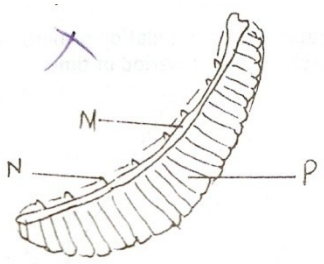
GASEOUS EXCHANGE

1. 1992 Q11 P1

The diagram below represents an organ from a bony fish. Study the diagram and answer the questions that follow



(a) Identify the organ and the parts labelled M, N, and P
(b) How the structures are labelled P adapted to their function?U

2. 1994 Q14 P1

What are the characteristics do gills of a fish and the mouth cavity of a frog have in common that enables them to be efficient in gaseous exchange?

3. 1996 Q14 P1

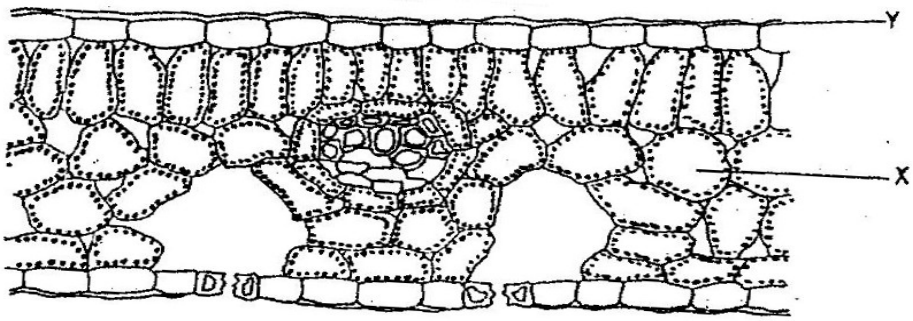
(a) Describe the path taken by carbon dioxide released from the tissue of an insect to the atmosphere (3 marks)
(b) Name two structures used for gaseous exchange in plants (2 marks)

4. 1998 Q4 P1

Why are gills in fish highly vascularised? (1 mark)

5. 2000 Q11c P1

The diagram below represents a section of a leaf.



(a) Name the parts labelled X, and Y (2 marks)
(b) Using arrows indicate on the diagram the direction of flow of water during the transpiration stream (1 mark)

(c) State two ways in which the leaf is suited to gaseous exchange (2 marks)

6. 2001 Q10 P1

Name three sites where gaseous exchange takes place in terrestrial plants. (3 marks)

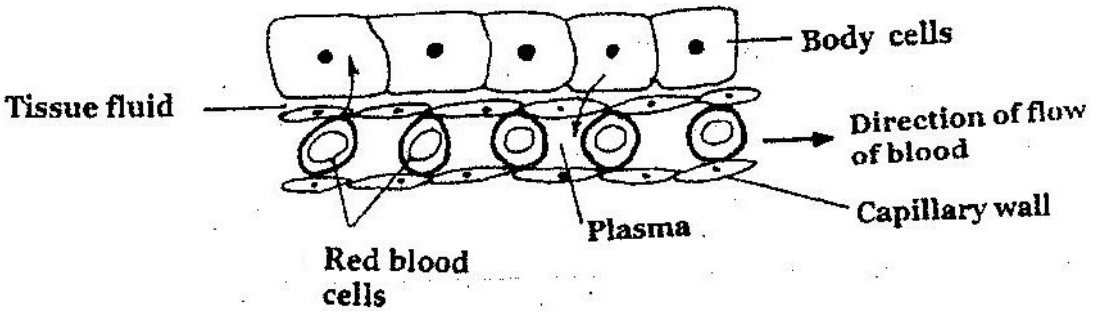
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7. 2002 Q9 P1

Name two gaseous exchange structures in higher plants. (2 marks)

8. 2003 Q13 P1

The diagram below shows gaseous exchange in tissues.



a) Name the gas that diffuses:
   i) To the body cells (1 mark)
   ii) From the body cells (1 mark)

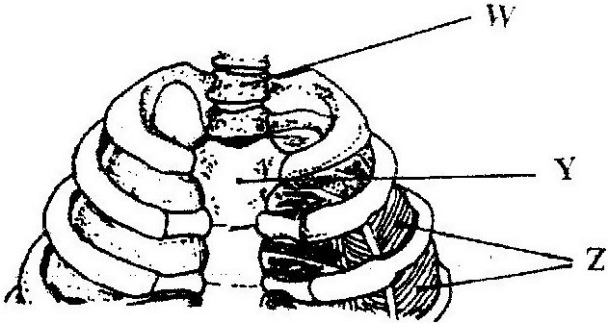
b) Which compound dissociates to release the gas named in (a) (i) above? (1 mark)

c) i) What is tissue fluid? (1 mark)
   ii) What is the importance of tissue fluid? (2 marks)

d) Name the blood vessel with the highest concentration of:
   i) Glucose (2 marks)
   ii) Carbon dioxide

9. 2004 Q3 P1

The diagram below represents a part of the rib cage.



a) Name the parts labelled W, Y and Z. (3 marks)

b) How does the part labelled Z facilitates breathing in? (3 marks)

10. 2005 Q18 P1

Describe how gaseous exchange takes place in terrestrial plants. (20 marks)

11. 2006 Q5 P1

State two ways in which floating leaves of aquatic plants are adapted to gaseous exchange. (2 marks)

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12. 2006 Q24 P1

State four ways in which respiratory surfaces are suited to their function. (4 marks)

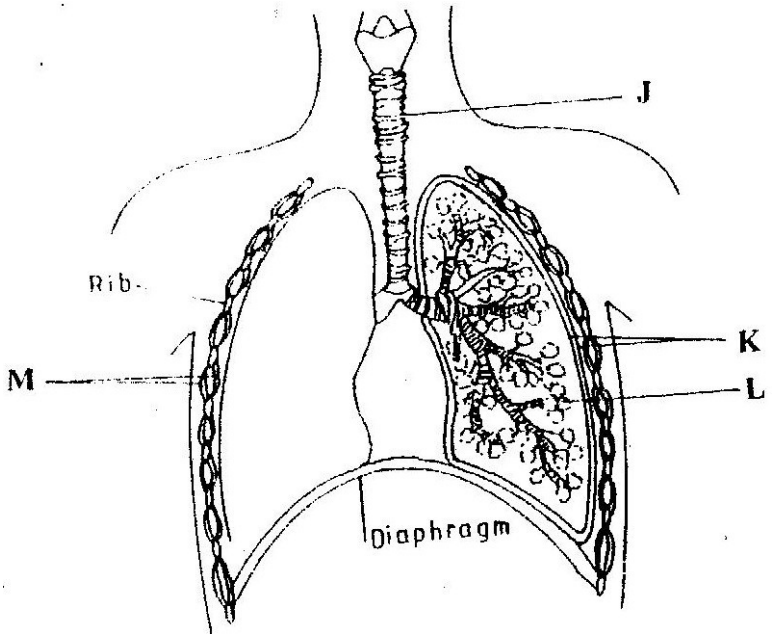
13. 2007 Q12 P1

(a)Name two structures for gaseous exchange in aquatic plant (2 marks)

(b)What is the effect of contraction of the diaphragm muscles during breathing in mammals? (3 marks)

14. 2007 Q1 P2

The diagram below represents some gaseous exchange structures in humans



(a) Name the structures labeled K, L, and M (3 marks)

(b) How is the structure labeled J suited to its function? (3 marks)

(c) Name the process by which inhaled air moves from the structure labeled L into blood capillaries (1 mark)

(d) Give the scientific name of the organism that causes tuberculosis in humans (1 mark)

15. 2008 Q8 P2

16. 2009 Q16 P1

17. 2010 Q5 P1

State three ways in which a respiratory surface is adapted to its function. (3 marks)

18. 2011 Q19a P1

a) Apart from the lungs, name two gaseous exchange surfaces in a frog. (2 marks)

19. 2011 Q22 P1

State the difference in content of oxygen and carbon (IV) Oxide in the air that enters and leaves the human lungs. (2 marks)

20. 2011 Q3a, b P2

a) Name the causative agents for the following respiratory diseases.

i) Whooping cough. (2 marks)

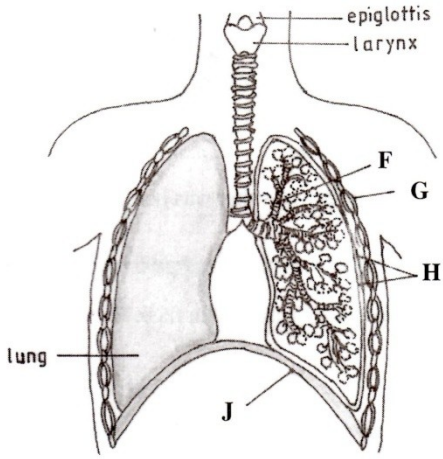
ii) Pneumonia (2 marks)

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b) Describe how oxygen in the alveolus reaches the red blood cells (4 marks)

21. 2012 Q6 P1

The diagram below represents part of gaseous exchange system in human



(a) Name the parts labelled F and G. (2 marks)

(b) State one function of each of the parts labelled H and J (2 marks)

22. 2012 Q5 P2

(a) Describe the process of inhalation. (4 marks)

(b) Explain the mechanism of stomatal opening (4 marks)

23. 2013 Q10 P1

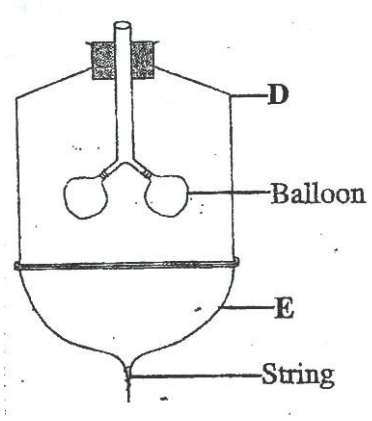
How are lenticels adapted for gaseous exchange? (2 marks)

24. 2013 Q7b P2

How are respiratory surfaces in mammals adapted to their functions? (10 marks)

25. 2014 Q12 P1

The diagram below represents a model used to demonstrate breathing in mammals



(a) Name the mammalian structure represented by the parts labeled **D** and **E**.

(i) D (1 mark)

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(ii) E (1 mark)

(b) State the observation made when the string is pulled downwards. (1 mark)

(c) Explain the observation in (b) above (2 marks)

26. 2014 Q27 P1

(a) How is the part labelled S structurally adapted to its function? (1 mark)

27. 2014 Q3 P2

(a) Describe the mechanism of gaseous exchange in plants through the lenticels (3 marks)

(b)Explain each of the following:

(i) The tracheoles lack spiral bands of chitin; (3 marks)

(ii) The floor of the mouth is lowered during inhalation in a bony fish (2 marks)

GASEOUS EXCHANGE
MARKING SCHEME

1. 1992 Q11 P1

a) Identity- Gill
M- Gill arch/bar
N- Gill raker
P- Gill filament

b) i) Numerous to increase surface area
ii) Thin(membrane/walled structure)
iii) Rich/dense network of blood supply;for efficient gaseous exchange rich of blood

2. 1994 Q14 P1

- Both are moist
- Both have thin lining/epithelium
- Both are richly supplied with blood capillaries/dense network of blood vessels/highly vascularized

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5. 1996 Q14 P1

a) CO_2 diffuses into tracheoles follows the trachea; not through spiracles

b) Stomata pores / stomata; cuticle

Acc. Lenticels.

4. 1998 Q4 P1

To facilitate transportation of gases/ Exchange of gases; if gases are mentioned (both must be O_2 and CO_2)

5. 2000 Q11c P1

(a) X– Spongy mesopyll (cell) layer

(b) Y – Cuticle

(c) Broad/ flat leaf (lamina) to provide large surface area or absorption of gases

Thickness: allow gases to pass though fast

Presence of stomata for efficient diffusion of gases

Presence of air spaces for easy diffuses

6. 2001 Q10 P1

– Mesophyll cells/ spongy mesophyll/ palisade mesophyll/ stomata/ substomatal chambers; lenticels; cuticles.

7. 2002 Q9 P1

Stomata, lenticels: (reject cuticle)

8. 2003 Q13 P1

a) i) Oxygen

ii) Carbon dioxide

b) Oxyhaemoglobin

c) i) The blood plasma except blood cells and proteins; that has filtered out of the capillaries.

ii) It is a medium of exchange of substances/ materials between capillaries and body cells; supply nutrients to cells / supply oxygen to cells / remove waste products from cells.

d) i) Hepatic portal vein

ii) Pulmonary artery

9. 2004 Q3 P1

a) W – (thoracic) Vertebrae;

Y – Sternum/sternabra(e)

Z – Intercostals muscle;(external /intercostals muscle

b) Has air spaces; which store gases for gaseous exchange buoyancy;

Acc. Floating.

10. 2005 Q18 P1

Gaseous exchange in terrestrial plants.

Gaseous exchange in plants involves two main respiratory gases: carbon IV oxide and oxygen.

During daytime green plants take in carbon IV oxide for photosynthesis and oxygen for respiration. During photosynthesis oxygen is given out as a by product and

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released to the atmosphere. In plants such as the flowering plants stomata in the leaves and lenticels in the woody stems and pneumatophores/breathing roots in aquatic woody plants provide the surface for gaseous exchange. Gaseous exchange taken place by diffusion across the respiratory surface.

Stomata

These are located mainly in the leaves and in younger parts of the stem. The opening and closing of stomata is controlled. Mainly by the intensity of light. They are normally open during the day and closed during the night. Several theories explaining the mechanism of stomata opening and closing have been put forward.

Photosynthetic theory

Guard cells have chloroplasts. During daylight, they carry out photosynthesis producing surges. The surges increase the osmotic pressure of the cell sap. This causes water to more into guard cells from the neighbouring epidermal cells by osmosis.

The results is an expansion and increase in turgidity of the guard cells causing the stomata to open.

In darkness photosynthesis stops. The sugar in the guard cells is converted to starch. This lowers the osmotic pressure of guard cells causing the to lose water to neighboring cells by osmosis.

The guard cells become flaccid and the stomata close.

The guard cells become flaccid and the stomata close.

Starch – sugar interconversion:

The enzymatic conversion of starch to sugar proceeds more readily in an alkaline environment(high PH).The conversion of sugar to starch occurs more readily in an acidic environment (low Ph).During the night, when photosynthesis is not taking place, carbon dioxide accumulates in leaf cells it combines with water to form carbonic acid.

This lower the PH in the guard cells leading to conversion of sugar to starch this decreases the osmotic pressure in the guard cells causing them to lose water to the neighboring epidermal cells. The guard cells become flaccid and the stomata close.

During daylight, when photosynthesis is taking places, the concentration of carbon dioxide in the leaf cells, raising their PH, and favouring the conversion of starch to sugar. This increases the osmotic pressure in the guard cells causing them to take in is an expansion and increase in turgidity of the guard cells causing the stomata to open.

Potassium Ion (K^+) mechanism

When guard cells are exposed to light, their chloroplasts manufacture ATP. The ATP drives at K^+ pump in the cell membrane of the guard cells. This causes an active uptake of K^+ into the guard cells from surrounding epidermal cells.

Accumulation of K^+ in guard cells increases the osmotic pressure of their cell sap. This causes water to move into the guard cells from neighbouring epidermal cells by osmosis. The result is an expansion and increase in turgidity of the guard cells causing the stomata to open.

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-At the onset of darkness, chloroplast stop making ATP and its concentration in guard cells falls rapidly stopping K^+ pump, K^+ migrate from the guard cells
Causing them to lose water to the neighbouring cells by osmosis. The guard cells become flaccid and the stomata close.
-Water molecules are pumped into the guard cells from adjacent epidermis cells.
-A small extent of gaseous exchange takes place in the stem through structures called lenticels.
These are small gaps in the bark usually circular or oval & slightly raked on the bark surface.
The cells in these area are thin walled and loosely packed leaving air space which communicates with air spaces in the cortex. Hence 0_2 for respiration is taken up & $C0_2$ is given out.

11. 2006 Q5 P1

- Stomata found on upper epidermis to allow efficient gaseous exchange
- Presence of large air spaces/Aerenchyma tissues to enable it float/Bouyant/
- Storage of air
- Absence of cuticle to enhance gaseous exchange.

12. 2006 Q24 P1

- Stomata found on upper epidermis to allow efficient gaseous exchange
- Presence of large air spaces/Aerenchyma tissues to enable it float/Bouyant/
- Storage of air
- absence of cuticle to enhance gaseous exchange.

13. 2007 Q12 P1

(a) - Pneumatophores
- Aerenchyma tissues
- Cuticle

b) The diaphragm flattens.
Volume in thoracic cavity increase.
Pressure decreases compared to atmospheric pressure. Air rushes into the lungs through the nostrils.

14. 2007 Q1 P2

(a) K- Pleural membranes L- Alveolus
M- Intercostal muscles

(b) Has c- shaped cartilage rings that support it preventing it from collapsing and allow free flow of air
- Inner lining has secreting cells that trap fine dust particles and micro-organisms
- Inner lining has hair like structures called cilia that enhance upward movement of the mucus to the larynx

(c) Diffusion

(d) Mycobacterium tuberculosis

15. 2008 Q8 P2

(a) Highly vascularized/ network of blood capillaries L.S.A (for G.E)

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Thin membrane/ epithelium/ one cell thick wall/ thin lining; rej thin walls moist lining

(b) **Breathing in**

External intercostals muscles contract; internal, intercostals muscles relax lifting/ raising the ribcage upwards and outwards; muscles of diaphragm contract. It flattens the volume of the thoracic cavity increases; pressure decrease; higher air pressure in the atmosphere forces air into the lungs

Breathing out

External intercostals/ muscles relax; internal intercostals muscles contract moving the ribcage downwards and inwards; the muscles of diaphragm relax, the diaphragm assumes dome shape; volume of thoracic cavity decreases; while pressure increases; higher pressure forces air out of the lungs

16. 2009 Q16 P1

(a) Tracheole; / *Rej: trachea / Tracheole system*

(b) Moist for gases to dissolve (in solution); Branched / ramify
Numerous tubes to increase surface area (for gaseous exchange)

17. 2010 Q16 P1

A large surface area for efficient diffusion of gases
Moist for gases to diffuse in solution form/to dissolve gases
Thin for efficient/diffusion of gases (across a short distance)
Most be close to body cells/well supplied with blood vessel to active cells
Ventilation mechanism for bringing in air rich in O_2 and expelling air rich in carbon(iv) oxide

18. 2011 Q19a P1

a) (i) Skin; (ii) buccal cavity

19. 2011 Q22 P1

- Air that enters lungs has a higher content of oxygen than air that leaves the lungs;
-Air that enters the lungs has lower content of carbon (IV) oxide than air that leaves the lungs; (2 marks)

20. 2011 Q3a, b P2

(a) i) Whooping cough
Bordetella partussis;
ii) Pneumonia
Streptococcus pneumoniae;

(b) Inhaled oxygen dissolves in moisture in the alveolus; since the oxygen concentration in blood is lower than in the alveolus; oxygen diffuse; through the alveolus epithelium, the capillary wall into the plasma, and finally into the red

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blood cells;

21. 2012 Q6 P1

(a) F Branchiole
G Intercostal muscles/external intercostal muscles;
Rej internal intercostal muscles

(b). H (Pleural membranes) secretes/encloses pleural fluid to lubricate/protects lungs;
J (Diaphragm) separates chest cavity from abdominal cavity/work to effect volume/
Pressure changes in chest cavity for inhalation and exhalation/ventilation;

22. 2012 Q5 P2

(a) The external intercostals muscles contract while the internal intercostals muscles relax;the ribcage is pulled upwards and outwards;the diaphragm muscles contract and
the diaphragm flattens; the volume of thoracic cavity/lung increases/the pressure in the thoracic cavity/lung decreases; air rushes into the lungs; from the atmosphere through the nose.

(b) The osmotic pressure of guard cells increase when sugar is manufactured during photosynthesis/starch is converted to sugar in low acidity/potassium ions move into guard cells during the day; water enters guard cells from the surrounding cells by osmosis; because the guard cells are bean shaped with thin outer walls and thick inner walls; the thin outer walls expand more as the cell becomes turgid; thus the thick inner walls curve causing the stomata to open

23. 2013 Q10 P2

- has a film of moisture to dissolve hence gass diffuse in solution form
- has large intercellular airspaces to allow easier circulation of gases.

24. 2013 Q7b P2

Respiratory surfaces (alvelous:

- are highly vascularized or has rich network of capillaries, well supplied with blood to maintain a steep concentration gradient for efficient exchange of gases.
- have epithelial lining covered by a thin layer of moisture/water film - it's always moist; to dissolve gases i.e. oxygen and carbon (IV) oxide gases for easy diffusion in the blood in solution form.
- have epithelial lining that is thin to provide a short distance for diffusing molecules for easier gaseous exchange.
- alveoli offer a large surface area for maximum gaseous exchange since they are numerous in number in one lung for efficient exchange of gases.
- are permeable to respiratory gases to allow movement of gases.

25. 2014 Q12 P1

(a)

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(i) Rib- cage

(ii) Diaphragm

(b)

- The balloons are inflated

(c)

- Pulling down the string increases the volume of **D** hence decreasing the pressure inside;
- The low pressure causes external atmospheric air to rush in and inflate the balloon.

26. 2014 Q27 P1

(a) Spiracle

(b) R is the trachea which are air tubes that penetrate the body space and carries oxygen to and carbon (IV) oxide away from tracheoles.

(c)

- Thin walled to reduce distance for diffusing molecules.
- Lack spiral bands of chitin to make the surface permeable to respiratory gases.

27. 2014 Q3 P2

(a)

Oxygen concentration is higher outside than inside the lenticeis; O2 diffuses into lenticels then into the cells; CO_2 concentration is higher inside the lenticels than on the outside: CO_2 diffuses out of the lenticels (into the atmosphere)

(b)

(i)

To provide a large surface area; make them thin; rej thin membrane for gaseous exchange/to reduce diffusion distance for respiratory gases

(ii)

This increases the volume of the buccal cavity while decreasing the pressure; which forces water to rush into the mouth.

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