

Full Higher Separate content. ★ = Higher Tier. ◆ = Separate Science only.

Q1. Define diffusion and state whether energy is required.

[2 marks]

Q2. Describe how THREE factors affect the rate of diffusion.

[3 marks]

Q3. Explain how the alveoli in the lungs are adapted for efficient gas exchange by diffusion.

[4 marks]

★ HIGHER TIER

Q4. ★ State Fick's Law and use it to explain why large organisms need specialised exchange surfaces.

[2 marks]

Total: 11 marks

Q1 (2 marks)

Define diffusion and state whether energy is required.

- Net movement of particles from a region of HIGH concentration to a region of LOW concentration (down a concentration gradient) [1]
- Passive process — no energy (ATP) required [1]

Q2 (3 marks)

Describe how THREE factors affect the rate of diffusion.

- Steeper concentration gradient → faster diffusion [1]
- Higher temperature → more kinetic energy → faster diffusion [1]
- Larger surface area → faster diffusion [1] — accept: shorter/thinner membrane

Q3 (4 marks)

Explain how the alveoli in the lungs are adapted for efficient gas exchange by diffusion.

- Large total surface area — millions of tiny alveoli [1]
- Thin walls — one cell thick, minimises diffusion distance [1]
- Dense capillary network — continuously removes O₂ and delivers CO₂, maintaining steep concentration gradient [1]
- Moist lining — gases dissolve before diffusing [1]

Q4 (2 marks) [★ HT]

★ State Fick's Law and use it to explain why large organisms need specialised exchange sur...

- Rate of diffusion \propto (surface area \times concentration difference) \div membrane thickness [1]
- Large organisms have a low SA:V ratio — diffusion alone is too slow; specialised exchange surfaces provide the large surface area and thin membranes required [1]