Water potential questions – answers

1. (a)
(i) The tendency of a solution to take in water by osmosis from pure water across a selectively permeable membrane
(ii) The water potential is the sum of the solute potential and the pressure potential

(b)
(i) -2000 + 500 = -1500 kPa
(ii) Out of the cell, water will move to the more negative water potential by osmosis.

(iii)
Diagram: Shows the cell membrane pulled away from the cell wall, only remaining attached at the points of plasmodesmata.
Explanation: Water left the cell and the protoplast pulled away from the cell wall, only remaining attached at the points of plasmodesmata.

2. (a)
The movement of water from a less negative water potential to a more negative water potential across a selectively permeable membrane.

(b)
(i) As the added fresh water percentage increases so does the relative body volume of the organism. Water potential inside the organism was more negative than the 20-80& added fresh water solutions so water moved in by osmosis and the body volume increased as the cells swelled.
(ii) So much water would enter that the cell would swell and eventually lyse. Plant cells have a wall to prevent lysis from occurring.

3. (a) -0.8 MPa

(b) Arrows from B to both A and C and from A to C.

(c) Water moves from the less negative to the more negative water potential.

(d) Cell water potential becomes more negative as water molecules form hydration shells around the sugars becoming less free. This makes the solute potential more negative (lower) and therefore also makes the water potential more negative.

4. (a) -1900 = 500 + ?
-1900 – 500 = -2400 kPa

(b) B to A. From the less negative to the more negative water potential.

(c) When water has left the cell and the protoplast is pulled away from the cell wall, only remaining attached at the points of plasmodesmata. This could occur if the cell is placed in a hypertonic solution.

(d) Zero
They are equal

5. (a) Water moves in by osmosis from the less negative (higher) water potential to the more negative (lower) water potential of the animal cell.

(b) (i)

$$\% \text{ change in mass} = \frac{\text{final} - \text{initial}}{\text{Initial}} \times 100$$

$$= \frac{19.3 - 20.6}{20.6} \times 100 = -6.31\%$$

$$= -6\%$$

(c) (ii) 1% and 2%. The sandworms increased in mass, showing that water moved into the more negative water potential of their cells from the less negative water potential of those solutions.

6. (a) Plasmolysed

(b) The surrounding sucrose solution has a more negative water potential than the cell and therefore water moved out by osmosis. The protoplast shrank and pulled the cell membrane away from the cell wall, remaining attached only at the plasmodesmata.

(c) The sucrose solution. This shows that the cell wall is fully permeable.