Pulsatile circulation: changing compliance and self-consistent valves — review sheet

Use this after attempting the worked examples and practice. Explain each claim in words before calculating.

Key ideas

- A closed circulation boundary permits changing regional volumes while conserving their total.
- An ideal forward valve carries max(upstream pressure - downstream pressure, 0)/R.
- Prescribed compliance changes represent pumping in this model.
- The outer loop advances time; the inner loop finds consistent pressures and valve states.
- Implicit updates use new-state flows; conservation and time accuracy are separate checks.

Common errors and repairs

Calling six storage regions six heart chambers. There are two ventricular regions and four vascular regions; atrial storage is omitted.

Using seconds directly with flow in L/min. Divide elapsed seconds by 60 before multiplying by a minute-based flow.

Auditing volume with the wrong compliance. Use pressure and compliance from the same saved phase.

Treating conservation as clinical validation. Conservation checks accounting; appropriate numerical references and independent physiological evidence answer other questions.

Retrieve without your notes

- What is the ideal forward flow for upstream 60, downstream 75 and resistance 3 in consistent units?
- At 80 beats per minute, how long is one cycle?
- Why might the first cycle differ from a later cycle?

Readiness check

- Trace the two pumps and two vascular beds in a six-region model.
- Use a forward pressure difference to predict an ideal valve flow.
- Explain how a changing pressure-volume relation represents pumping.
- Distinguish an outer time loop from an inner valve-consistency calculation.

- Audit total stored volume while explaining what conservation cannot establish.