

5.1 Homeostasis and body fluids

Name: _____ Class: _____ Date: _____

Total: 23 marks

KEY WORDS extracellular fluid

Objective

Compute compartment volumes and diagnose loop failures.

1 Key knowledge and worked examples

■ The tanks

42 L = ICF 28 + ECF 14 (plasma 3 + interstitial 11); water distributes by osmolality across all membranes.

■ Worked example: the 2 L drink

ECF takes ~0.67 L, ICF ~1.33 L ✓ – distribution arithmetic, not mystery.

2 Practice

2.1 Give the compartment volumes for a 70 kg adult. [3]

2.2 A loop running perfectly at the wrong target fails at the _____ and gives what pattern (SIADH example)? [3]

2.3 Why is plasma only 3 of the 14 ECF litres? [3]

3 Exam-style questions

3.1 An infusion of 2 L of isotonic saline is given (fictional).

Compute the distribution (saline stays ECF – why?). Predict the plasma volume gain. Explain why the same volume of pure water would distribute differently. [7]

3.2 A patient has inappropriate antidiuresis (fictional SIADH pattern).

Name the failed element. Explain why the loop holds the wrong target perfectly. State the expected sodium direction and the mechanism. [7]

Solutions

2.1

- ICF 28 L, ECF 14 L (plasma 3, interstitial 11) ✓.

2.2

- The set point; dilute plasma with inappropriately concentrated urine.

2.3

- Capillaries leak protein-poor fluid: most ECF sits outside the vessels.

3.1

- Isotonic saline is ECF-isotonic: it stays entirely extracellular (2 L ECF gain).
- Plasma gain $\approx 3/14 \times 2 \approx 0.43$ L ✓ (its ECF share).
- Pure water distributes by osmolality: ~ 1.33 L intracellular; plasma gains $3/42 \times 2 \approx 0.14$ L.

3.2

- The set point (osmostat reset low).
- The sensor, integrator and effector all work: the loop defends its (wrong) target perfectly.
- Hyponatraemia: retained water dilutes ECF sodium – the water, not the salt, is the problem.