

Exercise walk-through

1.3

Heart, blood vessels and the cardiac cycle (statements 1.6–1.8)

Pearson Edexcel · International A-Level · Biology

Atheroma, clot, catastrophe

Damage : smoking, hypertension, LDL cholesterol harm the endothelium

Plaque : inflammation and LDL deposition narrow and stiffen the artery

Clot : thromboplastin converts prothrombin to thrombin; fibrinogen becomes fibrin

Read a health study like an examiner

Your turn

Gum disease correlates with endothelial damage. List three checks before claiming causation.

- A. Who was sampled, how selected, how many?
- B. Were confounders like smoking, age, diet controlled?
- C. Is there a mechanism and a dose-response pattern?

DNA copies itself semi-conservatively

Unzip : helicase breaks the hydrogen bonds between the strands

Template : each old strand pairs with free nucleotides by complementary base pairing

Join : DNA polymerase links the nucleotides into a new strand

Exercises 2.1·2.3

2.1 Explain why the left ventricle wall is thicker than the right ventricle wall. [2]

2.2 Capillaries have no elastic fibres or smooth muscle in their walls. Explain why this absence suits their function. [2]

2.3 State two features of a vein, other than valves, that help return blood to the heart. [2]

Exercises 2.1·2.3

2.1 Explain why the left ventricle wall is thicker than the right ventricle wall. [2]

2.1 The left ventricle drives blood around the whole body against a higher resistance/pressure than the right, which only drives it to the nearby lungs; a thicker muscular wall generates the greater force.

2.2 Capillaries have no elastic fibres or smooth muscle in their walls. Explain why this absence suits their function. [2]

2.2 The single-cell endothelium gives a short diffusion path for exchange; absence of muscle/elastin keeps the wall thin and the total cross-sectional area vast, slowing flow to give time for exchange.

2.3 State two features of a vein, other than valves, that help return blood to the heart. [2]

2.3 Any two: wide lumen lowering resistance to flow; surrounding skeletal muscle contraction squeezes the deep veins; the negative thoracic pressure during breathing helps draw blood upward; one-way valves (already excluded).

Exercise 3.1

3.1 The table gives pressures at one moment in the cardiac cycle.

Region	Pressure / kPa
Left atrium	0.7
Left ventricle	8.5
Aorta	10.2

State whether the left atrio-ventricular valve and the aortic (semilunar) valve are open or shut, justifying each answer from the pressures, and name the phase of the cardiac cycle.

[4]

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3.1 AV valve: ventricular (8.5) exceeds atrial (0.7), so it is shut. Semilunar: aortic (10.2) exceeds ventricular (8.5), so it is also shut. Both shut with falling ventricular pressure after ejection – early diastole.

Exercises 3.2-3.3

3.2 A student claims that arteries “push blood along by squeezing in peristaltic waves like the gut.” Correct the student: describe how blood actually moves through an artery, name the tissue responsible for the artery’s recoil, and explain why artery walls must be thick. [5]

3.3 During diastole, the atria fill while the ventricles are relaxed. Explain how blood moves from the atria into the ventricles during diastole without any muscular contraction, and why the final third of ventricular filling needs atrial systole. [5]

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3.2 Blood is pushed by the heart’s pressure pulse, not by the artery’s own muscle. As the pulse stretches the wall, the elastic fibres store energy and recoil between beats, smoothing pulsatile flow into continuous flow. Walls must be thick to withstand and contain the high, rapidly changing pressure without bursting or excessive expansion.

3.3 During diastole, the atria fill while the ventricles are relaxed. Explain how blood moves from the atria into the ventricles during diastole without any muscular contraction, and why the final third of ventricular filling needs atrial systole. [5]

3.3 As the ventricle relaxes, its pressure falls below atrial pressure, so the AV valve opens and blood flows in passively down the pressure gradient – the atrium has been filling during systole and is already pressurised. The ventricle stiffens as it fills, so the passive gradient fades; atrial systole then raises atrial pressure to deliver the final ~30 % of the stroke volume.