Amoeba Sisters: (Osmosis and Water Potential)

Bozeman Biology: Water Potential

1. Give the definition of water potential.

   Water potential is the potential energy of water per unit area compared to pure water.

2. What does water potential allow us to figure out?

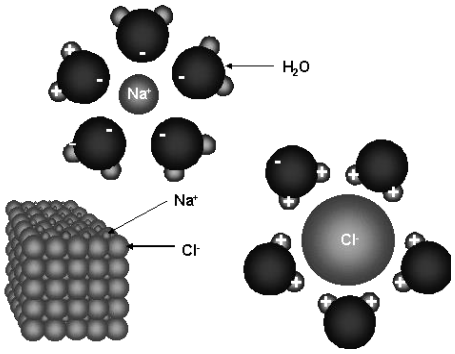
   Water potential allows to figure out where water is going to flow.

3. What is the "unit" for water potential?

   Symbol = psi or ψ and the unit is Bar.

4. Use the diagram to the right to help you explain how water (*a polar molecule*) orientation changes when NaCl is added to it?

   The negative Cl ion will be surrounded by the positive parts of water (H+) and the negative parts of water (O-) will surround the positive Na ion.



5. What is the water potential of pure water?

   The water potential of pure water is 0 bars.

6. Which way does water move?

   Water moves from an area of high water potential to an area of low water potential.

7. Summarize, using water potential, why salt causes water to leave a slug.

   The salts causes a lower water potential on the surface of the slug cause the water to move from an area of high water potential (*inside the slug*) to an area of low water potential (*on the surface of the slug*).

8. Label the diagram of the tree below and use it to explain why water moves from the roots to the tips of the treetops.

atmosphere = -1000 bars

leaves = -15 bars

stems = -6 bars

roots = -2 bars

Water will move up the tree along the water potentail gradient from an area of high water potential (root) to an area of low water potential (leaves) and eventually out of the leaves through the stomates by transpiration (evaporation) and into the atmosphere where water potential is lowest.

9. Write out and describe the water potential equation. $\psi = \psi_s + \psi_p$

(Solute Potential) *(Pressure Potential)*

10. Solute potential is a factor of osmosis, what is pressure potential a factor of?

Pressure potential is a physical potential due to features of the cell (*cell wall*) and/or the atmosphere.

11. Why is pressure potential often a positive number?

Pressure potential is often positive for cell due to the constant flow of water into the cell causing a force or pressure against the cell membrane or cell wall.

12. Write out and explain each part of the solute potential equation:

$$\psi_S = -iCRT$$

i = ionization constant
C = concentration (mole/L)
R = pressure constant (0.0831 liter bars / mole K
T = temperature (Kelvin - 273 + ^oC)

13. Why is **i** (*the ionization constant*) a value of 2 for NaCl and a value of 1 for sucrose?

NaCl has an ionization constant of 2 because NaCl in water NaCl disassociates into Na+ and Cl- ions. Sucrose dissolves but does not disassociate in water and so has an ionization constant of 1.

14. How does increasing temperature affect solute potential?

Increasing temperature increases the average kinetic energy of the solute molecules and so increases the solute potential which decreases the water potential.

15. Show the steps (**E**quation – **S**ubstitute – **A**nswer) to work out his sample problem below.

$$\psi_S = -iCRT$$

$\psi_s = -1(\mathbf{0.2}$ mole/liter$)(\mathbf{0.0831}$ liter bars / mole K$)(\mathbf{273}$K + $\mathbf{22})$

$\psi_s = -1(\mathbf{0.2}$ mole/liter$)(\mathbf{0.0831}$ liter bars / mole K$)(\mathbf{295}$K$)$

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$\psi_s = \mathbf{-4.9029}$

$\psi_s = \mathbf{-5}$ **bars**