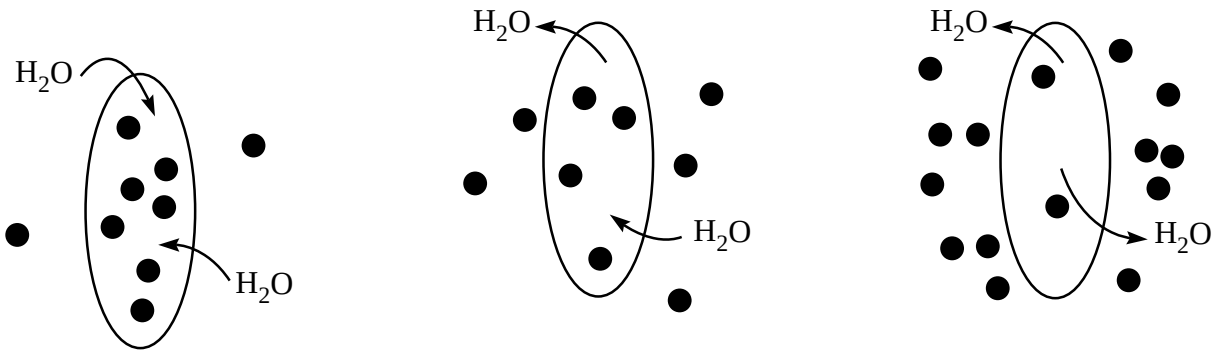
CHEM1612 Worksheet 8 – Answers to Critical Thinking Questions

The worksheets are available in the tutorials and form an integral part of the learning outcomes and experience for this unit.

Model 1: The origin of osmotic pressure

1. See below



(i) Hypotonic medium (ii) Isotonic medium (iii) Hypertonic medium

2. (i) Increase. (ii) Stay the same. (iii) Decrease.
3. The cells in the blood will swell and possibly burst. This can be fatal.
4. (a) This reduces the total solute concentration in the cell and hence reduces the driving force for water to diffuse in.

   (b) This increases the total solute concentration in the cell causing water to flow in as well. The blood cells become spherical or elliptical rather than disc-shaped. (The change in shape and hence suarface area of the cell reduces the ability to take up oxygen and can reduce stamina and anaemia.

Model 2: Osmotic pressure

1. (i) 0.35 M (ii) 0.15 M (iii) 0.50 M
2. 1.00 M = 1.00 mol L^{-1} = 1.0×10^3 mol m^{-3}
3. $\pi = (1.0 \times 10^3 \text{ mol m}^{-3}) \times (8.314 \text{ J K}^{-1} \text{ mol}^{-1}) \times (298 \text{ K}) = 2.5 \times 10^6$ Pa = 24 atm. Pretty big!
4. Entropy drives the process: water moves to equalise the concentrations. The entropy of dilute solutions increases wuth the number of particles present but does not depend on their identity.
5. (i) (b) Stay the same size.

   Remember that only the number of particles *not* their size is important. The fact that sucrose molecules are larger than glucose molecules is irrelevant.

   (ii) (a) Swell.

   Water will flow from the medium into the compartment, to reduce the sucrose concentration in the compartment and simultaneously increase its concentration in the medium, until the concentrations are equal.

   (The osmotic pressure is larger in the compartment than in the medium as it has the higher sucrose concentration.)

   (iii) (b) Stay the same size.

   The concentration of particles is about the same on both sides as NaCl dissociates into 2 ions ($Na^+(aq) + Cl^-(aq)$) whilst sucrose is present as individual molecules and does dissociate.

(iv) (c) Shrink.

Each $MgCl_2$ dissociates into 3 particles so the concentration in the medium is ≈ 0.15 M. Water will flow from the compartment into the medium to increase the concentration in the compartment and simultaneously decrease the concentration in the medium, until the two concentrations are equal.

Model 3: Other colligative properties

1. (a) 0.1 M (b) just above 0.1 M (c) 0.2 M (d) 0.3 M (e) 0.4 M
2. Water
3. 0.1 M K_3PO_4 > 0.1 M $MgCl_2$ > 0.1 M HBr > 0.1 M CH_3COOH > 0.1 M sucrose