

2.7 Nitrogen metabolism and the urea cycle

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

KEY WORDS urea cycle

Objective

Trace nitrogen to urea, balance the daily ledger, and read a urea-cycle vignette.

1 Key knowledge and worked examples

■ The cycle

Transamination → glutamate → liver: $\text{NH}_3 + \text{CO}_2 + \text{aspartate} \rightarrow \text{urea}$ (2 N) at 3 ATP (4 bonds); glutamine and alanine are the taxis.

■ Worked example: the daily ledger

~70–100 g protein/day $\approx$ 11–16 g N; 30 g urea $\times$ 28/60 $\approx$ 14 g N ✓ – the urine matches the diet.

2 Practice

2.1 Which molecule carries nitrogen from brain to liver? [3]

2.2 How many nitrogens does one urea carry, and from which sources? [3]

2.3 Why is ammonia toxic at micromolar levels? [3]

3 Exam-style questions

3.1 A (fictional) patient eats 90 g protein/day.

Compute the nitrogen intake (assume 16 % N by mass). Compute the urea excreted if all N leaves as urea. Verify the ATP cost of that urea per day. [7]

3.2 (Fictional newborn) coma after first feeds; ammonia high, orotic acid in urine.

Localise the block to OTC deficiency. Explain the orotic acid. Explain why the brain, having no cycle, suffers first. State two management levers implied by the mechanism. [8]