



ANSWER BOOK

Lungs: seventy square metres, folded into a chest

Exchange surfaces and gas exchange · Unit B07

AQA 3.3.2 · OCR A 3.1.1 · CAIE 9.1

5 questions · 18 marks

NAVY EDITION

SECTION A · Short, 1 to 2 marks

- A1** **A1** the airway is a bronchus, identified from the blocks of cartilage in its wall. **A1** [2]
a bronchiole has a conspicuous layer of smooth muscle, with elastic fibres, and no cartilage at all.
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SECTION B · Standard, 3 to 5 marks

- B1** **M1** ventilation rate = $21 \times (60 \div 84)$, converting the count to a number of [5]
breaths per minute. **A1** 15 breaths per minute. **M1** pulmonary ventilation rate = tidal
volume $\times$ ventilation rate = 0.55×15 . **A1** $8.25 \text{ dm}^3 \text{ min}^{-1}$, with the unit given. **A1** alveolar
volume = $(0.55 - 0.15) \times 15 = 6.0 \text{ dm}^3 \text{ min}^{-1}$, because the dead space is paid for on every
breath.
- B2** **B1** the external intercostal muscles contract, pulling the ribcage upwards and [4]
outwards. **B1** the diaphragm contracts, flattens and moves downwards. **B1** the volume
of the thoracic cavity increases, and the lungs are stretched with it. **A1** the pressure
inside the lungs falls below atmospheric pressure, so air moves in down the pressure
gradient.
- B3** **B1** inspiration depends on the diaphragm and external intercostal muscles [4]
contracting, and muscle contraction requires ATP. **B1** elastic fibres in the alveolar walls
and airways are stretched as the lungs inflate, storing energy as they do so. **B1** in quiet
expiration those muscles simply relax, and the stretched elastic tissue recoils, which
needs no contraction of any muscle. **A1** the recoil reduces the volume of the thorax, so
pressure in the lungs rises above atmospheric and air moves out.
- B4** **B1** the total surface area available for gas exchange falls, and rate of diffusion [3]
is proportional to surface area. **B1** loss of elastic fibres weakens the recoil, so expiration
is no longer largely passive and less air is expelled per breath. **A1** less oxygen therefore
reaches the blood each minute, so ventilation has to rise steeply to meet the extra
demand of exercise and the person feels breathless.
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