

# Past-paper walk-through

Gas exchange in humans ■ 11.1

eXercise

## Questions in this set

- 0610/21 N25 Q17 ■ 1 mark
- 0610/22 N25 Q16 ■ 1 mark
- 0610/23 N25 Q18 ■ 1 mark
- 0610/21 J25 Q18 ■ 1 mark
- 0610/22 J25 Q6 ■ 1 mark
- 0610/22 J25 Q20 ■ 1 mark
- 0610/23 J25 Q18 ■ 1 mark
- 0610/42 J25 Q1 ■ 20 marks

## Reading the mark scheme

- **B1** a mark that stands on its own – the point is either made or not.
- **M1** a *method* mark: the right approach, even if the number is wrong.
- **A1** an *answer* mark, and it usually needs its M mark first.
- **C1** a working mark on the way to the answer.
- **//** separates answers the examiner accepts equally.
- **ecf** = error carried forward: a later part is marked on your own earlier answer.
- **owtte** = “or words to that effect” – the wording need not match.

## Question 17

0610/21 N25 ■ Q17 ■ 1 mark

- 17** Which muscles in the breathing system contract during inspiration?
- A** external intercostal and diaphragm only
  - B** external intercostal and internal intercostal only
  - C** external intercostal, internal intercostal and diaphragm
  - D** internal intercostal and diaphragm only

## Solution 17

Answer: **A**

### Why

- Inspiration needs the chest volume to increase.
- The diaphragm contracts and flattens downwards.
- The external intercostal muscles contract to pull the ribs up and out; the internal ones are used in forced expiration.

## Question 16

0610/22 N25 ■ Q16 ■ 1 mark

**16** Which row describes what happens when breathing in?

|          | diaphragm | external intercostal muscles |
|----------|-----------|------------------------------|
| <b>A</b> | contracts | contract                     |
| <b>B</b> | contracts | relax                        |
| <b>C</b> | relaxes   | contract                     |

## Question 16

|          |         |       |
|----------|---------|-------|
| <b>D</b> | relaxes | relax |
|----------|---------|-------|

## Solution 16

Answer: **A**

### Why

- Breathing in needs the chest cavity to get bigger.
- The diaphragm contracts and flattens downwards.
- The external intercostal muscles contract to lift the ribs up and out.

## Question 18

0610/23 N25 ■ Q18 ■ 1 mark

**18** Which changes cause expiration?

|          | external<br>intercostal muscles | diaphragm              |
|----------|---------------------------------|------------------------|
| <b>A</b> | contract                        | relaxes and moves down |
| <b>B</b> | contract                        | relaxes and moves up   |
| <b>C</b> | relax                           | relaxes and moves down |
| <b>D</b> | relax                           | relaxes and moves up   |

## Question 18



## Solution 18

Answer: **D**

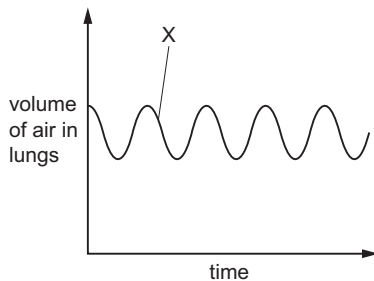
### Why

- Expiration needs the chest cavity to get smaller.
- The external intercostal muscles relax, so the ribs fall.
- The diaphragm relaxes and moves back *up* into its domed shape.

## Question 18

0610/21 J25 ■ Q18 ■ 1 mark

- 18** The graph shows how the volume of air in lungs changes when a person is breathing at rest.



Which processes are occurring to change the volume at the point marked X?

## Question 18

- A** The diaphragm is relaxing and the external intercostal muscles are relaxing.
- B** The diaphragm is contracting and the internal intercostal muscles are contracting.
- C** The diaphragm is contracting and the internal intercostal muscles are relaxing.
- D** The diaphragm is relaxing and the external intercostal muscles are contracting.

## Solution 18

Answer: **A**

### Why

- Lung volume increases during inspiration and decreases during expiration.
- Inspiration needs the diaphragm to contract and flatten, and the external intercostals to contract.
- So read whether the volume is rising or falling at the marked point and match the muscle actions.

## Question 6

0610/22 J25 ■ Q6 ■ 1 mark

**6** Which row shows the conditions when diffusion of oxygen into the blood is fastest?

|          | alveolar surface<br>area | concentration<br>gradient | diffusion path<br>distance |
|----------|--------------------------|---------------------------|----------------------------|
| <b>A</b> | high                     | high                      | short                      |
| <b>B</b> | high                     | low                       | short                      |
| <b>C</b> | low                      | high                      | long                       |
| <b>D</b> | low                      | low                       | long                       |

## Solution 6

Answer: **A**

### Why

- Diffusion is fastest with a large surface area, a steep concentration gradient and a short path.
- All three factors work in the same direction here.
- So the fastest case is high area, high gradient and short distance.

## Question 20

0610/22 J25 ■ Q20 ■ 1 mark

- 20** The table shows the breathing rate and the average total volume of air breathed by a student when exercising for 20 minutes.

| time<br>/minutes | breathing rate<br>/breaths per<br>minute | average total volume<br>of air breathed<br>/cm <sup>3</sup> per minute |
|------------------|------------------------------------------|------------------------------------------------------------------------|
| 0                | 12                                       | 5 000                                                                  |
| 5                | 12                                       | 9 000                                                                  |
| 10               | 12                                       | 15 000                                                                 |
| 15               | 18                                       | 20 000                                                                 |
| 20               | 22                                       | 25 000                                                                 |

Which conclusion can be made from the data in the table about the effect of exercise on

## Question 20

breathing?

- A** Between 0 minutes and 10 minutes, there is no change to the depth of breathing.
- B** Between 0 minutes and 10 minutes, the depth of breathing increases.
- C** Between 10 minutes and 20 minutes, there is no change to the rate of breathing.
- D** Between 15 minutes and 20 minutes, the depth of breathing decreases.

## Solution 20

Answer: **B**

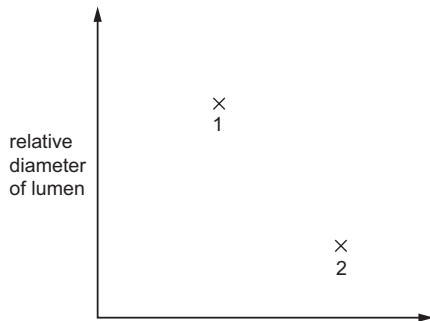
### Why

- Total air per minute = breathing rate  $\times$  volume of each breath.
- So read both columns and multiply them for each time.
- The rise during exercise supplies the extra oxygen the muscles need for aerobic respiration.

## Question 18

0610/23 J25 ■ Q18 ■ 1 mark

- 18** The plotted points, 1 and 2, on the graph show two different types of structure in the breathing system of a human.



## Question 18

distance from the larynx

Which row identifies a structure attached to alveoli and a structure containing cartilage?

|          | a structure attached to alveoli | a structure containing cartilage |
|----------|---------------------------------|----------------------------------|
| <b>A</b> | 1                               | 1                                |
| <b>B</b> | 1                               | 2                                |
| <b>C</b> | 2                               | 1                                |
| <b>D</b> | 2                               | 2                                |

## Solution 18

Answer: **C**

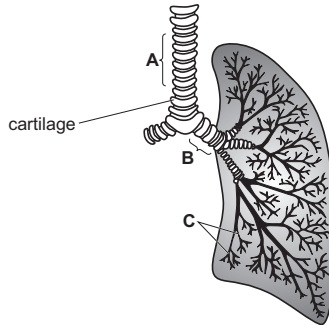
### Why

- Moving away from the larynx, the airways branch and each branch is narrower.
- So the trachea has the widest lumen and a bronchiole the narrowest.
- Read the two plotted points: the one further from the larynx must have the smaller diameter.

## Question 1

0610/42 J25 ■ Q1 ■ 20 marks

- 1 (a) Fig. 1.1 shows part of the human gas exchange system.



# Question 1

**Fig. 1.1**

- (i) Identify structures **A**, **B** and **C** shown in Fig. 1.1.

## Question 1

## Question 1

## Question 1

[3]

- (ii) State the function of the cartilage shown in Fig. 1.1.

## Question 1

(iii) Explain how inspiration occurs.

# Question 1

1/11 -

- (b) Cystic fibrosis is a condition that affects the lungs. People with cystic fibrosis have mucus in the airways of their lungs that is thicker and stickier than usual.
- (i) Two types of cells that line the airways protect the body against pathogens and particles.

State the names of these **two** types of cell **and** describe how they protect the body.

## Question 1

- (ii) Suggest how having thicker and stickier mucus in the airways affects the ability of a person to do exercise.

# Question 1

(c) Cystic fibrosis is an inherited condition in humans caused by a recessive allele of a gene.

There are two alleles for this gene:

- the allele for no cystic fibrosis is represented by the letter **F**
- the allele for cystic fibrosis is represented by the letter **f**.

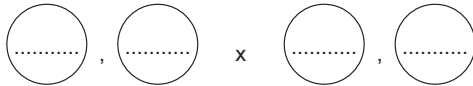
Two heterozygous parents wanted to have a child.

Complete the genetic diagram to predict the probability of these parents having a child with cystic fibrosis.

parental phenotypes                  no cystic fibrosis                  x                  no cystic fibrosis

# Question 1

gametes



## Question 1

## Question 1

## Question 1

[5]

[Total: 20]

## Solution 1

### (a)(i) Mark scheme

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- A
- trachea ;
- B
- bronchus / bronchi ;
- C
- bronchiole(s) ;
- 3

## Solution 1

**(a)(ii)**

### Mark scheme

- to keep the airway open / prevents collapse (of airway) ;
- 1

# Solution 1

## (a)(iii) Mark scheme

---

- any four from:
- 1
- diaphragm, contracts / flattens / lowers ;
- 2
- external intercostal muscles contract (and internal intercostal
- muscles relax) ;
- 3
- ribs / ribcage, lifted / AW, up / out / forwards ;

## Solution 1

- 4
- increase the volume, in the thorax / lungs / chest ;
- 5
- decreasing the pressure, in the thorax / lungs / chest ;
- 6
- air is drawn in to equalise the pressure (between atmosphere and
- lungs) ;
- 4
- A air pressure lower than atmospheric
- pressure / air moves in down a pressure gradient

# Solution 1

## (b)(i) Mark scheme

---

- 1
- any two named cells from:
  - ■
  - goblet (cells)
  - ■
  - ciliated (cells)
  - ■
  - lymphocytes

## Solution 1

- ■
- phagocytes
- plus any two from:
  - 2
  - goblet cells, secrete / produce, mucus to trap,
  - particles / pathogens / AW ;
  - 3
  - cilia on ciliated cell, move / AW, mucus, up / out / away / AW ;
  - 4
  - lymphocyte produces antibodies ;

## Solution 1

- 5
- phagocyte carry out phagocytosis OR engulf,
- pathogens / particles / AW ;
- 3
- 0610/42
- May/June 2025
- Guidance

# Solution 1

## (b)(ii) Mark scheme

---

- any four from:
- 1
- blockage / narrowing of, airways / lumen / AW ;
- 2
- reduced, diffusion / surface area (for gas exchange) ;
- 3
- ref. to less / slower, (delivery of) oxygen / (removal of) carbon
- dioxide / gas exchange ;

## Solution 1

- 4
- into, blood / muscle ;
- 5
- less (aerobic) respiration / (more) anaerobic respiration ; ora
- 6
- less energy (released) / ATP (produced) ; ora
- 7
- for muscle contraction ;
- 4
- A increased diffusion distance

# Solution 1

## (c) Mark scheme

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- 1
- correct parental genotypes:  $Ff$  and  $Ff$  ;
- 2
- correct gametes:  $F, f$  and  $F, f$  ;
- 3
- correct offspring genotypes:  $FF, Ff, (Ff), ff$  ;
- 4
- correct offspring phenotypes:

## Solution 1

- no cystic fibrosis and no cystic fibrosis (no cystic fibrosis) and
- cystic fibrosis ;
- 5
- probability:  $0.25 / 25(\%) / 1 \text{ out of } 4 / 1:3$  ;
- 5
- A genotypes in any order
- MP4 offspring phenotypes must be in the same
- order as offspring genotypes
- ecf from previous step
- 0610/42

# Solution 1

- May/June 2025
- Guidance