Deacon's Challenge No. 66 Answer

A subject was infused with a drug at the rate of 12 mmol/h until a plasma steady state concentration of 200 µmol/L was reached. Calculate, and comment on, the clearance of the drug.

The clearance of a drug is the *volume of plasma* from which the drug is completely removed per unit time and can be calculated from the ratio of the amount cleared in unit time divided by its plasma concentration, *provided a steady state exists:*

$$\text{Clearance} = \frac{\text{Rate of removal from body}}{\text{Plasma concentration}}$$

In a steady state the plasma concentration is constant because:

$$\text{Rate of administration} = \text{Rate of removal}$$

Therefore:

$$\text{Clearance} = \frac{\text{Rate of administration}}{\text{Plasma concentration}} = \frac{12\ (\text{mmol/h})}{200\ (\mu\text{mol/L})}$$

The drug units must be the same in both the numerator and denominator, therefore the rate of administration must be multiplied by 1000 to convert from mmol/h to µmol/h:

$$\text{Clearance (L/h)} = \frac{12 \times 1000}{200}$$

To obtain the clearance in the more familiar units of mL/min, divide by 60 (to convert from h to min) and multiply by 1000 (to convert clearance from L/min to mL/min):

$$\text{Clearance} = \frac{12 \times 1000 \times 1000}{200 \times 60} = \mathbf{1000\ mL/min}$$

This clearance is far in excess of any possible GFR indicating that the major mechanism for the drug's elimination is not glomerular filtration alone. The drug is probably cleared by tubular secretion, metabolism or biliary excretion or by a combination of these mechanisms. ■

Question 67

How many mL of hydrochloric acid (SG 1.16) are required to prepare 500 mL of 2.5 molar hydrochloric acid? The purity of the acid is 32% w/w.