

8.3 The heart

Name: _____ Class: _____ Date: _____

Total: 12 marks

KEY WORDS ventricle 心室 • cardiac cycle 心动周期 • systole 收缩期
• atrioventricular node 房室结 • atria 心房

Objective

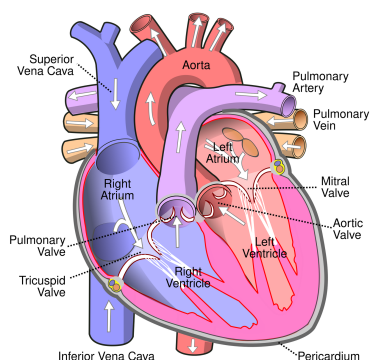
Build the skills to answer exam questions on **the heart** — its structure, the **cardiac cycle** 心动周期, and the control of the heartbeat by the **sinoatrial node** 窦房结.

You must be able to:

- describe the structure of the heart and explain the differences in wall thickness
- describe the cardiac cycle and how pressure changes open and close the valves
- explain the roles of the SAN, AVN and Purkyne tissue

1 Worked examples

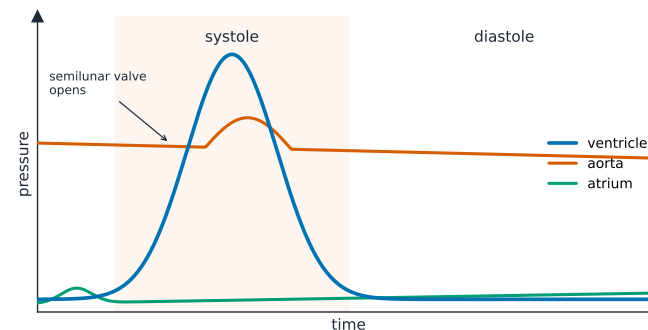
■ Heart structure



Four chambers, valves and main vessels; the left ventricle wall is the thickest

- **atria** 心房 — thin walls (only push blood into the ventricles).
- **ventricles** 心室 — thick muscular walls (pump blood out).
- the **left ventricle** wall is thickest, to pump blood all round the body; the right only pumps to the nearby lungs.

■ The cardiac cycle

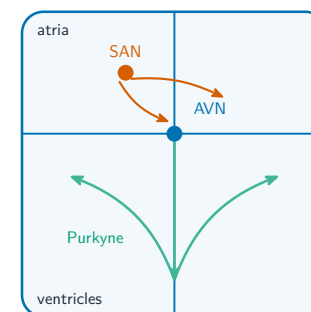


systole = contraction (high P) • diastole = relaxation/fill • valves open on P gradients

The ventricle pressure spikes in systole; a valve opens or closes whenever two pressure curves cross

Systole 收缩期 = contraction (pressure rises); **diastole** 舒张期 = relaxation/filling. A valve opens when the pressure behind it is higher, and closes when the pressure in front is higher — so blood flows one way only.

■ Controlling the heartbeat



SAN fires → atria contract → AVN delays → Purkyne → ventricles contract from the bottom up

The SAN sets the rhythm; the AVN delays the wave; the Purkyne tissue makes the ventricles contract bottom-up

The **SAN** (pacemaker) fires a wave that contracts the atria; the **AVN** delays it (so atria empty first); the **Purkyne tissue** 浦肯野组织 carries it through the ventricle walls so they contract from the bottom up.

2 Practice

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

2.2 State what happens to a heart valve when the pressure in front of it (downstream) becomes higher than the pressure behind it. [1]

3 Exam-style questions

3.1 What is the role of the atrioventricular node (AVN)? [1]

- | | |
|---|---|
| A | B |
| C | D |
- A** to set the basic heart rhythm
B to delay the wave of excitation so the atria empty first
C to pump blood into the aorta
D to close the semilunar valves

3.2 During ventricular systole, the semilunar (aortic) valve opens when: [1]

- | | |
|---|---|
| A | B |
| C | D |
- A** atrial pressure exceeds ventricular pressure
B ventricular pressure exceeds aortic pressure
C the ventricle relaxes
D the atria contract

3.3 A person has a stroke volume (volume pumped per beat) of 70 cm^3 and a heart rate of 75 beats per minute.

(a) Calculate the cardiac output (volume pumped per minute), in cm^3 per minute. [2]

(b) During exercise the heart rate rises to 150 beats per minute and stroke volume to 90 cm^3 . Calculate the new cardiac output. [1]

3.4 Describe the sequence of events from the firing of the SAN to the contraction of the ventricles. [4]
