IGCSE BIOLOGY • EXERCISE SHEET

9.2 Heart

Name: _____ Class: _____ Date: _____ **Total: 26 marks**

KEY WORDS heart 心脏 • coronary heart disease 冠心病 • heart rate 心率 • vena cava 腔静脉 • aorta 主动脉

Objective

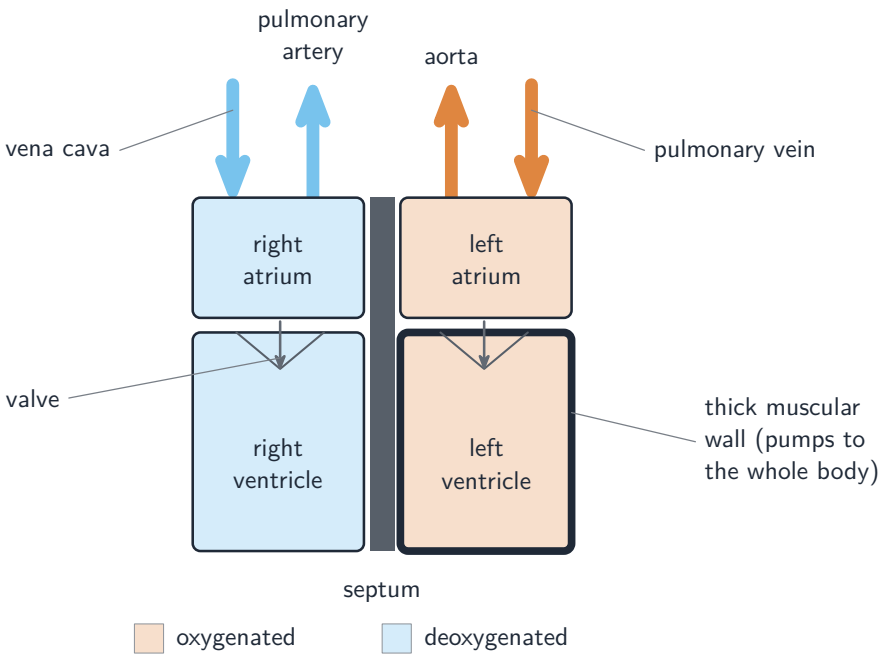
Build the skills to answer exam questions on the **heart** 心脏 — its chambers, why the left ventricle wall is thicker, heart rate, and **coronary heart disease** 冠心病.

You must be able to:

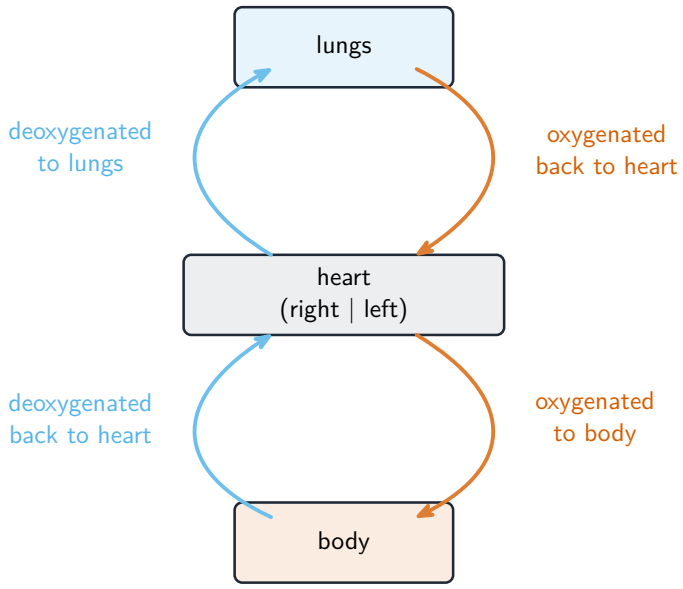
- name the chambers and the role of the septum and valves
- explain why the left ventricle wall is thickest
- give the risk factors for coronary heart disease

1 Worked examples

■ Heart structure



Left ventricle wall is thickest — it pumps blood to the whole body



The heart drives two circuits of blood

- **atria** (upper, thin) push blood to the **ventricles** (lower); the **septum** keeps the two sides apart.
- valves stop blood flowing backwards; coronary arteries feed the heart muscle.

■ The heart, the vessels, and the double circulation

The double circulation 双循环: blood passes through the heart **twice** for each complete circuit. The **pulmonary circuit** carries blood to the lungs and back; the **systemic circuit** carries it to the rest of the body and back. The advantage is that blood leaves the heart for the body at **high pressure**, so it travels quickly and reaches every organ.

The path through the heart, which the exam asks for in order: vena cava → right atrium → tricuspid valve → right ventricle → pulmonary artery → lungs → pulmonary vein → left atrium → bicuspid valve → left ventricle → aorta → body.

△ The **pulmonary artery is the one artery carrying deoxygenated blood**, and the **pulmonary vein the one vein carrying oxygenated blood**. Naming vessels by their oxygen instead of their direction is the standard error: an **artery carries blood AWAY from the heart**, a **vein carries it TOWARDS** the heart, whatever it contains.

The left ventricle has a much thicker muscular wall than the right, because it pumps blood all round the body against greater resistance, while the right pumps only to the lungs, which are close by and whose delicate capillaries would burst at high pressure.

Vessel	Wall	Lumen	Valves	Job
artery 动脉	thick, muscular and elastic	narrow	none	carries blood away from the heart at high pressure
vein 静脉	thin	wide	yes	returns blood at low pressure; valves stop backflow
capillary 毛细血管	one cell thick	very narrow	none	exchange with the tissues

Worked example. Explain two ways the structure of a capillary suits exchange. Its wall is one cell thick, so the diffusion distance is short and substances pass quickly. Its very narrow lumen slows the blood and forces red cells to pass in single file, giving more time and a larger surface for exchange.

2 Practice

2.1 Name the upper and lower chambers of the heart. [2]

2.2 State the role of the septum. [1]

2.3 Name the vessel that carries oxygenated blood to the heart. [1]

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

2.5 State the function of the valves in a vein. [1]

3 Exam-style questions

3.1 The wall of the left ventricle is thicker than the right because it: [1]

- **A** pumps blood only to the lungs
- **B** pumps blood to the whole body
- **C** holds more blood
- **D** has no valves

3.2 During exercise the heart rate increases.

(a) Explain why this is needed. [2]

(b) State two risk factors for coronary heart disease. [2]

3.3 The diagram of a mammalian heart shows the four chambers and the main vessels.

(a) Name the blood vessel that carries blood from the heart to the lungs, and state whether the blood in it is oxygenated or deoxygenated. [2]

(b) Give the path of a red blood cell from the vena cava to the aorta, naming every chamber and vessel it passes through. [4]

(c) Explain why mammals are described as having a double circulation, and give one advantage of it. [3]

(d) Complete the table comparing an artery with a vein. [3]

Feature	Artery	Vein
thickness of wall		
width of lumen		
valves present?		

(e) Explain two ways in which a capillary is adapted for exchange with the tissues. [2]

Solutions

2.1 upper: atria; lower: ventricles.

2.2 it keeps oxygenated and deoxygenated blood apart (so they do not mix).

3.1 B. The left ventricle pumps blood to the whole body, so its wall is thickest.

3.2 (a) the muscles need more oxygen and glucose during exercise; a faster heart rate delivers blood (and these) to them faster.
(b) any two of: high-fat diet; lack of exercise; smoking; stress; genetics/age.

2.3 The pulmonary vein.

2.4 The left ventricle pumps blood all round the body, against greater resistance, so it needs a thicker muscular wall to produce the higher pressure.

2.5 They prevent the backflow of blood, keeping it moving towards the heart.

3.3 (a) The pulmonary artery; the blood in it is deoxygenated.
(b) Vena cava → right atrium → right ventricle → pulmonary artery → lungs → pulmonary vein → left atrium → left ventricle → aorta.
(c) The blood passes through the heart twice for each complete circuit of the body: once to the lungs and once to the rest of the body. The advantage is that blood is returned to the heart and re-pressurised before going to the body, so it travels quickly and reaches every organ.
(d) Wall: artery thick, muscular and elastic; vein thin. Lumen: artery narrow; vein wide. Valves: artery none; vein yes.
(e) The wall is one cell thick, so the diffusion distance is short; the lumen is very narrow, which slows the blood and gives more time for exchange.