

Solutions

2.1

- Glutamine (the ammonia taxi).

2.2

- Two: one from free NH_3 (carbamoyl phosphate), one from aspartate.

2.3

- The brain lacks the urea cycle and ammonia drains into glutamate $\rightarrow$ glutamine, depleting intermediates and osmotic balance (astrocyte swelling).

3.1

- $90 \times 0.16 = 14.4 \text{ g N/day}$.
- Urea: $14.4 \div (28/60) = 30.9 \text{ g urea/day}$ ✓.
- Moles: $30.9/60 = 0.515 \text{ mol} \times 3 \text{ ATP} = 1.5 \text{ mol ATP/day} \approx \text{ordinary liver expenditure}$.

3.2

- OTC: carbamoyl phosphate cannot enter the cycle; it spills to cytosolic pyrimidine synthesis $\rightarrow$ orotate.
- Brain has no urea cycle $\rightarrow$ ammonia accumulates locally, glutamine pools swell $\rightarrow$ oedema and encephalopathy.
- Levers: limit nitrogen intake; scavenge/alternatives (benzoate/ phenylbutyrate) and feed arginine/citrulline.