

Exchange and transport in animals practice questions

29 questions · 80 marks · mark scheme at the back

For Edexcel GCSE Biology 1BI0 and Combined Science 1SC0. **Triple only** is not in Combined Science. **Higher tier** is only on the Higher paper.

Name

Total / 80

Transport and exchange surfaces Spec 8.1-8.3

1 Which substance is a waste product that is carried in the blood to the kidneys? [1 mark]

- A. ☐ Urea
- B. ☐ Oxygen
- C. ☐ Glucose
- D. ☐ Mineral ions

2 Describe the need to transport (a) dissolved food molecules into cells and (b) urea out of cells. [4 marks]

3 A cube-shaped piece of tissue has sides of 4 cm. Calculate the surface area : volume ratio. Give your answer in the form x : 1. [3 marks]

Answer =

8

Triple only

[2 marks]

In some lung diseases the walls of the alveoli become thicker. Explain how this affects the rate of diffusion of oxygen into the blood.

9

Triple only

[3 marks]

A membrane has a surface area of 50 units and a thickness of 4 units. The concentration difference across it is 8 units. Use Fick's law to calculate the rate of diffusion in arbitrary units.

Answer =

10

Triple only

[3 marks]

A student says that the rate of diffusion across a membrane will double if both the surface area and the thickness of the membrane are doubled. Use Fick's law to evaluate the student's idea.

Blood and blood vessels Spec 8.6-8.7

11

What is the function of platelets?

[1 mark]

- A. ☐ To carry oxygen
- B. ☐ To engulf pathogens
- C. ☐ To help the blood to clot
- D. ☐ To produce antibodies

12 Explain how the structure of a red blood cell is related to its function. **[3 marks]**

13 Describe how phagocytes and lymphocytes protect the body against pathogens. **[4 marks]**

14 State two substances that are transported in the blood plasma. **[2 marks]**

15 **Higher tier** **[2 marks]**

A blood sample has 5×10^6 red blood cells in each mm^3 . Calculate the number of red blood cells in 3 mm^3 of this blood. Give your answer in standard form.

Answer =

16 Explain how the structure of an artery is related to its function. **[3 marks]**

17 Explain how the structure of a capillary is related to its function.

[3 marks]

The heart and circulation Spec 8.8, 8.12

18 Which blood vessel carries oxygenated blood from the lungs to the heart?

[1 mark]

- A. ☐ Aorta
- B. ☐ Pulmonary artery
- C. ☐ Pulmonary vein
- D. ☐ Vena cava

19 Explain the role of the valves in the heart.

[2 marks]

20 Explain why the wall of the left ventricle is thicker than the wall of the right ventricle.

[3 marks]

21 A person has a heart rate of 72 beats per minute and a stroke volume of 70 cm³. Calculate the cardiac output. Include the unit. **[2 marks]**

Answer =

- 22** A person has a cardiac output of 6300 cm^3 per minute and a heart rate of 90 beats per minute. Calculate the stroke volume. **[3 marks]**

Answer =

[illegible]

- 23** A student counts 21 pulse beats in 15 seconds. Calculate the student's heart rate in beats per minute. **[2 marks]**

Answer =

[illegible]

- 24** Explain how the structure of the heart and the circulatory system allow blood to be delivered to both the lungs and the rest of the body. **[6 marks]**

[illegible]

Respiration Spec 8.9–8.11

- 25** Respiration is an exothermic reaction. What does this mean? [1 mark]

- A. ☐ Energy is transferred to the surroundings
- B. ☐ Energy is taken in from the surroundings
- C. ☐ Oxygen is used up
- D. ☐ Carbon dioxide is produced

26 Write the word equation for aerobic respiration.

[2 marks]

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27 Describe how a respirometer can be used to compare the rate of respiration of germinating seeds at two different temperatures.

[4 marks]

[illegible]

28 In a respirometer experiment, the coloured liquid moved 12 mm in 4 minutes at 20 °C and 30 mm in 5 minutes at 30 °C. Calculate the rate of movement at each temperature in mm per minute and state how many times faster the rate of respiration was at 30 °C. **[3 marks]**

Answer =

[illegible]

29 Compare the process of aerobic respiration with the process of anaerobic respiration.

[6 marks]

[illegible]

Mark scheme

One mark for each point unless a maximum is given. Words in brackets are not needed for the mark.

1. [1]

A A (urea)

2. [4]

- (a) dissolved food molecules such as glucose are used in respiration (1) allow amino acids used for growth or to make proteins
- (a) to release energy (1)
- (b) urea is a waste product (1)
- (b) it must be removed from the body / carried to the kidneys and excreted in urine (1) allow urea is toxic if it builds up
- Max 4

3. [3]

- surface area = $6 \times 4 \times 4 = 96 \text{ cm}^2$ (1)
- volume = $4 \times 4 \times 4 = 64 \text{ cm}^3$ (1)
- $96 : 64 = 1.5 : 1$ (1) allow 3 : 2

4. [3]

- single-celled organism has a large surface area : volume ratio (1)
- short diffusion distance, so substances can diffuse across the surface fast enough (1)
- a human has a small surface area : volume ratio / cells are deep inside the body (1)
- so diffusion is too slow / diffusion distance too long to supply all the cells (1)
- Max 3

5. [1]

B B (the walls are one cell thick)

6. [6]

Level 3 5-6	A detailed, well-linked explanation covering several adaptations of the alveoli and the capillaries. Each feature is linked to its effect on diffusion, and the direction of movement of both gases is stated or implied.
Level 2 3-4	Some adaptations are explained with links to diffusion, but the explanation may be incomplete or some links may be missing.
Level 1 1-2	Adaptations are stated with little or no explanation of how they affect diffusion.

Indicative content

- oxygen diffuses from the air in the alveoli into the blood, and carbon dioxide diffuses from the blood into the alveoli
- millions of alveoli give a large surface area
- alveolus walls and capillary walls are one cell thick, so there is a short diffusion distance
- a rich network of capillaries / good blood supply carries oxygen away and brings carbon dioxide, keeping a steep concentration gradient
- ventilation brings fresh air in and removes air containing carbon dioxide, maintaining the concentration gradient
- moist lining so gases dissolve

7. [1] Triple only

C C (increasing the thickness of the membrane)

8. [2] Triple only

- diffusion distance increases (1)
- so the rate of diffusion decreases / less oxygen enters the blood (1)

9. [3] Triple only

- surface area $\times$ concentration difference = $50 \times 8 = 400$ (1)
- $\div$ thickness = $400 \div 4$ (1)
- 100 (arbitrary units) (1)

10. [3] Triple only

- rate of diffusion is proportional to surface area (1)
- and inversely proportional to thickness, so doubling both cancels out (1)
- rate stays the same, so the student is not correct (1)

11. [1]

C C (to help the blood to clot)

12. [3]

- biconcave disc shape gives a large surface area (for absorbing oxygen) (1)
- contains haemoglobin which combines with oxygen (1)
- no nucleus so there is more room for haemoglobin (1)

13. [4]

- phagocytes engulf pathogens (1)
- and digest them (1)
- lymphocytes produce antibodies (1)
- which destroy pathogens (1) allow bind to pathogens

14. [2]

- carbon dioxide / urea / digested food molecules (glucose, amino acids) / mineral ions / hormones (1)
ignore heat; do not accept oxygen or red blood cells
- any second different substance from the same list (1)
- Max 2

15. [2] Higher tier

- $3 \times 5 \times 10^6 = 15 \times 10^6 / 15\,000\,000$ (1)
- 1.5×10^7 (1)

16. [3]

- thick muscular wall to withstand high pressure (1)
- elastic fibres allow the wall to stretch and spring back (1)
- narrow lumen helps maintain high pressure (1)
- Max 3

17. [3]

- walls are one cell thick (1)
- so there is a short diffusion distance (1)
- narrow and forms a large network, giving a large surface area for exchange with cells (1)

18. [1]

C C (pulmonary vein)

19. [2]

- prevent backflow of blood (1)
- so the blood flows in one direction only (1)

20. [3]

- left ventricle pumps blood around the whole body (1)
- right ventricle pumps blood only to the lungs (1)
- so the left ventricle needs to produce a higher pressure / more force, so a thicker muscle wall is needed (1)

21. [2]

- 72×70 (1)
- = 5040 cm³ per minute (1) allow cm³/min; correct answer with no working = 2 marks; 5040 with no unit or the wrong unit = 1 mark

22. [3]

- stroke volume = cardiac output $\div$ heart rate (1)
- $6300 \div 90$ (1)
- 70 cm³ (1)

23. [2]

- $21 \times 4 / 21 \div 15 \times 60$ (1)
- = 84 beats per minute (1) allow bpm

24. [6]

Level 3 5-6	A clear and logical explanation which follows the blood through both circuits, naming the major vessels and explaining the roles of the valves and the different wall thicknesses.
Level 2 3-4	Some of the structure is described with some explanation of function, but the account of the route or the adaptations may be incomplete.
Level 1 1-2	Some structures or vessels are named, with little or no explanation of how they relate to function.

Indicative content

- double circulatory system: one circuit to the lungs, one to the body
- deoxygenated blood enters the right atrium from the vena cava, and passes to the right ventricle
- right ventricle pumps blood to the lungs through the pulmonary artery
- oxygenated blood returns in the pulmonary vein to the left atrium, then the left ventricle
- left ventricle pumps blood to the body through the aorta
- left ventricle has a thicker wall than the right ventricle because it pumps blood at higher pressure around the whole body, while the right ventricle pumps to the lungs
- valves prevent backflow so blood flows one way
- ventricle walls are thicker than atrium walls because they pump blood out of the heart

25. [1]

A A (energy is transferred to the surroundings)

26. [2]

- glucose + oxygen (1)
- → carbon dioxide + water (1) allow correct balanced symbol equation

27. [4]

- place seeds in a tube with soda lime / carbon dioxide absorber, connected to a capillary tube with a drop of coloured liquid (1)
- place the tubes in water baths at the two temperatures (1)
- measure the distance the liquid moves in the same time (1)
- control variables, for example the same mass of seeds and the same time (1)
- repeat and calculate a mean (1)
- Max 4

28. [3]

- 20 °C: $12 \div 4 = 3$ mm per minute (1)
- 30 °C: $30 \div 5 = 6$ mm per minute (1)
- twice as fast / 2 times (1)

29. [6]

Level 3 5-6	A detailed comparison covering oxygen requirement, energy released and the products in animals and in plants or yeast. Similarities and differences are clearly linked.
Level 2 3-4	Some similarities and differences are described, but the comparison is incomplete, for example products for only one type of organism.
Level 1 1-2	Basic statements about one or both types of respiration, with little or no comparison.

Indicative content

- both are exothermic reactions that release energy from glucose
- both happen in living cells to release energy for metabolic processes
- aerobic respiration needs oxygen, anaerobic respiration does not
- aerobic respiration breaks glucose down completely, anaerobic is an incomplete breakdown
- aerobic releases much more energy per glucose molecule
- aerobic products are carbon dioxide and water
- anaerobic products in animals: lactic acid
- anaerobic products in plants and yeast: ethanol and carbon dioxide