This is the **Higher Combined Science** version. Higher Tier questions (★) are included. Some Separate-only content has been omitted.

The Heart and Blood Vessels (8.1–8.3)

Specification reference: 8.1

Q1. Explain why the mammalian heart is described as a double pump.

[3 marks]

Q2. Compare the structure of arteries, veins and capillaries. Explain how each structure is suited to its function.

[4 marks]

★ HIGHER TIER

Q3. ★ A patient has a heart rate of 75 bpm and stroke volume of 75 cm^3. Calculate their cardiac output in dm^3/min.

[2 marks]

Gas Exchange and Digestion (8.4–8.10)

Specification reference: 8.4

Q4. Explain how the alveoli are adapted for efficient gas exchange.

[4 marks]

Q5. Describe how villi are adapted for absorption of nutrients in the small intestine.

[4 marks]

★ HIGHER TIER

Q6. ★ Explain the role of lacteals in the absorption of fat.

[3 marks]

Total: 20 marks

The Heart and Blood Vessels (8.1–8.3)

Q1 (3 marks)

Explain why the mammalian heart is described as a double pump.

- The right side pumps deoxygenated blood to the lungs (pulmonary circulation) [1]
- The left side pumps oxygenated blood to the body (systemic circulation) [1]
- The two circuits are completely separate — prevents mixing of oxygenated and deoxygenated blood [1]

Q2 (4 marks)

Compare the structure of arteries, veins and capillaries. Explain how each struc…

- Arteries: thick elastic/muscular walls — withstand high pressure blood from heart [1]
- Veins: valves — prevent backflow of low-pressure blood [1]
- Capillaries: one cell thick — minimises diffusion distance for exchange of O■, CO■, glucose [1]
- Capillaries: extensive network — brings exchange surfaces close to every cell [1]

Q3 (2 marks) [★ HT]

★ A patient has a heart rate of 75 bpm and stroke volume of 75 cm³. Calculate th…

- Cardiac output = 75 × 75 = 5625 cm³/min [1]
- = 5.625 dm³/min [1]

Gas Exchange and Digestion (8.4–8.10)

Q4 (4 marks)

Explain how the alveoli are adapted for efficient gas exchange.

- Large total surface area (millions of alveoli) — maximises area for diffusion [1]
- Thin walls (one cell thick) — minimises diffusion distance [1]
- Dense capillary network — maintains steep concentration gradient by continuously removing O■ [1]
- Moist lining — gases dissolve before diffusing through membrane [1]

Q5 (4 marks)

Describe how villi are adapted for absorption of nutrients in the small intestin…

- Finger-like projections increase surface area massively [1]
- Microvilli on surface of cells further increase surface area [1]
- Thin walls (one cell thick) — short diffusion distance [1]
- Rich blood capillary supply — maintains steep concentration gradient, removes absorbed nutrients rapidly [1]

Q6 (3 marks) [★ HT]

★ Explain the role of lacteals in the absorption of fat.

- Fatty acids and glycerol are absorbed into the epithelial cells of villi [1]
- They are reassembled into triglycerides (fat droplets) inside the cells [1]
- These fat droplets enter the lacteal (lymph vessel in villus) and travel through the lymphatic system before entering the blood [1]