Deacon's Challenge No. 92 Answer

As part of a research project, you are developing a new assay for thiamine in plasma.
In order to perform a recovery experiment, 100µL of an aqueous primary standard with a
thiamine concentration of 18.1 µg/L is spiked into 900µL normal serum with a thiamine
concentration of 1.7 µg/L. The thiamine concentration of the mixture is 3.2 µg/L.
Calculate the recovery of the thiamine added to the normal serum.

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100 µL of thiamine at a concentration of 18.1 µg/L was added to 900 µL
of normal serum to give a total volume of 1,000 µL. Therefore the
concentration of thiamine in the spiked sample, due to the thiamine added is:

Thiamine added =

$$\frac{\text{Concentration of aqueous solution added (µg/L) x Volume added (µL)}}{\text{Total volume (µL)}}$$

$$= \quad \frac{18.1 \ \text{x} \ 100}{1,000} \quad = \quad 1.8 \ \text{µg/L} \quad (2 \ \text{sig figs})$$

900 µL of normal serum containing thiamine at a concentration of
1.7 µg/L was added to 100 µL of the aqueous thiamine solution to give a
final volume of 1,000 µL. Therefore the concentration of endogenous
thiamine in the spiked sample originating from the normal serum is:

Endogenous thiamine =

$$\frac{\text{Serum thiamine concentration (µg/L)} \quad \text{x} \quad \text{Volume serum (µL)}}{\text{Total volume (µL)}}$$

$$= \quad \frac{1.7 \ \text{x} \ 900}{1,000} \quad = \quad 1.5 \ \text{µg/L} \quad (2 \ \text{sig figs})$$

Thiamine recovered   =

Measured thiamine in spiked sample   -   Endogenous thiamine
concentration

$$= \quad 3.2 \quad - \quad 1.5$$

$$= \quad 1.7 \ \text{µg/L}$$

$$\text{Recovery (\%)} \quad = \quad \frac{\text{Thiamine recovered (µg/L)} \ \text{x} \ 100}{\text{Thiamine added (µg/L)}}$$

$$= \quad \frac{1.7 \ \text{x} \ 100}{1.8} \quad = \quad \textbf{94\%} \quad (2 \ \text{sig figs})$$

Question 93

A 25-year old married woman in good health has just discovered that her brother is
homozygous for the C282Y haemochromatosis gene mutation. Her sister has been tested and
has the normal genotype. Her own genotype is as yet unknown. The population gene
frequency for C282Y is 8%.

a) Calculate the probability that the woman is a homogygote.

b) Calculate the probability that her husband is a homozygote.

c) If the woman were subsequently tested and found to be a heterozygote, calculate the
probability that their son will be a homozygote.

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