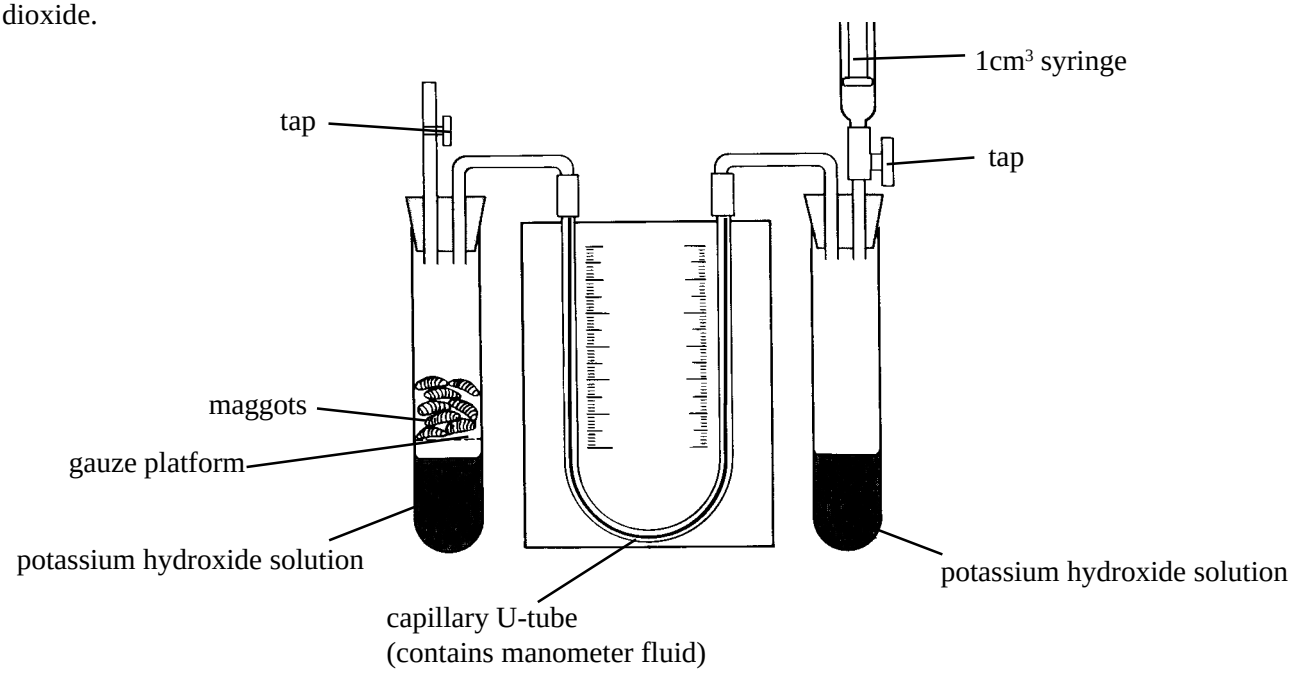
Do not write in margin

The diagram shows a simple respirometer set up by a student. Potassium hydroxide solution absorbs carbon dioxide.



(a) Describe how the apparatus was used to measure the oxygen consumption of the maggots.

.....

.....

.....

.....

[5]

(b) The student then modified the apparatus and conducted a second investigation to measure the volume of carbon dioxide produced by the maggots.

(i) What modification would the student have made?

.....

[1]

(ii) Explain how the student would have measured the carbon dioxide production of the maggots.

.....

.....

.....

.....

[4]

TOTAL / 10

GAS EXCHANGE

QUESTIONSHEET 2

Do not write in margin

The table shows the composition of inspired, expired and alveolar air in humans.

Figures are in volumes %.

Gas	Inspired air	Expired air	Alveolar air
Oxygen	20.7	14.6	13.2
Carbon dioxide	0.04	3.8	5.0
Nitrogen	78.0	75.4	75.6
Water vapour	1.3	6.2	6.2

(a) With reference to the figures in the table, explain the differences between the percentages of oxygen in inspired, expired and alveolar air.

.....

.....

.....

[3]

(b) Explain the difference between the percentage of nitrogen in inspired air and expired air.

.....

.....

[2]

(c) Why is the water vapour content of expired air higher than that of inspired air?

.....

[1]

(d) (i) Describe two effects of smoking on gas exchange in the alveoli.

1. .....

.....

2. .....

.....

[2]

(ii) Long term smoking may result in bronchitis and emphysema. How would the figures in the table alter in emphysema?

.....

.....

[2]

TOTAL / 10

QUESTIONSHEET 3

The table below compares the respiratory systems of an insect and a mammal. If the feature is correct place a tick (✓) in the appropriate box and if it is incorrect place a cross (×) in the appropriate box.

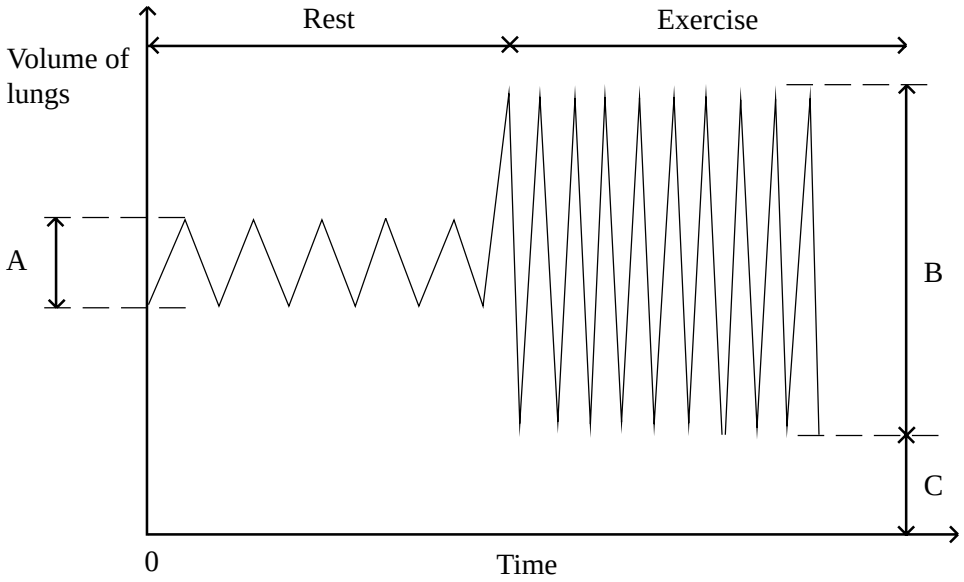
Feature	Mammal	Insect
Walls of air ducts supported by skeletal material		
Respiratory surfaces moist		
Respiratory ducts partly lined with cilia		
Air passages reach directly into respiring cells		
Oxygen carried on a respiratory pigment in blood		
Volume of fluid in respiratory ducts varies in proportion to activity		

[6]

TOTAL / 6

Do not write in margin

The graph below shows the volumes of air breathed in and out by a human at rest and during exercise.



(a) What names are given to the volumes A, B and C?

A: ..... B: ..... C: ..... [3]

(b) (i) What changes occur to the breathing pattern during exercise?

..... [2]

(ii) Chemoreceptors in the body are involved in the regulation of breathing rate. What chemical are they sensitive to?

..... [1]

(iii) Name two sites of these chemoreceptors in the body.

1: ..... 2: ..... [2]

(c) (i) The inspiratory and expiratory control centres are in the brain. In which part of the brain are they?

..... [1]

(ii) With reference to the intercostal muscles, diaphragm and ribs describe the process of inspiration in a human.

.....

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.....

.....

[4]

TOTAL / 13

GAS EXCHANGE

QUESTIONSHEET 5

Do not write in margin

(a) (i) Respiratory surfaces generally need to be large in relation to the size of the organism. Explain why this is so.

.....

..... [2]

(ii) Explain why the cell surface area of Amoeba is adequate as a respiratory surface but many larger organisms have evolved complex respiratory surfaces to gain more surface area.

.....

.....

.....

..... [3]

(iii) List three features, other than large surface area, that are required by efficient respiratory surfaces in animals.

1: .....

2: .....

3: ..... [3]

(b) (i) Name the respiratory surfaces of the following organisms:

an earthworm. .....

an insect. .....

a bony fish. .....

a mammal. ..... [4]

(ii) Describe how the respiratory surface of mammals is suited to efficient gas exchange.

.....

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.....

.....

..... [4]

TOTAL / 16

GAS EXCHANGE

QUESTIONSHEET 6

Do not write in margin

The equation below represents Fick's Law of diffusion across membranes:

$$J = DA\frac{\Delta c}{\Delta x}$$

where J = net rate of diffusion
D = diffusion constant of the dissolved solute
A = area of the membrane
Δc = concentration difference across the membrane
Δx = thickness of the membrane

(a) Use Fick's Law to explain why the efficiency of oxygen transport across the alveolar surfaces of a mammalian lung is improved by the surfaces:

(i) having a large area. .....

..... [1]

(ii) being a thin membrane. .....

..... [1]

(iii) having an efficient blood supply. .....

..... [2]

(b) With reference to Fick's Law explain why it is necessary for Amoeba to divide once it reaches a certain volume.

.....

.....

.....

..... [3]

(c) How is the value of J (the net rate of diffusion) increased in the respiratory surfaces of:

(i) an insect: .....

.....

..... [2]

(ii) a bony fish? .....

.....

.....

..... [3]

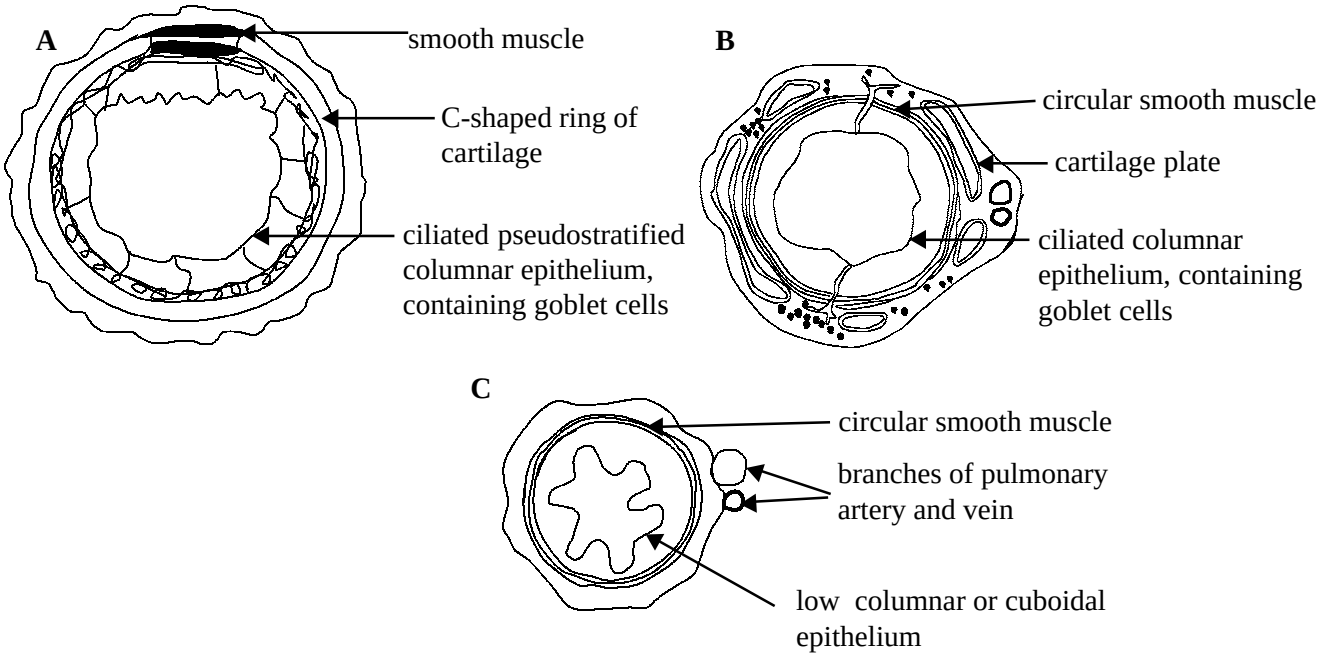
TOTAL / 12

GAS EXCHANGE

QUESTIONSHEET 7

Do not write in margin

The drawings below show the structure of a bronchiole, a bronchus and the trachea, seen in transverse section.



(a) (i) Name ducts A, B and C in the diagram above. [3]

A: ..... B: ..... C: .....

(ii) For each duct give two reasons for your identification in (i).

A: 1. .....

2. ..... [2]

B: 1. .....

2. ..... [2]

C: 1. .....

2. ..... [2]

(*Continued...*)

Do not write in margin

(b) Explain the importance of the following in the bronchial tree:

(i) the ciliated epithelia and goblet cells.

.....

.....

.....

..... [3]

(ii) the cartilage.

.....

.....

.....

..... [3]

(iii) the smooth muscle.

.....

.....

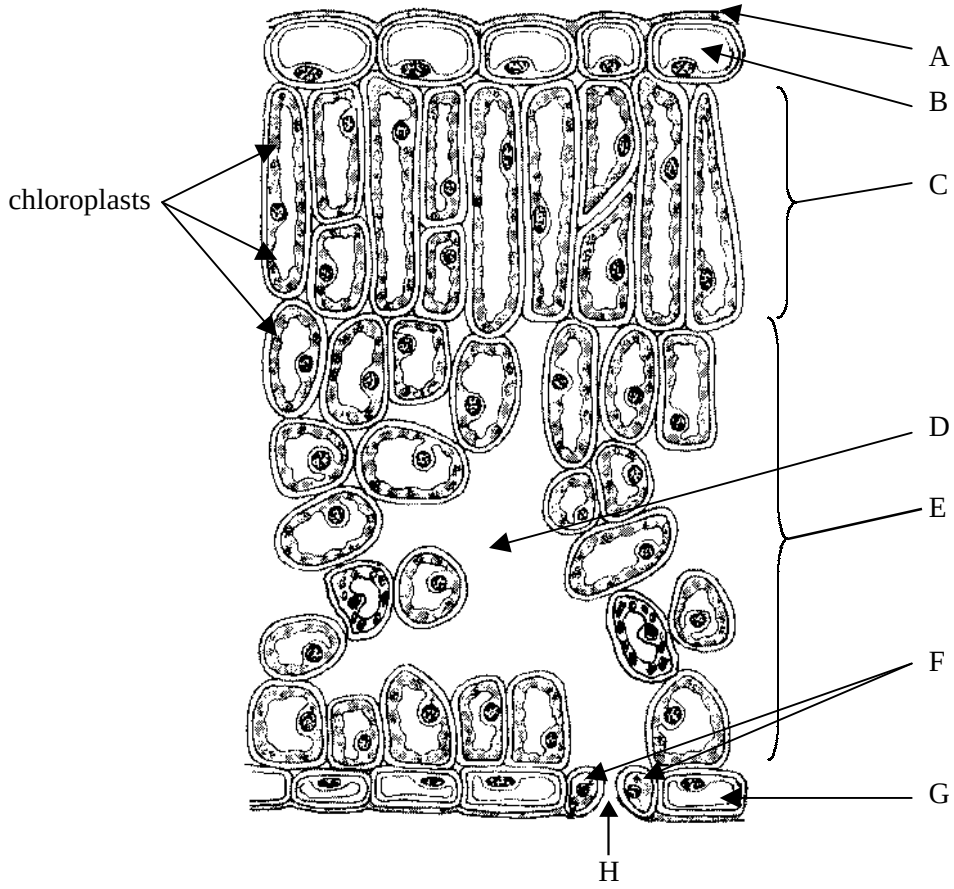
.....

..... [3]

TOTAL / 18

Do not write in margin

The drawing below shows the structure of a dicotyledonous leaf in vertical section.



(a) (i) Name structures A to F.

A: ..... B: .....

C: ..... D: .....

E: ..... F: .....

G: ..... H: ..... [8]

(*Continued...*)

Do not write in margin

(ii) Why is gaseous exchange important in the leaf?

.....

.....

.....

..... [4]

(iii) Gas exchange surfaces should have large surface areas, be moist and be thin. How are these conditions met in the leaf?

.....

.....

.....

..... [3]

(b) Describe the mechanism of stomatal opening and closing.

.....

.....

.....

.....

.....

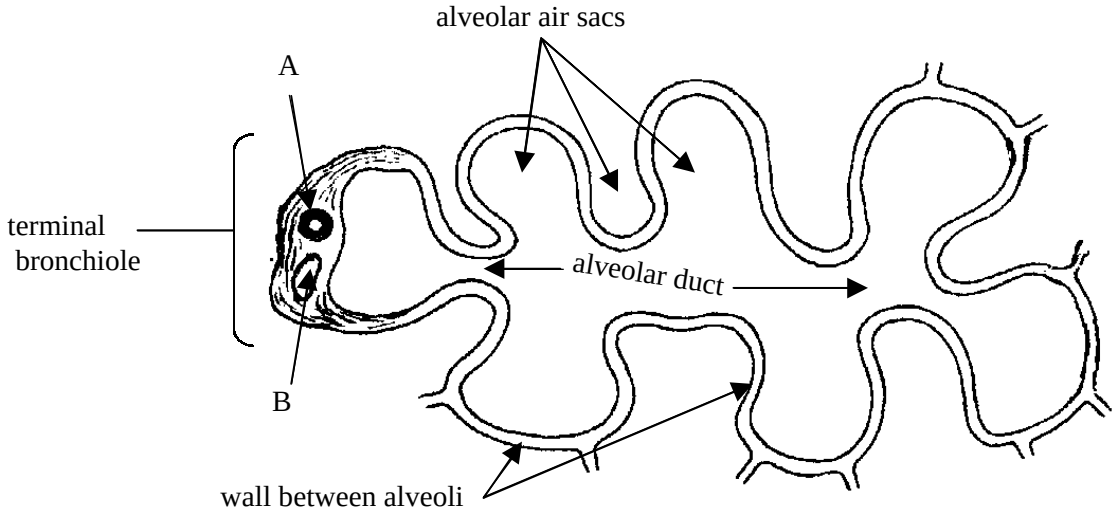
..... [5]

TOTAL / 20

QUESTIONSHEET 9

Do not write in margin

The drawing below shows a terminal bronchiole, alveolar duct and associated alveolar air sacs.



(a) (i) Name blood vessels A and B.

A: ..... B: ..... [2]

(ii) The alveolar wall is lined with fluid. Name this fluid and state its functions?

Name: ..... [1]

Functions: .....

.....

..... [2]

(iii) Explain how the structure of the wall between the alveoli is suited for:

1. efficient gas exchange.

.....

.....

.....

..... [3]

2. enabling ventilation movements.

.....

.....

..... [2]

(b) If any particles of dust or bacteria reach the alveoli, how are they removed?

.....

..... [2]

TOTAL / 12

AS 6

GAS EXCHANGE

QUESTIONSHEET 10

Do not write in margin

Read through the following passage about breathing movements in humans and then fill in the spaces with the most appropriate word or words.

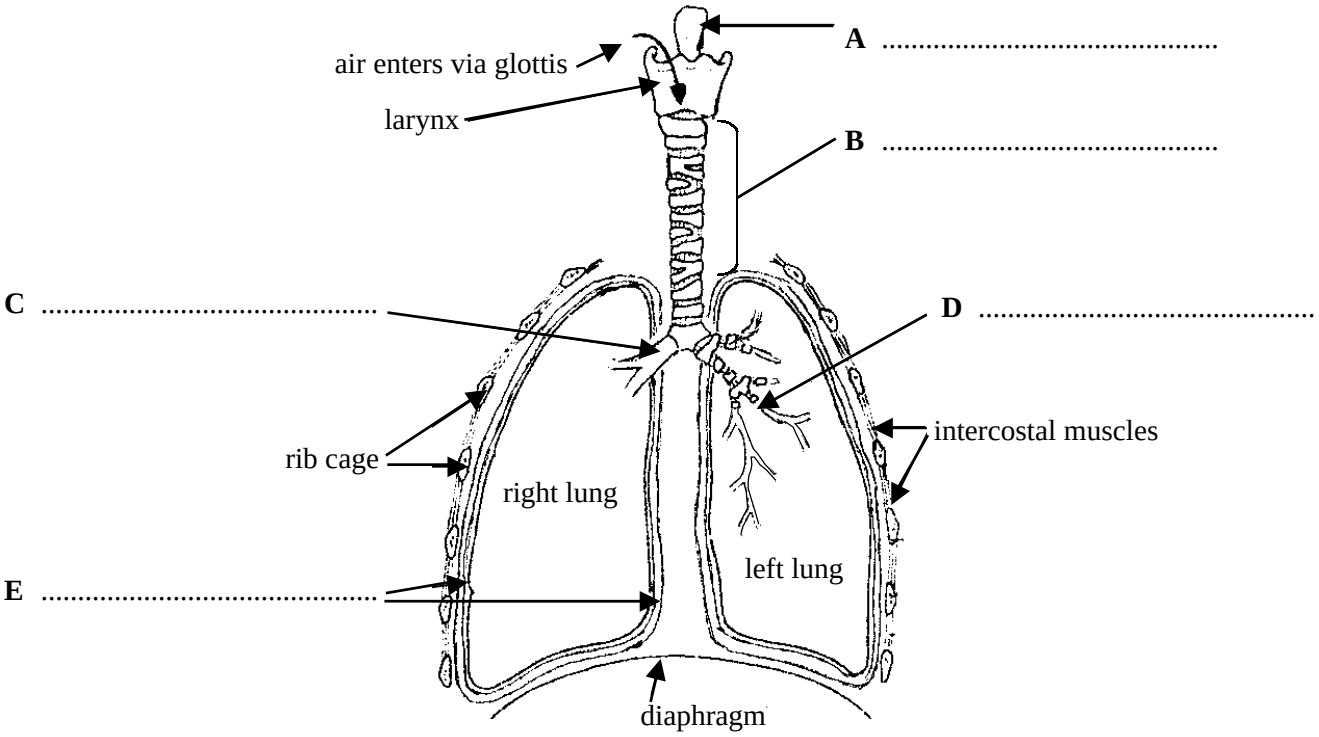
During inspiration the diaphragm ..... changing from a ..... shape to a ..... shape. At the same time the .....muscles contract and the ..... muscles relax. This pulls the ribcage upwards and outwards which ..... the volume of the thorax . ..... pressure in the ..... cavity means that the lungs must increase in volume, thus ..... the pressure in the ..... where gaseous exchange occurs, so that air rushes in through the nasal passages and ..... tree to equilibrate the pressure. During expiration the diaphragm and ..... muscles relax and the ..... muscles contract.

TOTAL / 13 _____

Do not write in margin

QUESTIONSHEET 11

The drawing below shows the respiratory tract in the neck and thorax of a human.



(a) (i) Name structures A to E. [5]

(ii) State the function of structure A.

..... [1]

(iii) Explain the functions of structures E.

.....

.....

..... [3]

(b) Describe the process of expiration.

.....

.....

.....

..... [4]

(c) Define the terms:

(i) Tidal volume.

..... [1]

(ii) Vital capacity.

.....

..... [2]

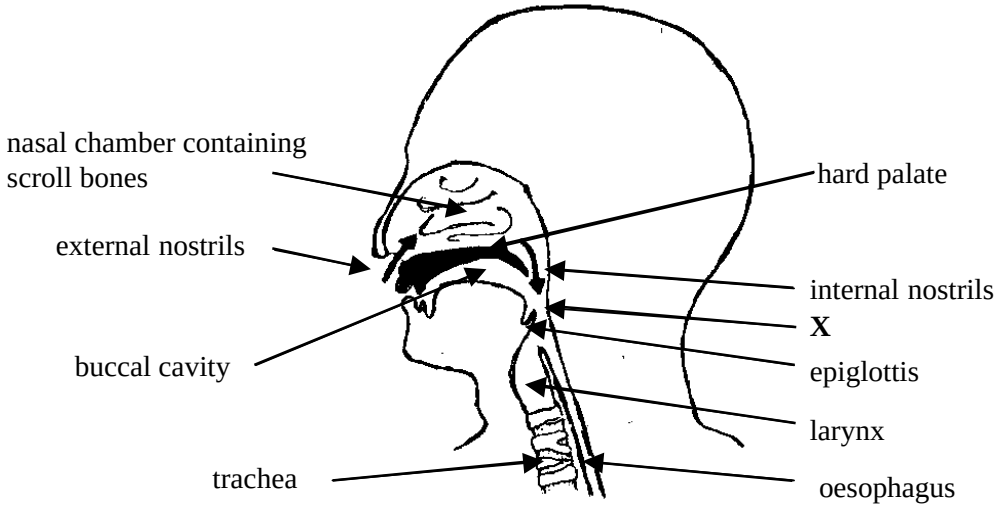
TOTAL / 16

GAS EXCHANGE

QUESTIONSHEET 12

Do not write in margin

The drawing below shows a human head cut in vertical section to show the respiratory passages.



(a) (i) Name chamber X at the back of the throat.

.....[1]

(ii) Suggest a function for the hard palate.

.....[1]

(iii) State the function of the epiglottis.

.....[1]

(iv) Explain why it is not wise to eat and speak at the same time?

.....

.....[2]

(b) The nasal chamber contains the scroll (turbinate) bones which are covered with the nasal mucosa. The nasal mucosa consists of highly vascular connective tissue which is covered by a psuedostratified ciliated mucous columnar epithelium. Numerous receptor cells are also present.

Suggest three functions of the nasal mucosa. Give an explanation for each.

1: .....

.....

2: .....

.....

3: .....

.....

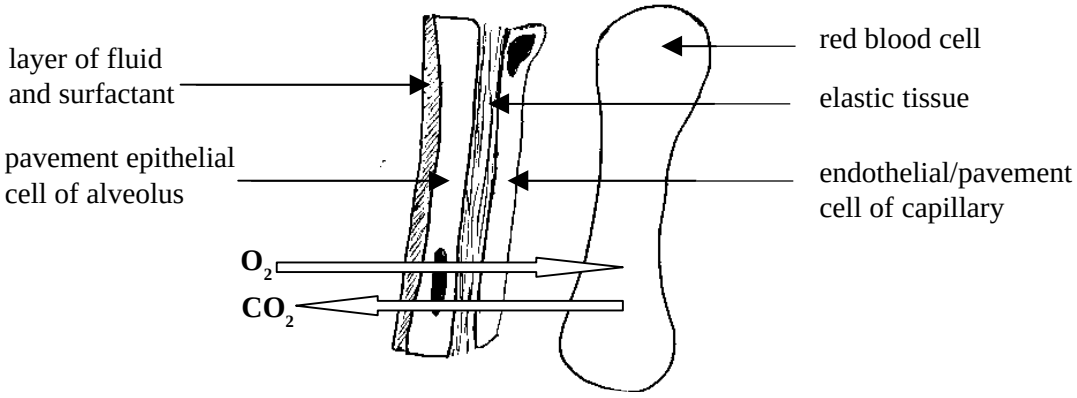
.....[6]

TOTAL / 11

QUESTIONSHEET 13

Do not write in margin

The drawing below shows a cross section through the alveolar wall of a mammal.



(a) (i) Describe the mechanism by which oxygen passes from the alveolar space into the red blood cell.

.....

.....

.....

.....

..... [4]

(ii) Describe the mechanism by which carbon dioxide passes from the red cell to the alveolus.

.....

.....

.....

.....

..... [4]

(b) (i) State two functions of the elastic tissue in the alveolar walls.

1: ..... [1]

2: ..... [1]

(ii) What is the main function of the surfactants in the alveolar fluid?

..... [1]

(*Continued...*)

Do not write in margin

(c) The equation below represents Fick's Law of diffusion across membranes:

$$J = DA \frac{\Delta c}{\Delta x}$$

where J = net rate of diffusion
D = diffusion constant of the dissolved solute
A = area of the membrane
Δc = concentration difference across the membrane
Δx = thickness of the membrane

In emphysema the elastic tissue around the alveoli degenerates so that alveoli are lost. The alveolar walls may also become thickened as fibrous tissue is deposited.

With reference to Fick's Law explain how emphysema can cause inefficient gas exchange.

.....

.....

.....

.....

.....

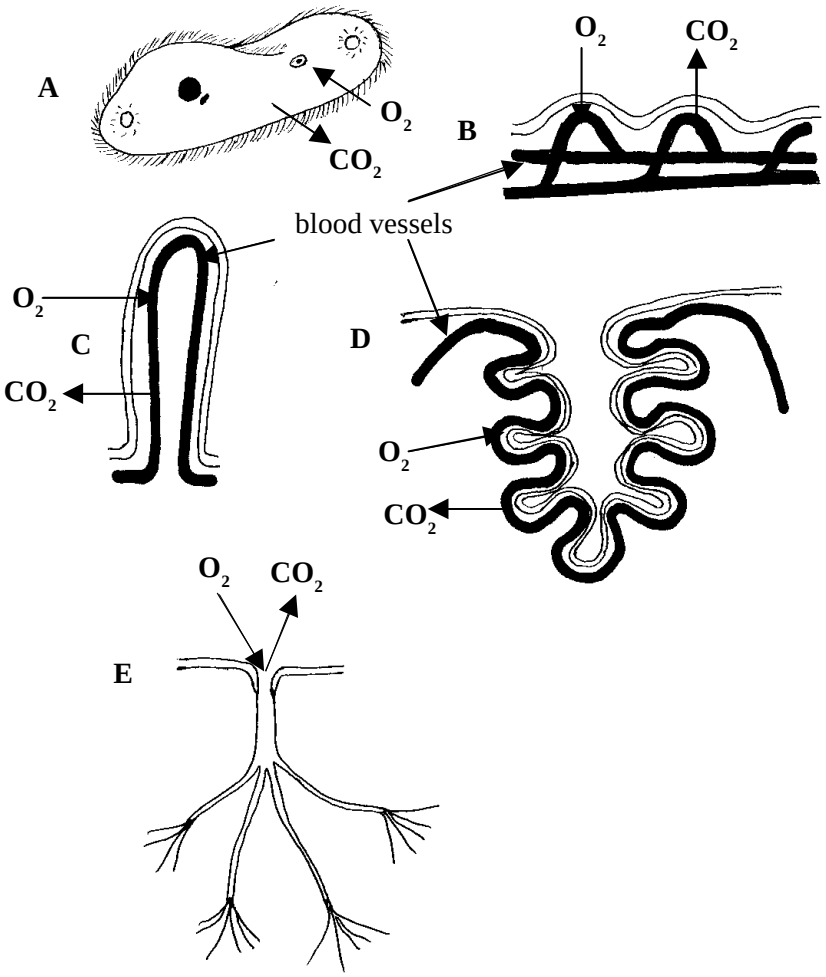
..... [4]

TOTAL / 15

QUESTIONSHEET 14

Do not write in margin

The drawings below show stages in the evolutionary development of respiratory surfaces in the animal kingdom.



(a) (i) Complete the following table by filling in appropriate details about A to E, concerning the nature of the respiratory surface and an organism or type of organism that it is found in.

	Respiratory surface	Example of organism
A		
B		
C		
D		
E		

[10]

(*Continued...*)

Do not write in margin

(ii) What general trend is shown by the sequence A to D?

..... [1]

(iii) Respiratory surfaces must be kept moist. Suggest how is that can be achieved in examples A to E?

A: .....

B: .....

C: .....

D: .....

E: ..... [5]

(b) Explain the need for the development of a respiratory pigment in many types of organism.

.....

.....

.....

..... [3]

TOTAL / 19

GAS EXCHANGE

QUESTIONSHEET 15

Do not write in margin

Explain the following:

(a) In bony fish the blood flow through the gills and the waterflow over the gills are in opposite directions. (simple diagrams could be helpful in this answer).

.....

.....

.....

.....

..... [3]

(b) The need for stretch receptors in the mammalian lung.

.....

.....

.....

.....

..... [4]

(c) The role of chemoreceptors in regulating ventilation in mammals.

.....

.....

.....

.....

..... [4]

(d) The role of the phrenic nerves in regulating ventilation.

.....

.....

.....

..... [3]

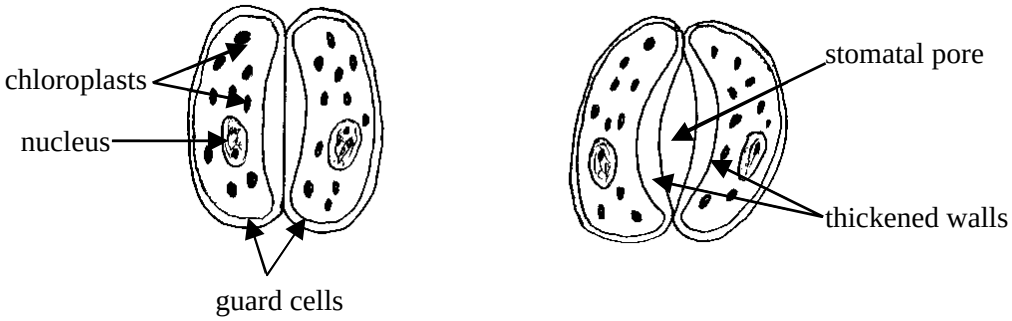
TOTAL / 14

GAS EXCHANGE

QUESTIONSHEET 16

Do not write in margin

The drawings below show a stoma in surface view in closed and open state.



(a) (i) When do the stomata:

1. release most water vapour. .....

..... [1]

2. take up carbon dioxide. .....

..... [1]

3. take up oxygen? .....

..... [1]

(ii) Suggest and explain why guard cells contain chloroplasts whereas the surrounding epidermal cells do not.

.....

.....

.....

..... [3]

(b) The guard cells possess a potassium pump which takes up potassium ions from the surrounding accessory cells during light periods. Suggest an explanation for this.

.....

.....

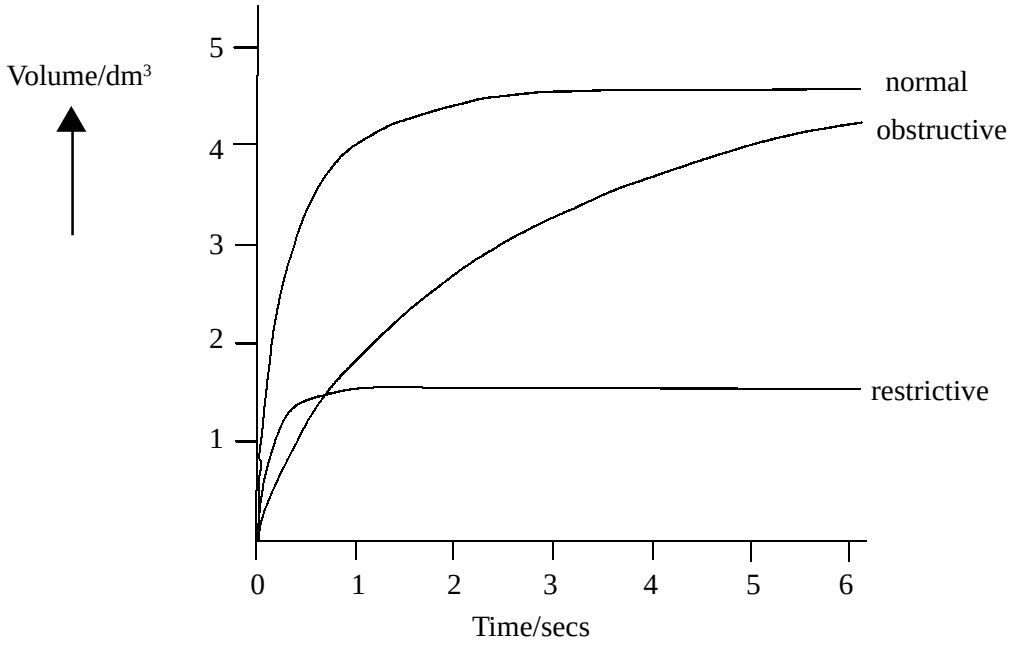
.....

..... [3]

TOTAL / 9

QUESTIONSHEET 17

The graph below shows a spirometer tracing from a respiratory function test. In this test the patient would breathe suddenly and forcibly into the apparatus to measure the peak flow rate of air out of the lungs. Reduced lung function is found in the obstructive condition where the lung passages are blocked by infections, and in the restrictive condition where the elastic tissues of the lung are being destroyed.



(a) (i) Suggest why infections may obstruct the bronchial passages.

.....

.....

.....

..... [3]

(ii) Suggest reasons why the elastic tissue of the lungs might be destroyed.

.....

.....

.....

..... [3]

(b) Suggest an explanation for the different shapes of the obstructive and restrictive graphs.

.....

.....

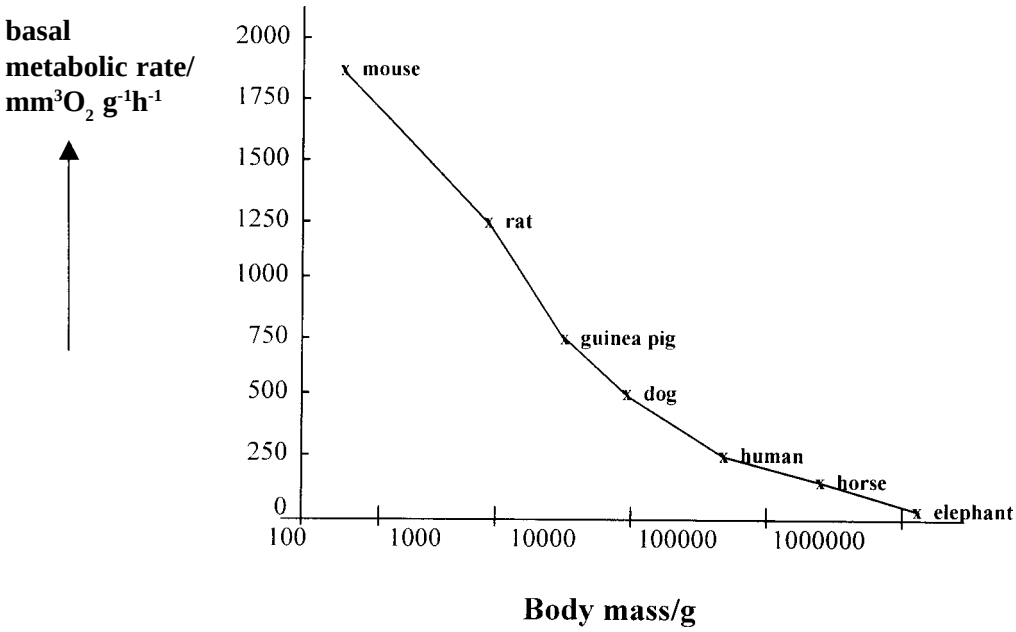
..... [2]

TOTAL / 8

GAS EXCHANGE

QUESTIONSHEET 18

The graph below shows the basal metabolic rate of various mammals.



(a) What is meant by the term 'basal metabolic rate'?

.....[1]

(b) How is the metabolic rate of different mammals measured?

.....

.....

.....[3]

(c) Explain why smaller mammals have higher metabolic rates than large mammals.

.....

.....

.....

.....

.....[3]

(d) How do small animals get enough oxygen to the tissues to maintain a continuous high rate of metabolism?

.....

.....

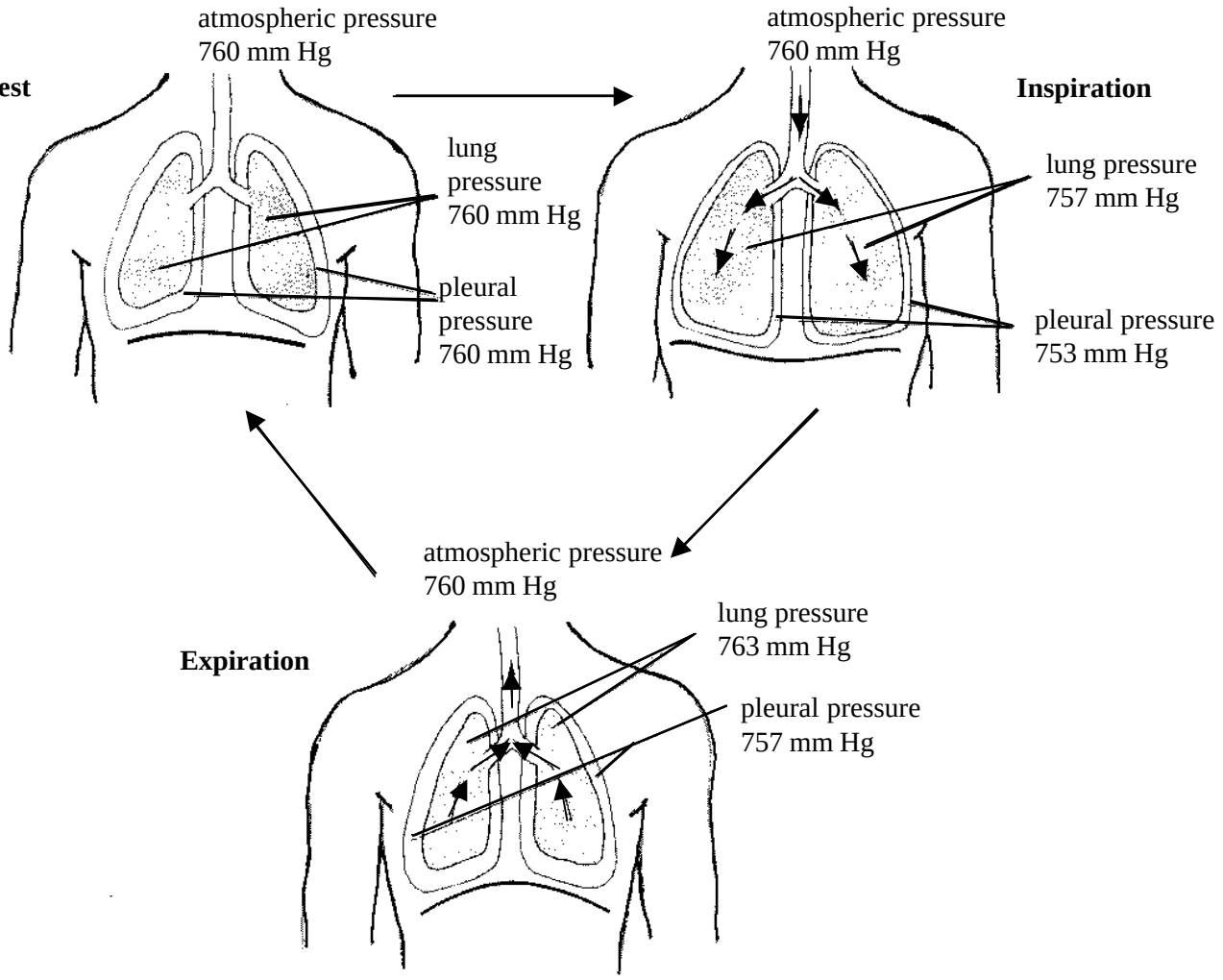
.....[2]

TOTAL / 9

QUESTIONSHEET 19

Do not write in margin

The drawings below indicate the pressure changes that occur in the lungs and pleural cavities during one cycle of inspiration and expiration.



(a) Describe the muscular actions and movements of inspiration.

.....

.....

.....

.....

..... [4]

(*Continued...*)

Do not write in margin

(b) Explain the significance of the pressure changes in the lungs and pleural cavities during,

(i) inspiration. .....

.....

.....

.....

..... [4]

(ii) expiration. .....

.....

.....

.....

..... [2]

(c) Explain the effects on ventilation of a perforation of the pleural membranes, for instance, by a stab wound.

.....

.....

.....

..... [3]

TOTAL / 13

GAS EXCHANGE

QUESTIONSHEET 20

Do not write in margin

Distinguish between each of the following pairs:

(a) Minute respiratory volume and vital capacity.

.....

.....

.....

..... [3]

(b) Insect tracheae and tracheoles.

.....

.....

.....

..... [3]

(c) Spiracles and stomata.

.....

.....

.....

..... [3]

(d) Gill filaments and gill lamellae.

.....

.....

.....

..... [3]

(e) Spongy mesophyll and palisade mesophyll.

.....

.....

.....

..... [3]

TOTAL / 15