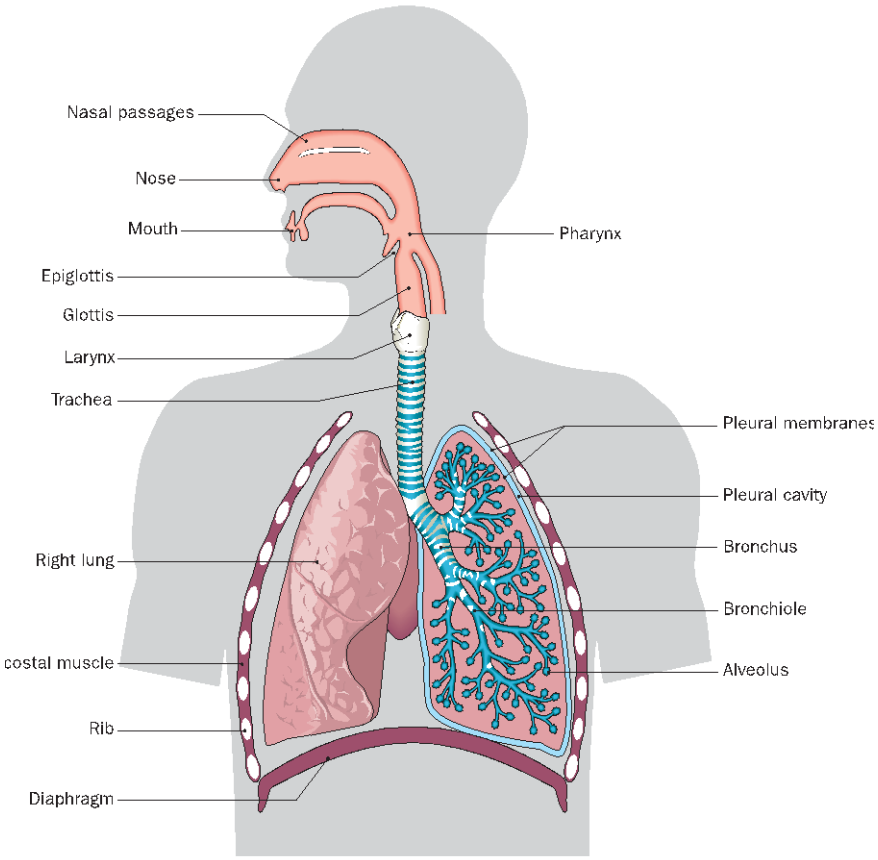
Name:

3.4 Breathing System	**Objectives**
3.4.4 Lungs & Breathing	1. Draw and identify the breathing tract in humans 2. Give the function of the parts: Nasal and buccal cavities, pharynx, epiglottis, glottis, larynx, trachea, bronchi, bronchioles, alveoli 3. Explain the essential features of the alveoli and capillaries as surfaces over which gas exchange takes place 4. Describe the mechanism of breathing -- how we inhale and exhale air 5. Give the role of the diaphragm, the intercostal muscles and brain (exclude CO2, levels) in breathing 6. Explain pressure changes in the thoracic cavity during breathing 7. Outline gaseous exchange in alveoli 8. Give the role of haemoglobin in oxygen transport 9. Explain source of carbon dioxide from the plasma 10. Explain water vapour exhalation. 11. Carry out the breathing exchange experiment using limewater or bicarbonate indicator 12. Describe the experiment to show the effect of exercise on the breathing rate 13. Compare healthy lungs with lungs of unhealthy respiratory systems and note the differences 14. Demonstrate the effect of cigarette smoking using cotton wool, bicarbonate indicator, etc 15. Explain one breathing disorder, e.g. from asthma and bronchitis 16. Give possible causes of the disorder 17. Describe prevention and treatment of the disorder

Gaseous exchange (external respiration) refers to the need to take in oxygen and release carbon dioxide.

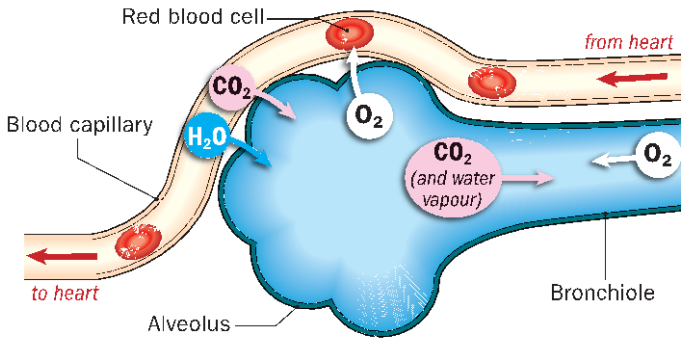
Respiratory organs



1. Breathing in through the **nose.** **This** filters (by hairs and mucus), warms and moistens the air, which can then diffuse more easily from lungs into bloodstream.
2. The **trachea** is made of inflexible cartilage, which keeps it open, otherwise air pressure changes or movements of the neck might cause temporary suffocation. Mucus-secreting cells secrete mucus to trap particles such as dust, bacteria and viruses and cilia sweep up the mucus into the oesophagus where it is swallowed. Covered by **epiglottis** to prevent food entering. Contains the **larynx** (voice -box).
3. The **alveoli** allow diffusion by being one-celled thick, having a moist lining and being enclosed in an extensive network of capillaries.
4. Oxygen dissolves in the film of water lining the alveolus and then diffuses through the alveolus and capillary walls into the red blood corpuscles in the blood. Here it combines with haemoglobin to form oxyhaemoglobin
5. Carbon dioxide and water vapour diffuse from the blood plasma through the alveolar wall and into the film of water and then into the alveolus. Finally it is removed from the lungs during expiration. CO_2 is produced by respiration. Some dissolves in blood plasma, but most of it diffuses into the red blood cells. In the red cells an enzyme causes CO_2 to combine rapidly with water to form carbonic acid. This then splits in two forming hydrogen ions and hydrogen carbonate ions. The hydrogen carbonate ions diffuse out into the plasma.

Adaptations of alveoli for gas exchange:
1. Large surface area of contact between alveoli and blood capillaries - faster rate of gas exchange.
2. Alveoli and capillaries are only one-celled thick. The short distance between air and blood establishes a steep conc. gradient for rapid diffusion.
3. Slow blood flow gives max. time for oxygenation and excretion of carbon dioxide.
4. Alveoli are elastic for efficient inspiration and expiration.
5. Alveoli lining is moist - dissolved gases diffuse faster.

Gas exchange in alveolus:



Capillaries:

1. Capillaries are tightly packed (covering almost 90% of alveolar surface) - faster rate of exchange.
2. The capillaries are narrower in diameter than red blood corpuscles. Hence (1) a greater area of each R.B.C. is pressed against the capillary wall through which oxygen is diffusing and (2) R.B.C. are slowed down as they squeeze through the capillary thus increasing the time available for oxygen absorption. They have a tiny internal diameter

Protection of airways:

Hair and mucus in nose trap larger dust particles and some bacteria.
Mucus in trachea traps smaller foreign particles.
Cilia lining trachea move mucus with trapped particles upwards and out of airway - mucus is then swallowed.
Macrophages leave blood and roam alveoli to digest any foreign matter.

	Oxygen	Carbon dioxide	Nitrogen	Water vapour
Inspired air	20.9 %	0.03 %	79 %	1.27 % (variable)
Expired air	16.4 %	4.1 %	79%	6.2 % (saturated)

Oxygen is mostly (97%) transported by haemoglobin in RBC. 3% carried dissolved in plasma. Carbon dioxide is mostly (80%) carried dissolved in plasma, 20% carries by haemoglobin..

Expt.: To show that expired air contains more carbon dioxide than inspired air.

Breathing mechanism:

- **Inspiration:**

1. Brain detects a rise in CO_2 levels (occurs ≈ every 4 - 5 seconds when at rest) and sends a message, via nerves, to the intercostal muscles and diaphragm to contract.
2. As a result the ribs and sternum move up and outwards, the diaphragm flattens.
3. The volume of the thoracic cavity increases.
4. As the volume increases the pressure inside the lungs decreases (Boyle's law).
5. Hence air rushes in to the lungs to equalise the pressure (of the atmosphere and chest).

- **Expiration:**

1. Intercostal muscles and diaphragm relax - ribs and sternum move down and in and diaphragm becomes dome-shaped.
2. Volume of thoracic cavity decreases.
3. As a result air pressure on lung walls increases.
4. Therefore air is forced out of the lungs.

Note: inspiration is active (requires energy – muscles contract) expiration is passive.

Expt. Artificial lung experiment.

Inspiration:
When the rubber (diaphragm) is pulled down the volume increases, thus pressure decreases and the balloons inflate.
Expiration:
When the rubber is pushed up the volume decrease, pressure increases and the balloon deflates.

Mandatory activity: To show the effect of exercise on the rate of breathing.

Note:
Average breathing rate = 15 per min.
Exercise increases rate and depth of breathing. Breathing rate returns to normal faster in fitter individuals. If it falls below resting rate the person is breathing deeper.

Learn one breathing disorder

Asthma

Asthma is a difficulty in breathing caused by the narrowing of the smaller bronchioles. This is due to the contraction of the muscles in bronchiole walls and inflammation of the wall lining. Cells lining airways make more mucus(phlegm) than normal.

Typical symptoms include:

- itchy throat;
- coughing and wheezing;
- tightness of chest;
- lips and fingernails may turn blue;
- difficulty in talking and walking (breathlessness);
- nostrils flaring.

Cause:

- Common asthma triggers include allergens such as pollen, fruit mould, feathers, animal hair or fur, household dust and dust mites. Other allergens include cold air, perfumes, household chemicals, paint and air pollutants such as coal dust, chalk dust and cigarette smoke. Allergic reactions to medicines and foods also cause attacks.
- Lung infections - bacterial and viral infections and mucus from sinusitis.
- Exercise (especially in cold air)
- Stress/anxiety

Prevention of asthma attacks

- Identify your asthma triggers and avoid them. Tests can be done to identify precise allergens.
- Recognise the signs of an asthma attack beginning.
- Take preventive medicine before attacks are likely - especially when the air quality is poor or before exercise. Anti-inflammatories (steroid inhalers) used before any attacks. They coat the linings of the bronchioles and prevent any irritation or mucus build-up. They should be used regularly regardless of how the patient feels.
- Use a peak flow meter to indicate any change in the internal volume of your lungs.
- Avoid cigarette smoke.

Treatment
Bronchodilator inhalers relax the smooth muscle of bronchiole lining and cause them to dilate. Used during an asthma attack and gives relief by increasing the lung volume. In severe cases these drugs are given by inhalers.

Prevention:
Both medications can be taken by inhalers.

Bronchitis

Bronchitis is an inflammation of the bronchi.
Acute bronchitis lasts for a few days.

Cause:

Most often caused by a viral infection e.g. common cold or following influenza. Sometimes bacteria such as Streptococci and staphylococci may be the cause.

Symptoms:

Coughing - due to over-production of mucus that is congesting and irritating.

Chronic bronchitis (long-term bronchitis)

A common disease of the middle-aged and elderly.
It is an inflammation and eventual scarring of the bronchial tubes.

Treatment:

- Steam inhalation and expectorant cough mixtures help to loosen the mucus.
- If bacteria are involved antibiotics can be used.

Symptoms include:

- A shortness of breath - even at rest;
- A persistent cough - including coughing during the night;
- Increased mucus with frequent clearing of throat.

Causes

- Exposure to cold, damp, dust and cigarette smoke(90%).
- Repeated chest infections produce slow destruction of lung tissue and overproduction of mucus.

Treatment

- Stop smoking!
- Use bronchodilators to help breathing. In extreme cases an oxygen cylinder may be needed.
- Take antibiotics to treat lung infections.
- Exercise to strengthen muscles, clear mucus and improve breathing.

Prevention

Avoid cigarette smoke and poor quality air.

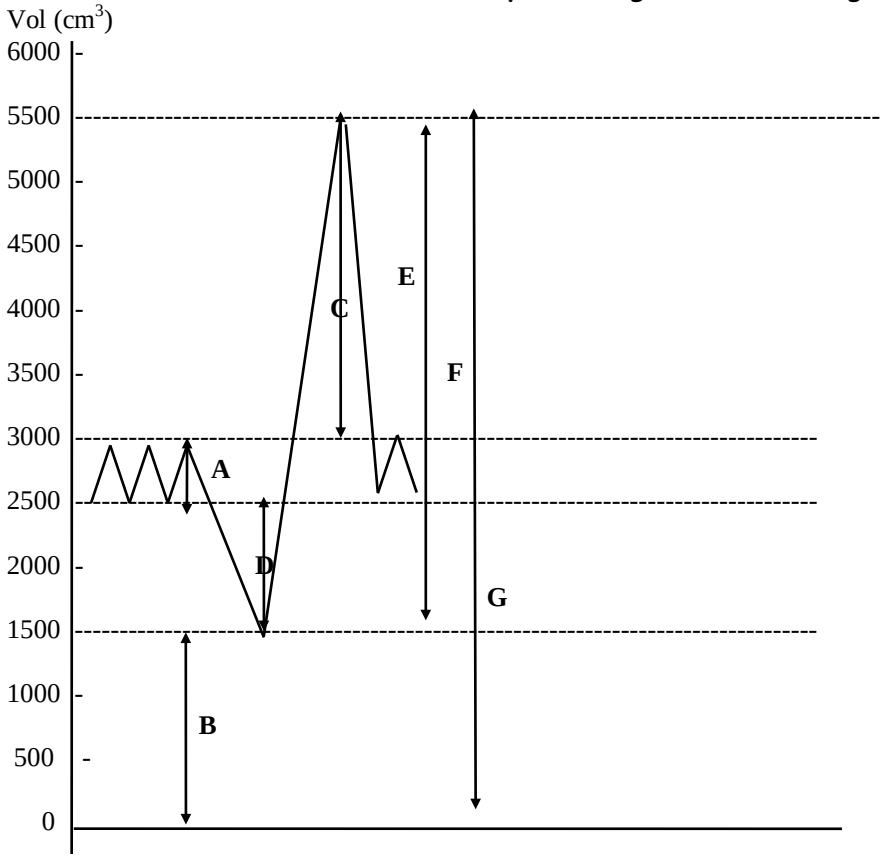
Emphysema is a condition of irreversible lung damage and heart failure. Infected mucus causes the white blood cells to increase in number. As they 'eat up' the invaders they release enzymes that digest the delicate structures of the alveoli. The area for gas exchange is reduced. The alveolar walls lose their ability to stretch and recoil and eventually break down. Lungs loose their elasticity and air becomes trapped inside. Bronchioles loose their support and collapse. Disease can last 20 years but is fatal. No real treatment except lung transplant.
Chronic obstructive pulmonary disease or COPD is chronic bronchitis and emphysema found together.

Medical conditions that are due to smoking

- Cigarette smoke thickens the lining of the bronchioles and forms hard masses of cells. These cells may become cancerous and spread.
- Nicotine is an addictive drug - cause a brief rise in blood pressure (due to narrowing of blood vessels) and heart rate. This increases the risk of heart attack or stroke. Clots, due to platelets bursting, are more likely. These can cut off the blood supply to organs such as the heart and brain.
- Cigarette smoke causes lung inflammation, overproduction of mucus and scarring which lead to bronchitis.
- Lung inflammation leads to overproduction of white blood cells with leakage of digestive enzymes. Breakdown of alveolar walls produces emphysema and heart failure.
- Cigarette smoke is an asthma allergen.
- Carbon monoxide in cigarette smoke combines with haemoglobin in red cells and prevents oxygen as normal.

- Tar particles coat alveolar lining and reduce surface area available for gas exchange. More rapid breathing is needed to make up this loss.

Graph showing variation in lung capacity.



A. Tidal volume is the normal amount of air taken in and out in one breath at rest (500 cm^3).

B. Residual volume is the amount of air left over in lungs after a maximum exhalation (1500 cm^3)

C. Inspiratory reserve volume is the maximum inhalation (deepest breath) above the tidal volume (2500 cm^3).

D. Expiratory reserve volume is the maximum exhalation above the tidal volume (max. amount of air that can be forced out at the end of expiration) (1000 cm^3).

E. Vital capacity = tidal volume + inspiratory reserve volume + expiratory reserve volume (500 + 2500 + 1000 = 4000 cm^3). (The max amount of air that can be breathed in after max. exhalation)

F. Total capacity = vital capacity + residual volume (5500 cm^3)

Control of breathing:

Breathing is an involuntary action. It is under the control of the medulla oblongata (respiratory centre) in hindbrain. Chemoreceptors in aorta and arteries leading to head are sensitive to levels of CO_2 and pH circulating the brain. High CO_2 levels (pH lower – carbonic acid) increase depth and rate of breathing and vv. The respiratory centres can be controlled consciously for a short time e.g. speaking, swimming or singing, swallowing, laughing when we control the timing of our breathing.

LC Questions

Section A

2007 OL

3. Indicate whether the following are true (**T**) or false (**F**) by drawing a circle around **T** or **F**.

Example: The pulmonary artery carries blood to the lungs ◯ **T** **F**

(c) Humans receive oxygen from the air they inhale T F

Section B

2004 OL

9. (a) Answer the following in relation to human breathing rate OR pulse rate.

State which of these you will refer to ……

What is the average rate at rest? …….

State a possible effect of smoking on the resting rate …….

……

(b) How did you measure the resting rate? …….

……

……

……

……

Describe how you investigated the effect of exercise on this rate.

……

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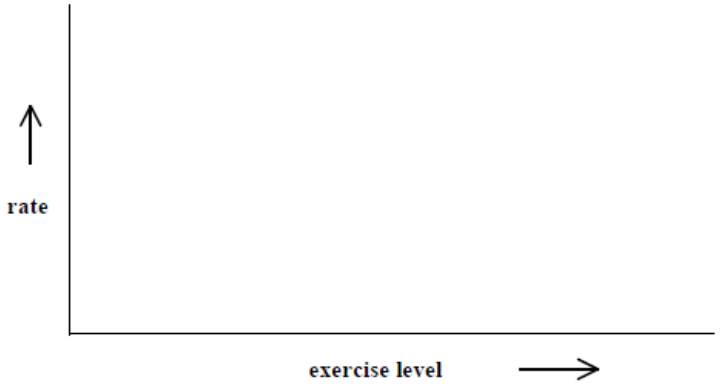
……

Using the axes below draw a graph to show how rate is likely to vary as the exercise level increases.



2008 OL

8. (a) State the location in the human body of the following muscles which are used for breathing:

(i) diaphragm _____

(ii) intercostals _____

(b) Answer the following questions about an activity that you carried out to investigate the effect of exercise on the breathing rate **or** pulse of a human.

(i) At the start of the investigation you asked the person who was about to do the exercise to sit down for a few minutes. Explain the purpose of this. _____

_____

_____

(ii) How did you measure the breathing rate **or** the pulse?

_____

_____

_____

_____

(iii) Describe how you conducted the investigation after the period of rest.

_____

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_____

_____

(iv) State the results of your investigation. _____

_____

_____

_____

2009 OL

7. (a) (ii) Give **one** way in which water is lost from the body.

_____

2012 OL

7. (a) (i) Name **one** disorder of the human breathing system. _____

(ii) Give **one** possible treatment for the disorder referred to above. _____

_____

(b) Answer the following questions about an activity that you carried out to investigate the effect of exercise on your breathing rate **or** your pulse rate.

/Tick the rate you will refer to.

Breathing Rate	
Pulse Rate	

(i) The investigation starts by measuring the resting rate. How did you measure the resting rate?

_____

_____

(ii) After measuring your resting rate, what other steps did you carry out to complete the investigation?

_____

_____

_____

_____

_____

(iii) What was the result of your investigation?

_____

_____

_____

(iv) Does this investigation give the same result for both fit and non-fit people? _____

(v) Give a reason for your answer.

_____

_____

_____

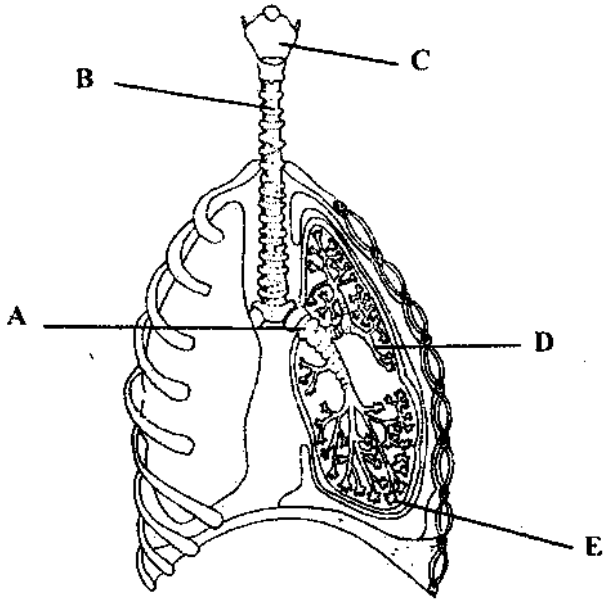
Section C

SEC Sample Paper HL

13. (a) (i) Distinguish between breathing and respiration.

(ii) Breathing rate in humans is controlled by the concentration of a gas dissolved in blood. Which gas is this? (9)

(b) The diagram shows the human breathing system



(i) Name the parts labelled A, B, C, D, E.

(ii) Where do cilia occur in this system? What is their function

(iii) State precisely the events that take place at E. How is E adapted for these events? **(27)**

(c) Asthma and bronchitis are common disorders of the breathing system. Answer the following in relation to one of these disorders. State the disorder to which you refer.
(i) State one possible cause of the disorder.
(ii) Suggest one way in which a person might adapt his/her lifestyle to minimise the effects of the disorder.
(iii) Give an example of a treatment for the disorder. **(24)**

2007 HL

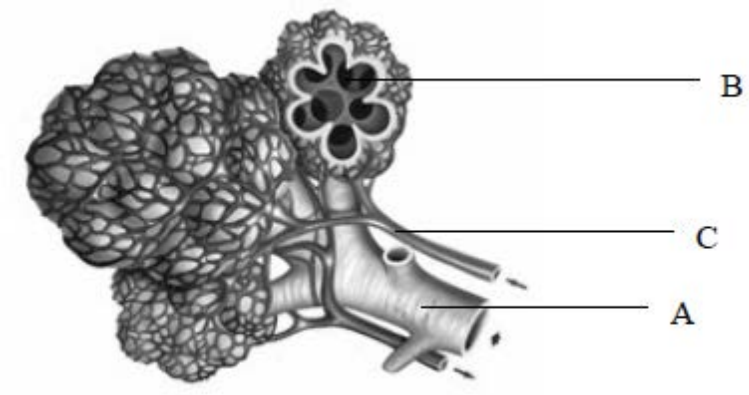
13. (a) (i) Name the blood vessel that returns blood to the heart from the lungs.
(ii) Name the main gas transported in the blood vessel that you have named in (i). How is this gas transported? **(9)**

(b) (i) Draw a large diagram of the human breathing system. Label the trachea, bronchus and lung.
(ii) State the function of the following: epiglottis, larynx.
(iii) Describe briefly the role of the diaphragm and intercostal muscles in inhalation. In your answer refer to volume and thoracic air pressure. **(27)**

(c) (i) Give three ways in which an alveolus is adapted for efficient gas exchange.
(ii) Name the process involved in the passage of gas between the alveolus and the blood.
(iii) Name a breathing disorder.
(iv) In the case of the breathing disorder that you have named in (iii) state:
1. a cause,
2. a means of prevention,
3. a treatment. **(24)**

2009 HL

13. (c)



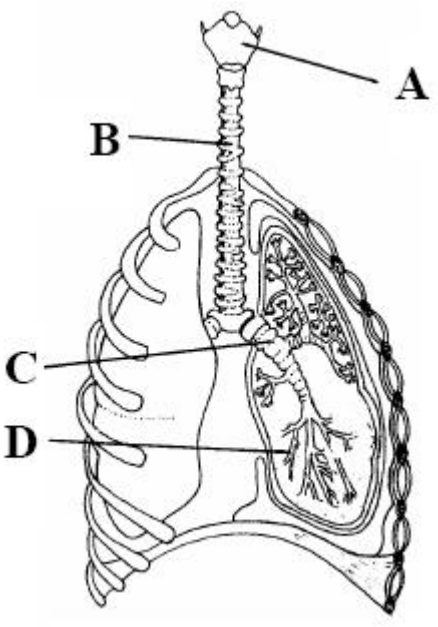
The diagram shows microscopic detail from a human lung.
(i) Name the parts labelled A, B and C.
(ii) Give **two** features of the structures in the diagram that allow for efficient gas exchange.
(iii) Name a disorder of the breathing system and say how it may be:
1. Caused.
2. Prevented.
3. Treated.
(iv) Which gas, dissolved in the blood, can trigger deeper or faster breathing?

2005 OL

12. (a) (i) Name the major blood vessels that carry blood
1. from the heart to the lungs
2. from the lungs to the heart.

(ii) What gas is released from the blood when it reaches the lungs?

(b) The diagram shows part of the human breathing system.



(i) Name A, B, C, D.
(ii) D ends in a small sac. What is the name of this sac?
(iii) What is the function of A?
(iv) B contains rings of cartilage. Suggest a function of this cartilage.
(v) Where is the epiglottis? What is its function? **(27)**

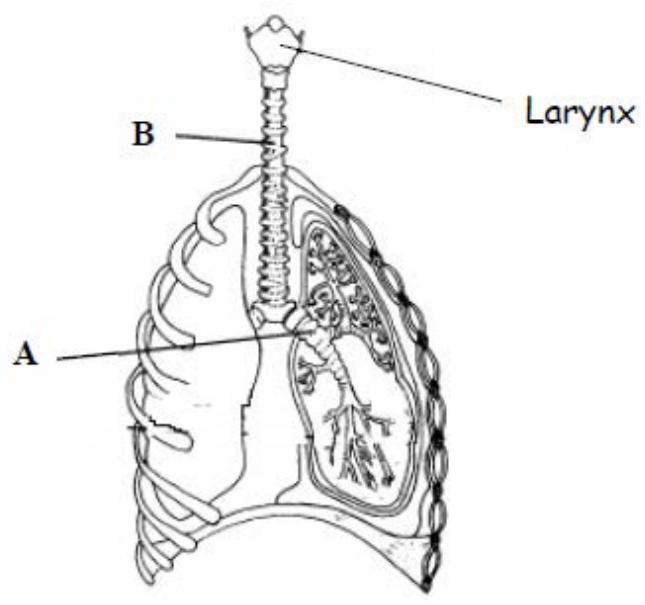
(c) (i) Name the muscles that are used in breathing.
(ii) Breathing causes pressure changes in the thoracic cavity. Describe briefly how these pressure changes are brought about.
(iii) Name a breathing disorder. Give a possible cause of this disorder and suggest a means of prevention **or** treatment. **(24)**

2008 OL

14. (c) (i) Draw a large labelled diagram of the human breathing tract and label the following parts; larynx, trachea, bronchus, bronchiole.
(ii) What is the role of alveoli in the lungs?
(iii) Name a breathing disorder.
(iv) Suggest a possible cause of the breathing disorder that you have named in (iii) and state how it may be treated.

2011 OL

13. (c) The diagram shows part of the human breathing system.



(i) Name the parts labelled A and B.
(ii) In what structures in the lungs does gaseous exchange take place?
(iii) Give one feature of the structure referred to in (ii) that allows efficient exchange of gases.
(iv) What is the function of the larynx?
(v) Outline the steps involved in inhalation. **(27)**

Marking scheme
Section A

2007 OL Q3

3.			**5(4)**
	(c)	T	

2004 OL Q9

9.	**(a)**		State which one (No mark – repeat of quest Average rate at rest (Pulse 65 to 79 bpm or Breathing 11 to 21 bpm) Raises rate	**0** **3** **3**
	(b)		**measure of resting rate:** use pulse monitor / read result in bpm or use of finger or wrist (radial pulse) / use timer or calculate in bpm / observe / count / repeat / average / record	**2(3)**
			investigation: (measure) resting rate/ description of exercise/ measure rate during (or immediately after) exercise/ repeat / compare or state result / record **any three**	**6+2(3)**
			graph (Showing increase – starting at origin is OK)	**6**

2008 OL Q8

8.	**(a)**			**5, 1**
		(i)	Any correct anatomical reference	
		(ii)	Any correct anatomical reference	
	(b)			**4(5)+4**
		(i)	Comparison /control / resting / normal / (breathing rate or pulse)	
		(ii)	Method described /count number of breaths or number of pulses /per unit time **OR** sensor (data logger)	
		(iii)	Exercise / description of exercise/ increased exercise/ breathing rate or pulse measured/ repeat/ average / **compare / record / result**	**Any two**
		(iv)	Increases / comment on return to normal / different	

2009 OL Q7

7.				**5 + 1**
(a)		(ii)	e.g. Sweating	

2012 OL Q7

7.				**5 + 1**
	(a)	(i)	EG. Asthma	(1 pt)
		(ii)	EG. Use of Inhaler (must match)	(1 pt)
				2(6)+6(2)
	(b)		Ticking Breathing Rate/Pulse Rate	(0 pts)
		(i)	Count pulse or breaths / time or rate repeat or average	(2 pts) (1 pt)
		(ii)	Exercise / check rate	(2 pts)
		(iii)	Exercise causes increase in rate	(1 pt)
		(iv)	Yes / No	(1 pt)
		(v)	Must match (iv)	(1 pt)

2004 HL Q12

12.	**(a)**		Maintaining (a constant) internal environment **or** described **Role of kidneys:** Maintaining salt balance **or** explained / Maintaining water balance **or** explained / *[Note: **Osmoregulation** = 2 points]*	**3** **3** **3**

2007 HL Q15(c)				
	(c)	**(i)**	*Homeostasis:* maintenance / of constant internal environment or two named factors constant *Reason:* allows normal metabolic activities or example **or** keeps temperature suitable for enzyme reactions	**2(3)** **3**

2009 HL Q15(c)				
15.	(c)			***Any three*** **3(4+3+3)**
		(iii)	Maintenance of / constant internal environment / example how / example why (Example = pH, solute concentrations or examples of such solutes, temperature, water)	

2012 HL Q15(c)

15.	(c)	(i)	*homeostasis*:	Maintenance of a constant internal environment	**3**
		(ii)	*diffusion*: *osmosis*: *active transport*:	movement of substances with (along) a concentration gradient **or** explained movement of water through a selectively permeable membrane from a high water concentration to a low concentration movement of molecules against a concentration gradient **or** movement of molecules using energy	**3** **3** **3**
		(iii)	1. 2. 3.	Excretion of water **or** excretion of CO_2 **or** release of heat	**3** **3** **3**

2012 OL Q15(a)

15.				**2(5)+2(4)+6(2)**
(a)		(v)	Maintaining constant internal conditions	(1 pt)

2004 HL Sample Q13

13.	(a)	(i)	Breathing is gas exchange. Respiration is the release of energy	**2(3)**
		(ii)	Carbon dioxide	**3**
	(b)	(i)	**A**: bronchus, **B**: trachea (allow cartilage), **C:** larynx, **D**: bronchiole **E**: alveolus.	**5(2)**
		(ii)	In the trachea/ nostrils. They move mucus upwards	**2(3)**
		(iii)	At E oxygen diffuses into the blood/ CO_2 diffuses out E is adapted by being moist/ thin walled / has a large blood supply	**2(3)** **3+2**

	(c)	(i)	Asthma: Cause: pet dander/ allergens/ exercise	**8**
13.	(a)	(i)	pulmonary vein*	**3**
		(ii)	oxygen* by (oxy)haemoglobin or by iron	**3** **3**
	(b)	**(i)**	diagram [*trachea, bronchus, alveoli, diaphragm or ribs*] ***[any one missing 3 marks]*** *labels* [*trachea, bronchus, lung]*	**6, 3. 0** **3(1)**
		(ii)	*epiglottis*: to close off trachea or described *larynx*: to make sound	**3** **3**
		(iii)	diaphragm contracts / lowers / intercostal muscles contract / rib cage up/ #volume of chest (cavity) increased / #decreased pressure / air in / to equalise pressure [*# points compulsory*]	**#2(3)** **2(3)**
	(c)	**(i)**	capillary network / moist surface / thin walled / elastic wall [*allow* large surface area **or** one cell thick **or** thin membrane]	**3(3)**
		(ii)	diffusion **or** passive transport	**3**
		(iii)	asthma **or** bronchitis	**3**
		(iv)	1. *cause:* 2. *prevention:* 3. *treatment:*	**3** **3** **3**

2009 HL Q13

	(c)	(i)	A = Bronchiole B = Alveolus C = Arteriole **or** Capillary	**2** **2** **2**
		(ii)	Thin walled / moist surfaces / proximity (of alveoli and capillaries) / large surface area / large number (of alveoli or capillaries)	**Any two** **2(3)**
		(iii)	Named disorder 1. Cause 2. Prevention 3. Treatment	**3** **2** **2** **2**
		(iv)	*CO_2	**3**

2005 OL Q12

12.	**(a)**	**(i)**	1. Pulmonary artery 2. Pulmonary vein	**3** **3**
		(ii)	carbon dioxide	**3**
	(b)	**(i)**	A = larynx (voice box) C = bronchus B = trachea (wind pipe) D = bronchiole	**4(3)**

		(ii)	Alveolus	**3**
		(iii)	To produce sound or speech	**3**
		(iv)	To keep trachea open / prevent collapse of trachea / protection of trachea	**3**
		(v)	At the back of the throat / top of windpipe / oesophagus	**3**
		(vi)	To prevent food entering trachea / wrong way / prevent choking	**3**
	(c)	**(i)**	diaphragm/ intercostal	**6+3**
		(ii)	diaphragm contracts (lowers) / intercostal muscles contract /ribs move up and out / increased volume of thoracic cavity / pressure decreases / intercostals relax / air rushes in / diaphragm relaxes / volume decreases / pressure increases / air pushed out / inhale / exhale **<u>any two</u>**	**2(3)**
		(iii)	name/cause/prevention or treatment **<u>Asthma</u>**/ allergic response or genetics or smoking or narrowing of bronchioles or infection or anxiety / use of inhaler or avoidance of allergens / exercise . **<u>Bronchitis</u>**/ infection or narrowing of bronchi/ antibiotics (for bacterial infection) / cancer of the lungs / MS effecting diaphragm.	**3(3)**

2008 OL Q14(c)

	(c)			**6 + 4(1)+4(5)**
		(i)	Diagram (Diagram to show, Trachea, Bronchus & Lungs) labels (larynx, trachea, bronchus, bronchiole)	**6, 3, 0** **Labels - Four pts**
		(ii)	exchange gases/ carbon dioxide out/ oxygen in / increase surface area / **diffusion**	
		(iii)	name of breathing disorder (Asthma, Pleurisy, Bronchitis, Cancer, Hay Fever, Cystic Fibrosis, pneumonia…)	
		(iv)	Possible cause Treatment	**Two points**

2011 OL Q13

	(c)	(i)	A=bronchus; B= trachea (allow cartilage for A *or* B)	**<u>3(5)+6(2)</u>** **(2 Pts)**
		(ii)	Alveoli or Air sacs	
		(iii)	Thin walls / moist surfaces / surrounded by capillaries/ large surface area / expandable	**(1 Pt)**
		(iv)	To make sound	
		(v)	Impulse from brain / (intercostal) muscles contract / diaphragm contracts / thoracic cavity increases <u>or</u> rib cage up and out <u>or</u> diaphragm flattens / pressure drops / air in (Any four points)	**(4 Pts)**