

Movement into and out of cells practice questions

18 questions • 52 marks • mark scheme at the back

For Cambridge IGCSE Biology 0610 (and 0970, which has the same content). **Supplement** is Extended content, only examined on Papers 2 and 4.

Name

Total / 52

Diffusion **Spec 3.1**

1 Which statement describes diffusion? [1 mark]

- A. ☐ The movement of particles from a low concentration to a high concentration using energy from respiration
- B. ☐ The net movement of water through a partially permeable membrane
- C. ☐ The net movement of particles down a concentration gradient as a result of their random movement
- D. ☐ The movement of particles using protein carriers in the cell membrane

2 (a) State the source of the energy for diffusion. [1] (b) Name one substance that leaves cells by diffusion through the cell membrane. [1] [2 marks]

3 Describe the importance of diffusion of gases and solutes in living organisms. [3 marks]

- 4** A student investigates diffusion into cubes of agar containing alkali and an indicator. The cubes are placed in dilute acid and the student times how long each takes to turn colourless. (a) Calculate the surface area to volume ratio of each cube. [2] (b) Use your answers to explain why the 1 cm cube turned colourless in less time. [1] **[3 marks]**

Agar cubes	
Length of side / cm	Time to turn colourless / s
1	95
2	310

Answer =

- 5** A student places a drop of dye in water at four different temperatures and measures the time taken for the dye to spread 5 cm. (a) Describe the relationship between temperature and the time taken. [2] (b) Explain this relationship. [2] **[4 marks]**

Time for dye to spread	
Temperature / °C	Time / s
10	480
20	300
30	190
40	120

- 6** A flatworm is a small, thin and flat animal with no blood system. Explain how its shape allows oxygen to reach all of its cells. **[3 marks]**

Osmosis Spec 3.2

- 7** Describe the role of water as a solvent in organisms with reference to digestion, excretion and transport. **[3 marks]**

- 8** A student ties a bag of dialysis tubing containing concentrated sucrose solution and places it in water. The mass of the bag at the start is 12.5 g. After 40 minutes it is 14.0 g. (a) Calculate the percentage change in mass of the bag. [2] (b) Explain the change in mass. [1] **[3 marks]**

Answer =

- 9** Cylinders of potato were placed in sugar solutions of different concentrations. The percentage change in mass was measured after 60 minutes. (a) Use the data to estimate the concentration of sugar solution that has no effect on the mass of the potato. [1] (b) Explain why the potato cylinder in 0.0 mol/dm^3 increased in mass. [2] (c) State one variable that must be kept constant in this investigation. [1] [4 marks]

Change in mass of potato	
Concentration / mol/dm^3	Change in mass / %
0.0	+18
0.2	+7
0.4	-4
0.6	-13
0.8	-20

- 10** Explain how water inside cells supports a young, non-woody plant stem. [3 marks]

- 11** **Supplement** [1 mark]

Two solutions are separated by a partially permeable membrane. Solution X is dilute. Solution Y is concentrated. What is the net movement of water?

- A. ☐ From X to Y, because X has a lower water potential
 B. ☐ From X to Y, because X has a higher water potential
 C. ☐ From Y to X, because Y has a higher water potential
 D. ☐ There is no net movement because the membrane is partially permeable

12

Supplement

[5 marks]

A piece of onion epidermis is placed in a concentrated sugar solution. When viewed under a microscope the cell membranes have pulled away from the cell walls. Use the terms plasmolysis, flaccid and water potential to explain what has happened.

13

Supplement

[4 marks]

A red blood cell and a plant cell are each placed in distilled water. The red blood cell bursts but the plant cell does not. Explain these results.

Active transport Spec 3.3

14

Which statement describes active transport?

[1 mark]

- A. ☐ Direction: down a concentration gradient; energy from respiration: needed
- B. ☐ Direction: against a concentration gradient; energy from respiration: needed
- C. ☐ Direction: against a concentration gradient; energy from respiration: not needed
- D. ☐ Direction: down a concentration gradient; energy from respiration: not needed

15

Describe two differences between diffusion and active transport.

[2 marks]

The concentration of nitrate ions is lower in the soil than inside a root hair cell. Explain how the root hair cell takes in nitrate ions and why it has many mitochondria.

(a) State what moves molecules or ions across a cell membrane during active transport. [1] (b) Explain why active transport stops in a cell that cannot respire. [2]

Barley roots were placed in solutions with and without oxygen. The uptake of nitrate ions was measured. (a) Describe the effect of removing oxygen on nitrate uptake. [1] (b) Explain this effect. [3]

Nitrate uptake by roots	
Condition	Nitrate uptake / arbitrary units
Oxygen present	45
Oxygen absent	6

Mark scheme

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

1. [1]

C C (1)

2. [2]

- kinetic energy (of random movement of molecules / ions) (1) ignore 'heat energy'; reject 'energy from respiration'
- carbon dioxide / urea (1) allow other correct example, e.g. oxygen in a leaf cell

3. [3]

- oxygen diffuses into cells for respiration (1)
- carbon dioxide diffuses out of cells / carbon dioxide diffuses into leaf cells for photosynthesis (1)
- digested food / glucose / amino acids (solutes) diffuse from the gut into the blood (1)
- urea (waste solute) diffuses out of cells into the blood (1)
- Max 3

4. [3]

- 1 cm cube: $6 \text{ cm}^2 \div 1 \text{ cm}^3 = 6$ (1)
- 2 cm cube: $24 \text{ cm}^2 \div 8 \text{ cm}^3 = 3$ (1)
- it has the larger surface area to volume ratio / the acid has a shorter distance to diffuse to the centre (1)

5. [4]

- as temperature increases, the time taken decreases (1)
- correct use of data, e.g. 480 s at 10 °C to 120 s at 40 °C (1)
- particles have more kinetic energy at higher temperature (1)
- so they move faster, so diffusion is faster / rate of diffusion increases (1)

6. [3]

- short distance for oxygen to diffuse (1)
- large surface area compared with its volume (1)
- oxygen diffuses down a concentration gradient fast enough to supply all the cells (1)

7. [3]

- digestion: food molecules dissolve in water so that they can be broken down by enzymes / absorbed (1)
- excretion: waste substances such as urea dissolve in water and are removed in urine (1)
- transport: substances dissolve in the water of plasma / sap and are carried around the organism (1)

8. [3]

- $14.0 - 12.5 = 1.5 \text{ g}$ (1)
- $1.5 \div 12.5 \times 100 = 12\%$ (1) allow 1 mark for correct working if the final answer is wrong
- water moved into the bag by osmosis through the partially permeable tubing (1)

9. [4]

- between 0.30 and 0.35 mol/dm³ (1) allow 0.3 mol/dm³
- water entered the potato cells (1)
- by osmosis through the (partially permeable) cell membrane (1)
- any one from: temperature / volume of solution / time in solution / size (surface area) or mass of cylinder / same type of potato (1) ignore 'amount of potato'

10. [3]

- water enters the cells by osmosis (1)
- the water inside the cells presses outwards on the cell wall (1)
- so the cells become firm / rigid and the stem is held upright (1)

11. [1] Supplement

B B (1)

12. [5] Supplement

- the sugar solution has a lower water potential than the cell contents (1)
- water leaves the cell by osmosis (1)
- through the partially permeable cell membrane (1)
- the cell loses turgor pressure and becomes flaccid (1)
- the cytoplasm shrinks and the cell membrane pulls away from the cell wall: this is plasmolysis (1)

13. [4] Supplement

- distilled water has a higher water potential than the cells / cell contents (1)
- water enters both cells by osmosis (1)
- the red blood cell has no cell wall, so it swells and bursts (1)
- the plant cell wall resists the expansion, so the cell becomes turgid (1) allow 'turgor pressure stops more water entering'

14. [1]

B B (1)

15. [2]

- diffusion is down a concentration gradient but active transport is against a concentration gradient (1)
- active transport needs energy from respiration but diffusion does not (1)

16. [3] Supplement

- by active transport (1)
- movement is against the concentration gradient (1)
- mitochondria release energy (from respiration) needed for active transport (1)

17. [3] Supplement

- protein carriers (1) allow carrier proteins; ignore 'proteins' alone
- respiration releases the energy needed for active transport (1) reject 'respiration makes / produces energy'
- without this energy, particles cannot be moved against their concentration gradient (1)

18. [4] Supplement

- uptake is much lower / falls from 45 to 6 without oxygen (1)
- no oxygen so less aerobic respiration (1)
- less energy released (1)
- less active transport of nitrate ions (against the concentration gradient) (1)