B3.1 Gas exchange

What the Cell · DP Biology · worksheet · animal statements B3.1.1–6

Name _____ **Date** _____ **Total** _____ / 52

About 50 minutes, or one section at a time. A calculator is allowed. The number of marks shows how many separate points to make. Look at the bold command term: "state" needs a brief answer, while "explain" needs reasons.

Section A: Recall

9 marks

1 **List** four properties of gas-exchange surfaces. B3.1.2 **[2]**

2 **State** the effect of surfactant on the lining of an alveolus. B3.1.4 **[1]**

3 **State** the structures in the lungs where gas exchange takes place. B3.1.4 **[1]**

4 **Distinguish** between tidal volume and vital capacity. B3.1.6 **[2]**

5 **State** the two sets of muscles that contract during inhalation at rest. B3.1.5 **[2]**

6 **State** the equation that gives vital capacity from the other measured volumes. B3.1.6 **[1]**

Section B: Understanding

14 marks

7 **Outline** why gas exchange becomes more challenging as organisms increase in size. B3.1.1 **[2]**

8 **Explain** three ways in which concentration gradients are maintained at the surface of the lungs. B3.1.3 **[3]**

9 **Explain** how the alveoli and their blood supply are adapted for gas exchange. B3.1.4 **[4]**

10 **Explain** why a fish must keep water moving over its gills. B3.1.3 **[2]**

11 A student wrote: "Air rushes into the lungs, and this pushes the diaphragm down." **Explain** the mistake and give the correct sequence. B3.1.5 **[3]**

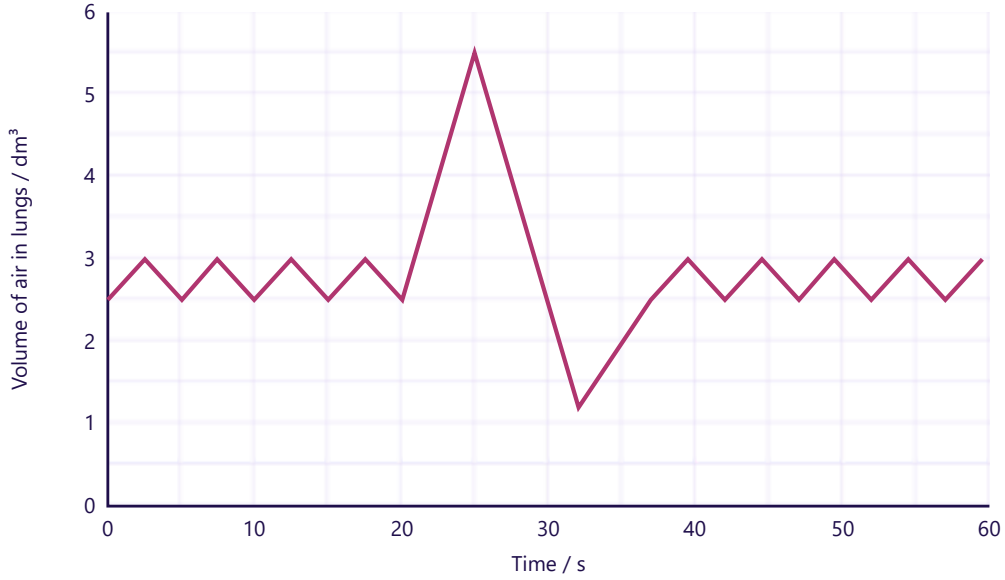
Section C: Working with data

21 marks

Data in questions 12 and 14 are invented for practice. The patterns are realistic, but they do not describe a real person.

12 B3.1.6

The spirometer trace shows a person breathing normally, then taking the deepest possible breath in, then breathing out as far as possible, then breathing normally again.



a **Determine** the tidal volume. **[1]**

b **Determine** the inspiratory reserve. **[1]**

c **Determine** the expiratory reserve. **[1]**

d **Calculate** the vital capacity, showing your working. **[1]**

e **Calculate** the resting ventilation rate in breaths per minute. **[2]**

f **Predict** two changes to the trace during vigorous exercise. **[2]**

13 B3.1.3, B3.1.4

The table gives typical percentages of two gases in air at three points.

Gas	Inhaled air / %	Air in alveoli / %	Exhaled air / %
Oxygen	20.9	14.0	16.0
Carbon dioxide	0.04	5.5	4.0

a **Calculate** the percentage change in oxygen from inhaled air to air in the alveoli. **[2]**

b **Explain** why the carbon dioxide percentage is far higher in the alveoli than in inhaled air. **[2]**

c **Suggest** why exhaled air contains more oxygen than air in the alveoli. **[2]**

14 B3.1.5, B3.1.6

A student measured their ventilation at three levels of activity.

Activity	Ventilation rate / breaths per minute	Tidal volume / dm^3	Air breathed / dm^3 per minute
Rest	12	0.5	
Walking	20	1.0	
Running	38	2.0	

a **Calculate** the three values missing from the table. **[2]**

b **Calculate** the percentage change in air breathed per minute from rest to running. **[2]**

c **Explain** why air breathed per minute rises during exercise. **[3]**

Section D: Longer answers

8 marks

15 **Describe** how the movements of muscles and ribs cause air to enter and then leave the lungs. B3.1.5 **[6]**

16 **Evaluate** using a balloon, rather than a spirometer, to estimate vital capacity. B3.1.6 [2]