- Henry's law describes the solubility of a gas in a liquid phase. What methods are possible to ensure a patient receives enough oxygen during surgery? Which method is the most practical? Explain. 3

Henry's law states that the higher the pressure of gas above a liquid, the greater the solubilityof the gas in that liquid:

$c = kP$

Normal air is 21% O_2. Anaesthetists can ensure a patient receives enough O_2 during surgery by increasing the % (*i.e.* partial pressure) of O_2 in the gas the patient breathes. This is the most practical and easy approach.

The alternative would be to get the patient to breathe a mixture of air at a pressure greater than 1 atm, but this would be more difficult to control and could lead to other problems (*e.g.*"the bends").

- A saline solution used to administer drugs intravenously is prepared by dissolving 0.90 g NaCl in 100.0 mL water. What mass of glucose ($C_6H_{12}O_6$) is required to prepare a 100.0 mL solution with the same osmotic pressure? 2

The formula mass of NaCl is (22.99 (Na) + 35.45 (Cl)) g mol^{-1} = 58.55 g mol^{-1}. The number of moles in 0.90 g is therefore:

$$\text{number of moles} = \frac{\text{mass}}{\text{formula mass}} = \frac{0.90\text{ g}}{58.55\text{ g mol}^{-1}} = 0.015\text{ mol}$$

Dissolution of NaCl(s) produces Na^+(aq) and Cl^-(aq) so the total number of moles of ions present is 2 × 0.015 mol = 0.030 mol. The concentration of ions in a solution with volume 100.0 mL is thus:

$$\text{concentration} = \frac{\text{number of moles}}{\text{volume}} = \frac{0.030\text{ mol}}{0.1000\text{ L}} = 0.30\text{ mol L}^{-1} = 0.30\text{ M}$$

The osmotic pressure is related to the concentration by $\Pi = cRT$. As glucose does not dissociate in solution, to produce the same concentration of particles in solution requires 0.030 mol of glucose.

The molar mass of glucose, $C_6H_{12}O_6$ is (6 × 12.01 (C) + 12 × 1.008 (H) + 6 × 16.00 (O)) g mol^{-1} = 180.156 g mol^{-1}.

The mass of 0.030 mol of glucose is therefore:

$$\text{mass} = \text{number of moles} \times \text{molar mass} = (0.030\text{ mol}) \times (108.156\text{ g mol}^{-1}) = 5.4\text{ g}$$

Answer: **5.4 g**