

5.3 Cardiovascular physiology

Name: _____ Class: _____ Date: _____ **Total: 24 marks**

KEY WORDS cardiac output

Objective

Compute cardiac output and MAP, and read the pressure-volume loop’s three levers.

1 Key knowledge and worked examples

■ The equations

$$CO = HR \times SV \text{ (70} \times \text{70 = 4.9 L/min); } MAP = CO \times SVR; MAP \approx DBP + \frac{1}{3}(SBP - DBP).$$

■ Worked example: the loop

Width = stroke volume; preload widens (Starling), contractility tilts, afterload narrows ✓; area = external work.

2 Practice

2.1 Compute MAP for 120/80. [3]

2.2 HR rises to 100 with SV 50 mL – what happens to CO? [3]

2.3 Name the loop’s three levers and their geometric effect. [3]

3 Exam-style questions

3.1 Haemorrhage (fictional): 1 L lost.

Predict CO and the reflex SVR change. Compute the new relative MAP (3×2 vs 5×1). Explain why organ perfusion falls more than pressure suggests. [8]

3.2 A new systolic murmur after myocardial infarction (fictional).

Explain how regurgitation splits the loop’s width. Predict the reflex heart-rate change and its purpose. State what the loop’s width now OVERestimates. [7]

Solutions

2.1

- $80 + 40/3 \approx 93$ mmHg ✓.

2.2

- $100 \times 50 = 5$ L/min – unchanged if SV falls proportionally ✓.

2.3

- Preload widens, contractility tilts up, afterload narrows.

3.1

- Filling falls $\rightarrow$ CO ≈ 3 L/min; baroreflex roughly doubles SVR.
- $MAP \propto 3 \times 2 = 6$ vs baseline $5 \times 1 = 5$: $\sim 120\%$ – pressure near-normal.
- Perfusion = flow per organ: CO is down 40% while pressure looks defended – flow, not pressure, feeds kidneys.

3.2

- Regurgitant ejection returns part of the width to the atrium: forward + backward = total width.
- Reflex tachycardia: hold forward CO by rate when SV leaks.
- Width overestimates FORWARD stroke: part is regurgitant.