1 A1 Concentrations

Calculate the mass of each compound which must be used to make a 600 ml solution with the following composition:

9 mM K_3PO_4 (RMM: 212.27 Da)
0.4 M $CaCO_3$ (RMM: 100.09 Da)

2 A1 Concentrations

Calculate the concentration of each compound in a solution of volume 550 ml with the following composition:

0.86 g K_2HPO_4 (RMM: 174.18 Da)

The relationship between the concentration (in moles/litre expressed as molL^{-1}), volume (in litres, L), mass (in grams, g) and relative molecular mass (RMM, also referred to as *gram formula mass* or *molar mass*) is given by the formula below

$$\text{concentration} = \frac{\text{mass}}{\text{RMM} \times \text{volume}}$$

This can be rearranged for mass to give

$$\text{mass} = \text{concentration} \times \text{volume} \times \text{RMM}$$

3 A2 Dilutions

0.1 ml of a solution with concentration 400 mM is diluted to a total volume of 400 ml. What is the concentration of the resulting solution?

4 A2 Dilutions

What volume of a solution with concentration 90 mM is required to make 5000 ml of a solution with a final concentration of 700.0 uM?

The equation for dilutions is the molar equivalence

$$C_1V_1 = C_2V_2$$

When a fixed volume of a solution is diluted, the total number of moles C_1V_1 remains the same. This can be rearranged for the unknown concentration or volume as follows:

$$C_1 = \frac{C_2V_2}{V_1}$$

or

$$V_1 = \frac{C_2V_2}{C_1}$$

5 A3 Absorbance

A sample of p-Nitrophenol with extinction coefficient 18200 $ML^{-1}cm_{-1}$ gives an absorbance reading of 0.488 when read in a cuvette with path length 1cm.

What is the concentration of the test solution?

6 A3 Absorbance

What absorbance reading would a sample of p-Nitrophenol with extinction coefficient 18200 $ML^{-1}cm_{-1}$ and concentration 12.03 uM give when read in a UV-vis spectrometer.

The relationship between the absorbance and concentration is given by the Beer-Lambert law.

$$A = \epsilon.c.l$$

where A is the concentration coefficient, ϵ is the extinction coefficient, c is the concentration and l is the path length. This can be readily rearranged for c or ϵ