Dilution of solutions for nurses

Introduction

In order to maximize all available storage space most solutions are stored in a concentrated form (known as **stock**). These solutions are then diluted to the required strength as and when required for the individual patient. This also means the same solution substance may be used for a different range of treatments.

This leaflet explains how dilution calculations are performed.

The strength of a solution

When stating the strength of solution required it may be expressed in **percentage strength**, in **grams per litre**, **millilitre per millilitre** or as **ratio strength**. Whenever it is expressed as a percentage there is an equivalent ratio and similarly if expressed as a ratio it could also be expressed as a percentage.

For practical purposes weak or very dilute solutions ratios of 1:1000, 1:2000 and 1:5000 maybe written as $\dfrac{1}{1000}, \dfrac{1}{2000}, \dfrac{1}{5000}$ rather than the more accurate $\dfrac{1}{1001}, \dfrac{1}{2001}, \dfrac{1}{5001}$.

Remember that the word percent means parts per hundred. For example 5% means 5 parts per hundred parts. As a ratio it would be written as 5 in 100 or simplified to 1 in 20. Whatever form the strength is given in, we always use the same equation:

$$\text{Amount of stock required} \;=\; \frac{\text{Strength Required}}{\text{Stock Strength}} \times \text{Volume Required}$$

Example Calculate the amount of

(i) stock solution required, and

(ii) water required to make 1.5 litres of 10% solution from 100% Stock Strength.

Solution 10% solution strength is equivalent to 1/10. 100% is equivalent to 1/1.

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\begin{aligned}
\text{Amount of stock required} \;&=\; \frac{\text{Strength Required}}{\text{Stock Strength}} \times \text{Volume Required} \\
&=\; \frac{1/10}{1/1} \times 1.5 \\
&=\; 0.15 \text{ litres} \\
&=\; 150 \text{ ml}
\end{aligned}
$$

$$\begin{aligned} \text{Water Required} \quad &= \quad \text{Volume Required} - \text{Stock Required} \\ &= \quad 1500 \text{ ml} - 150 \text{ ml} \\ &= \quad 1350 \text{ ml} \end{aligned}$$

In this Example, Stock Strength was given as 100% which may also be written as 1/1 or 1 in 1. Had the Stock Strength been given as a ratio or percentage then simply convert this to a fraction and complete the equation.

Example How much stock is required to make 3 litres of 1 in 80 solution from a stock strength of 1 in 40. The basic equation gives

$$\begin{aligned} \text{Amount of Stock Required} \quad &= \quad \frac{1/80}{1/40} \times 3 \\ &= \quad \frac{1}{2} \times 3 \\ &= \quad 1.5 \text{ litres} \end{aligned}$$

Similarly for a percentage stock strength solution the equation will be as in the following example.

Example Calculate the amount of

(i) stock solution required, and

(ii) water required to make 0.4 litre of 1% solution from 2% Stock Strength.

$$\begin{aligned} \text{Amount of stock required} \quad &= \quad \frac{\text{Strength Required}}{\text{Stock Strength}} \times \text{Volume Required} \\ &= \quad \frac{1/100}{2/100} \times 0.4 \\ &= \quad 0.2 \text{ litres} \\ &= \quad 200 \text{ ml} \end{aligned}$$

$$\begin{aligned} \text{Water Required} \quad &= \quad \text{Volume Required} - \text{Stock Required} \\ &= \quad 400 \text{ ml} - 200 \text{ ml} \\ &= \quad 200 \text{ ml} \end{aligned}$$

Exercises Calculate the amount of (i) stock solution required, and (ii) the water required to make the following solutions. Give your answers in millilitres: -

1. 800 ml of lotion from stock strength 1 in 10 to make strength of 1 in 40.

2. 1 litre of chlorhexidine 1 in 5000 from a stock chlorhexidine of 1 in 1000.

3. 50ml of cocaine solution 1% from stock solution of 2%.

4. 1000ml of 2% sodium hypochlorite solution from 10% sodium hypochlorite solution.

5. 0.6 litre of 2% solution from a stock strength solution of 1 in 25.

6. 5 litre of 1:5000 solution from a stock strength solution of 0.2%.

Answers: 1. (i) 200ml (ii) 600ml 2. (i) 200ml (ii) 800ml 3. (i) 25ml (ii) 25ml 4. (i) 200ml (ii)800ml 5. (i) 300ml (ii) 300ml 6. (i) 500ml (ii) 4500ml