NAME: _____ BLOCK: _____

# TONICITY WORD PROBLEMS

PRACTICE

1. A cell containing 74% water is placed into an environment containing 80% solute. Is the environment hypertonic, hypotonic, or isotonic? Is the cell hypertonic, hypotonic, or isotonic? Will the cell shrink or swell?

   The cell has an internal concentration of 26% solute (100-74=26) and is placed into an environment with a much higher solute concentration (80% solute) which makes the environment HYPERTONIC *to the cell*. That would make *the cell* HYPOTONIC *with respect to the solution*

   *(This is the key to using these terms correctly – you MUST identify to what you are comparing the concentration)*

   The cell will lose water in the HYPERTONIC environment – assuming only water can move – as the water leaves the cell it will shrink. This net movement of water out of the cell will continue until equilibrium is reached.

2. A cell containing 25% solute is placed into an environment containing 15% solute. In which direction will the water move? Will the cell swell or shrink?

   You must always ask yourself:

   *"Where is there more water?"*

   In this case, the solution outside the cell has a lower concentration and thus by nature is more "watery"; hence water will diffuse from the area of higher concentration (outside of the cell – the environment) to an area of lower concentration inside the cell. Therefore, the cell will swell! For reference, we would describe the solution as being HYPOTONIC compared to the cell.

3. A cell is placed in a solution of sugar and water. The cell has a sugar solution made up of 15mg of sugar and the outside has a sugar solution made-up of 20mg of sugar. The cell membrane is permeable to both water and sugar. Is the cell hypertonic, hypotonic, or isotonic? Which way will water move?

   This question requires you to make an assumption (frankly that makes it a pretty terrible question) but if you were to assume that the volume inside the cell and outside the cell were the same you could draw the conclusion that the solution outside of the cell is more concentrated → thus HYPERTONIC.

   Based on this, one can predict that water will move back and forth across the membrane but the NET movement would be OUT of the cell.

   *Aside: The question does say that the membrane is permeable to both sugar and water so one could also predict that sugar will diffuse from high to low concentration, hence into the cell.*

4. A cell is placed in a solution of sugar and water. The cell has a 10% sugar concentration and the outside has a 35% sugar concentration. The cell membrane is not permeable to sugar. Is the environment hypertonic, hypotonic, or isotonic? Which way will water move? Will the cell shrink or swell?

   The environment is HYPERTONIC to the cell as it has a higher concentration of solute – or sugar.

   Water will move out of the cell – since the inside of the cell has a much higher ***concentration of WATER.*** Remember, water always moves from high water concentration to low water concentration.

   The cell will lose water and hence will shrink. This is called ***crenation***.