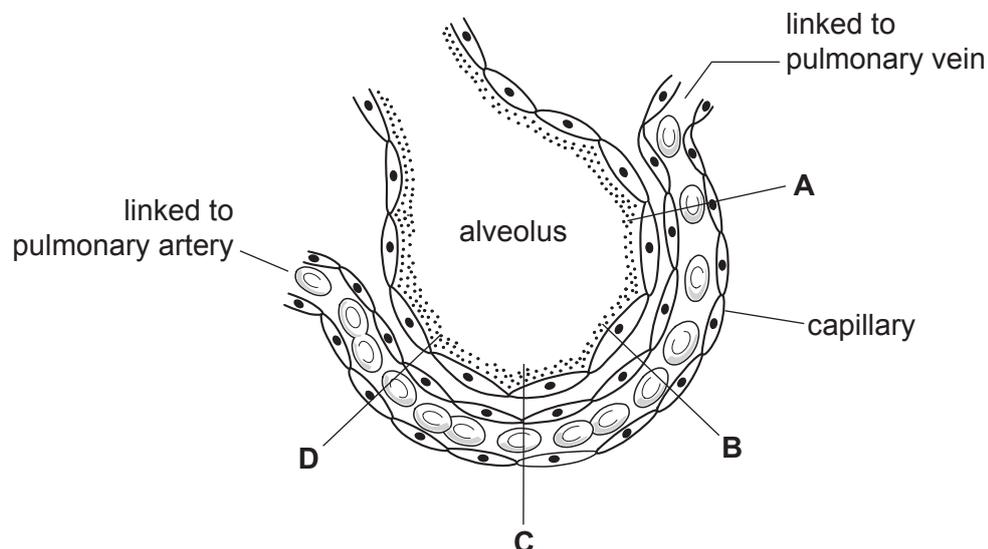


Which segments represent which gases?

	segment 1	segment 2	segment 3
A	nitrogen	other gases	oxygen
B	nitrogen	oxygen	other gases
C	oxygen	other gases	nitrogen
D	oxygen	other gases	carbon dioxide

13 The diagram shows an alveolus and an associated blood capillary.

At which point will the greatest rate of diffusion of carbon dioxide occur?



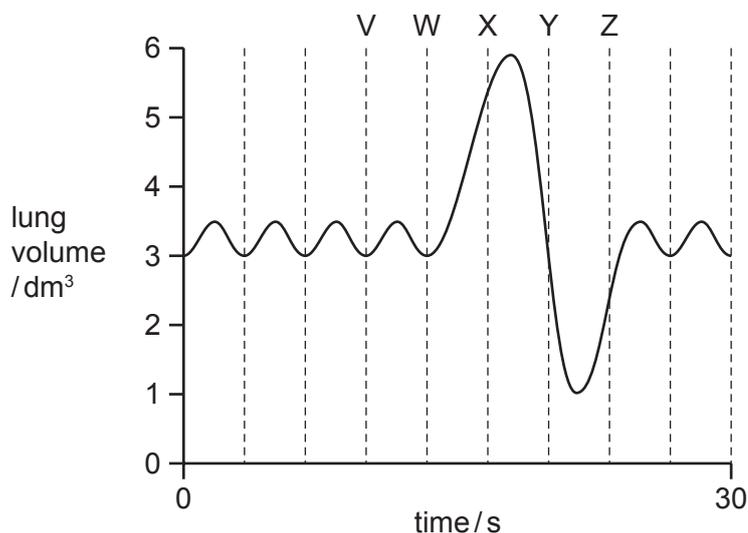
14 What happens to the volume of the thorax and the air pressure in the lungs during breathing out?

	volume of thorax	air pressure in lungs
A	decreases	increases
B	decreases	remains constant
C	increases	increases
D	increases	remains constant

15 What happens to the diaphragm muscles and to the internal and external intercostal muscles when a person breathes out during exercise?

	diaphragm	external intercostal muscles	internal intercostal muscles
A	contracts	contract	relax
B	contracts	relax	contract
C	relaxes	contract	relax
D	relaxes	relax	contract

16 The graph shows changes in the amount of air in a person’s lungs over a period of 30 seconds.



Between which time periods is the rate of breathing fastest?

- A** V to W **B** W to X **C** X to Y **D** Y to Z

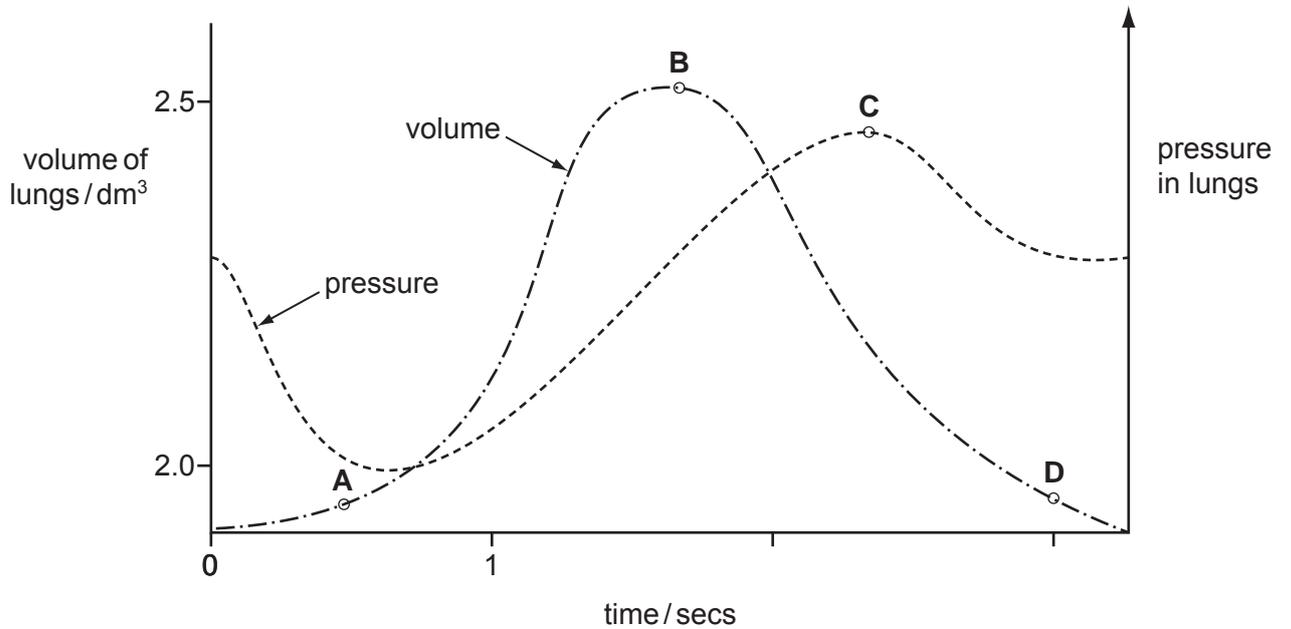
17 In the human breathing system, which features maintain the carbon dioxide gradient between the alveoli and the outside air?

- 1 blood continually pumped to the alveoli
- 2 breathing in and out
- 3 moist alveolar surfaces
- 4 thin alveolar walls

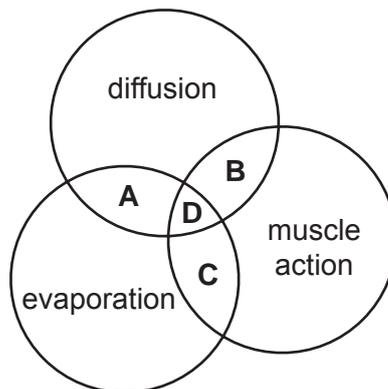
- A** 1 and 2 **B** 1 and 4 **C** 2 and 3 **D** 3 and 4

18 The graph shows how the pressure and volume inside the lungs change during one complete breath.

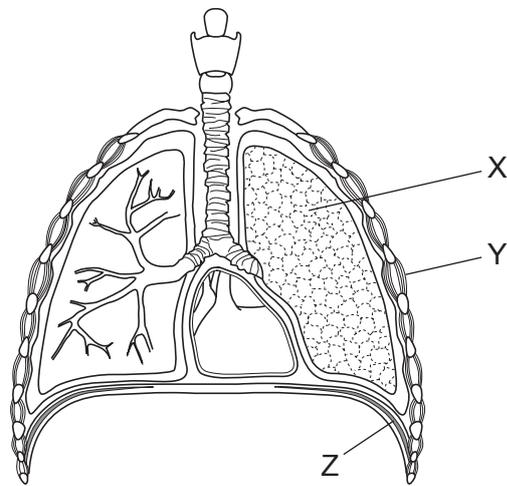
At which point are the muscles of the diaphragm starting to contract?



19 Which processes help the excretion of carbon dioxide from the lungs?



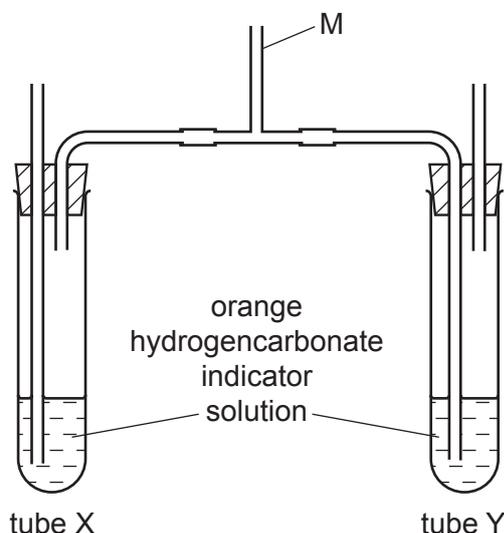
20 The diagram represents the human respiratory system.



Which structures contain muscles that contract when breathing in?

- A X only
- B X and Y only
- C Y and Z only
- D X, Y and Z

21 The diagram shows apparatus used to investigate breathing.



At the start, both tubes contain orange hydrogencarbonate indicator solution.

The solution is orange when atmospheric air passes through it.

The solution changes to red when air with less carbon dioxide passes through it.

The solution changes to yellow when air with more carbon dioxide passes through it.

Which changes occur to the hydrogencarbonate indicator solution in tubes X and Y when a person breathes in and out through the tube M?

	solution in tube X	solution in tube Y
A	becomes red	becomes yellow
B	becomes yellow	becomes red
C	stays orange	becomes red
D	stays orange	becomes yellow

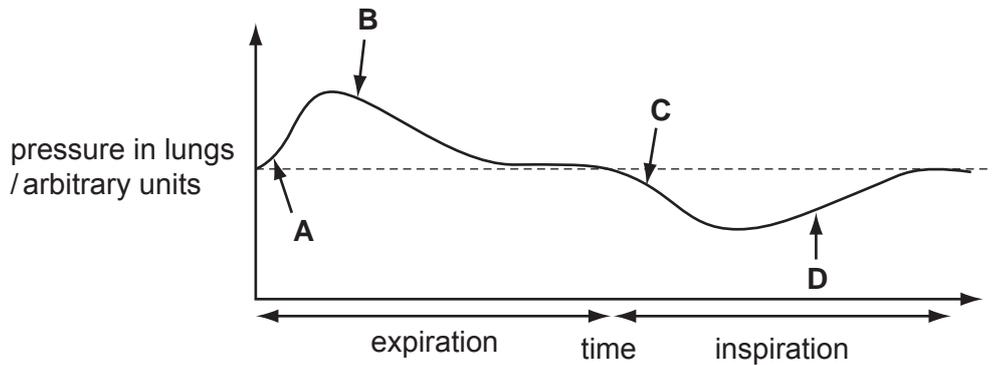
22 The table shows the percentage composition of four samples of air.

Which sample has been breathed out by a person?

	oxygen	carbon dioxide	water vapour
A	16	0.3	saturated
B	16	4	saturated
C	21	0.03	trace
D	21	3	trace

23 The diagram illustrates changes in air pressure taking place inside the lungs during a complete cycle of breathing.

Which position on the graph corresponds to the point at which the ribs are beginning to be lowered?



24 What properties make the alveoli walls efficient at gas exchange?

	elastic tissue in walls	equal oxygen concentrations inside and out	walls one cell thick
A	✓	✓	x
B	✓	✓	✓
C	✓	x	✓
D	x	✓	✓

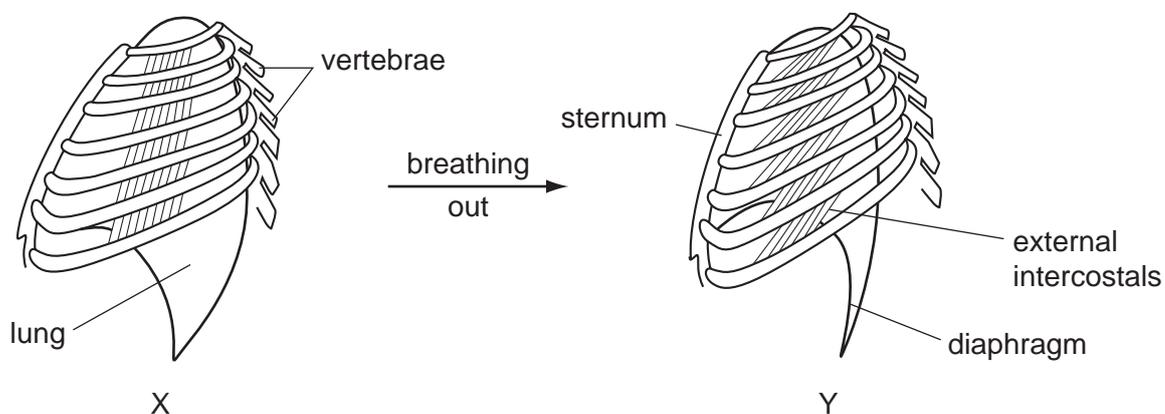
25 Which muscles contract when breathing out powerfully, such as when playing the trumpet?

	diaphragm	external intercostals	internal intercostals
A	no	no	yes
B	no	yes	no
C	yes	no	yes
D	yes	yes	no

26 What happens to the diaphragm when breathing in?

	muscle action	shape becomes
A	contraction	domed
B	relaxation	domed
C	contraction	flattened
D	relaxation	flattened

27 The diagram shows the ribs and some of the muscles used in breathing.



Which muscles relax in moving from position X to position Y?

	diaphragm	external intercostals
A	no	no
B	no	yes
C	yes	no
D	yes	yes

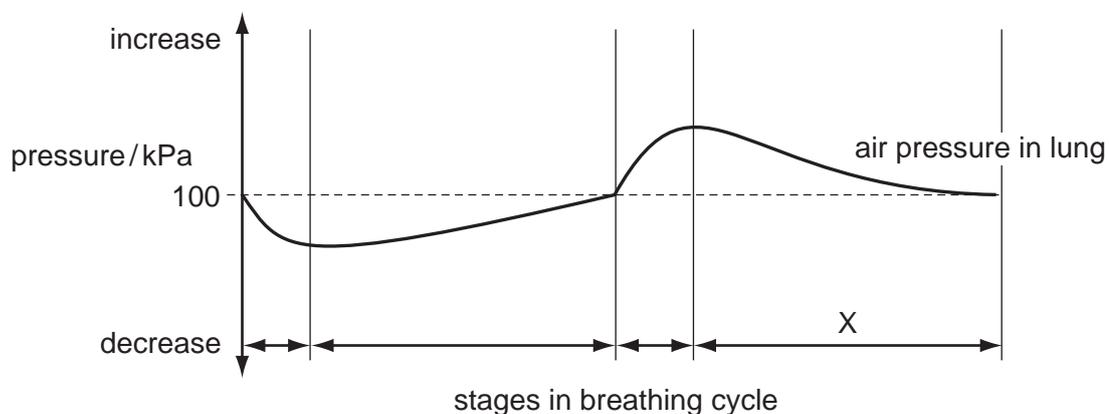
28 The table shows the composition of inspired and expired air.

	inspired air %	expired air %
carbon dioxide	0.04	X
oxygen	20	16
nitrogen and inert gases	79.96	Y

What are the likely percentages at X and Y?

	X	Y
A	0.04	83.96
B	4.04	79.96
C	20.04	63.96
D	83.96	0.04

29 The graph shows changes in the air pressure within the lungs during one breathing cycle.



What causes the change in air pressure during stage X?

- A** contraction of diaphragm muscles
- B** increase in volume of lungs
- C** outflow of air from lungs
- D** relaxation of internal intercostal muscles

30 What do the cilia do in the bronchi of the lungs?

	trap bacteria	move mucus out of the lungs
A	✓	✓
B	✓	✗
C	✗	✓
D	✗	✗

key

✓ = function of the cilia

✗ = not a function of the cilia

31 The following changes take place in an athlete’s body during a 100m race.

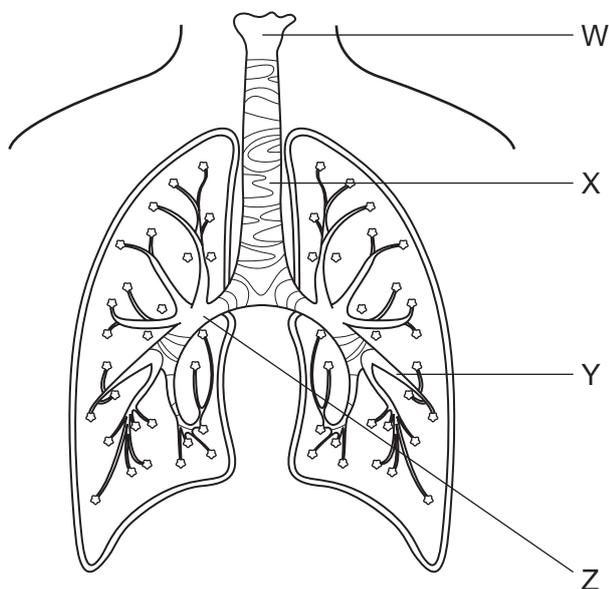
Which change occurs first?

- A** increased availability of oxygen to muscles
- B** increased breathing rate
- C** increased carbon dioxide concentration in the blood
- D** increased production of carbon dioxide by muscles

32 What happens to the muscles of the diaphragm, the external intercostal muscles and the position of the diaphragm when breathing in?

	diaphragm muscles	external intercostal muscles	diaphragm movement
A	contract	contract	downward
B	contract	relax	upward
C	relax	contract	upward
D	relax	relax	downward

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



What are W, X, Y and Z?

	bronchus	bronchiole	larynx	trachea
A	W	X	Z	Y
B	X	Z	Y	W
C	Y	W	X	Z
D	Z	Y	W	X

34 When breathing out, which changes occur in the volume of the thorax, the rib cage and the diaphragm?

	volume of thorax	rib cage	diaphragm
A	decreases	lowered	rises
B	decreases	raised	pulled down
C	increases	lowered	rises
D	increases	raised	pulled down

35 The composition of inhaled air and exhaled air is different.

Which analysis is correct?

	inhaled air	exhaled air
A	more carbon dioxide	less oxygen
B	less oxygen	less carbon dioxide
C	more oxygen	more carbon dioxide
D	less carbon dioxide	more oxygen

36 The table shows the composition of inspired and expired air.

	inspired air %	expired air %
oxygen	20	16
carbon dioxide	0.04	X
nitrogen and inert gases	79.96	Y

What are the likely percentages at X and Y?

	X	Y
A	0.04	83.96
B	4	80
C	20	64
D	83.96	0.04

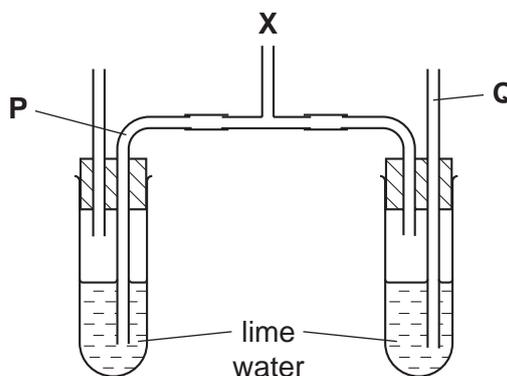
37 Which feature of alveoli decreases the distance over which oxygen and carbon dioxide molecules diffuse?

- A** Each alveolus has a large blood supply.
- B** Each alveolus is only 0.1-0.2 mm in diameter.
- C** There are approximately 150 million alveoli in each lung.
- D** The walls of the alveoli are only one cell thick.

38 Which changes occur as a person breathes in deeply?

	diaphragm muscle	external intercostal muscles
A	contracts	contract
B	contracts	no change
C	relaxes	contract
D	relaxes	relax

39 The diagram shows apparatus to investigate inspired and expired air. A person breathes in and out through tube X.



What are the carbon dioxide concentrations at **P** and **Q**?

	CO ₂ at P (%)	CO ₂ at Q (%)
A	16	20
B	0.04	4.00
C	4.00	0.04
D	20	16

40 The table shows the percentage composition of a gas in inspired and in expired air.

% composition	
inspired air	expired air
21.0	16.0

What is the gas?

- A carbon dioxide
- B nitrogen
- C oxygen
- D water vapour

41 Through which sequence does carbon dioxide pass as it leaves the lungs?

- A alveolar wall → in the alveoli → blood → capillary wall
- B blood → capillary wall → alveolar wall → in the alveoli
- C capillary wall → blood → in the alveoli → alveolar wall
- D in the alveoli → alveolar wall → capillary wall → blood

42 The table shows ventilation rates of an adult while resting and while exercising.

adult	volume of air inhaled per breath/cm ³	number of breaths per minute	volume of air exchanged per minute/cm ³
resting	400	20	8000
exercising	1200	40	?

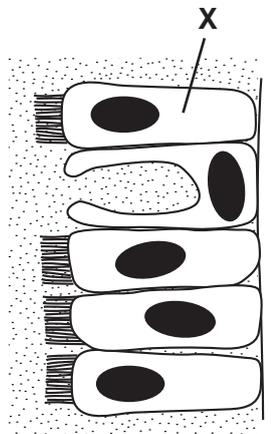
What is the volume of air exchanged per minute while exercising?

- A 16 000 cm³
- B 24 000 cm³
- C 32 000 cm³
- D 48 000 cm³

43 Why does emphysema cause severe breathlessness?

- A The alveoli become coated with tar.
- B The cilia lining the trachea are destroyed.
- C The lungs become cancerous.
- D The surface area of the lungs is reduced.

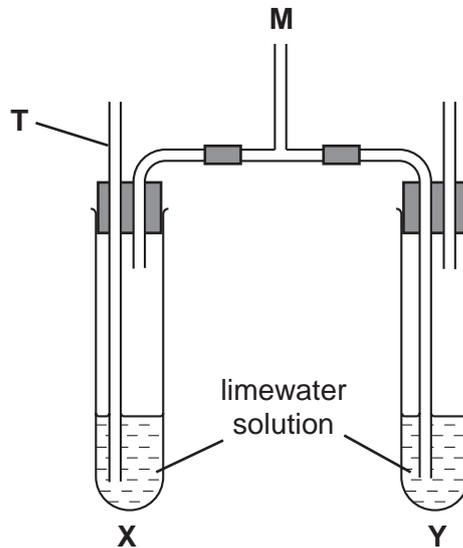
44 The diagram shows part of the lining of the human trachea.



What is the function of cell **X**?

- A gaseous exchange
- B mucus removal
- C phagocytosis
- D secretion of mucus

45 The apparatus shown is used to investigate gas exchange during breathing.



What would occur when a person breaths out through tube **M**?

- A** The solutions in **X** and **Y** both turn cloudy.
- B** The solution in **X** remains clear, but that in **Y** turns cloudy.
- C** The solution in **X** turns cloudy, but that in **Y** remains clear.
- D** The solution in **X** is forced out through the tube **T**.

46 Which sequence of structures does an oxygen molecule pass through as it is taken into the body?

	first	—————→			last		
A	larynx	→	trachea	→	bronchioles	→	capillaries
B	trachea	→	larynx	→	bronchioles	→	capillaries
C	larynx	→	trachea	→	capillaries	→	bronchioles
D	trachea	→	larynx	→	capillaries	→	bronchioles