

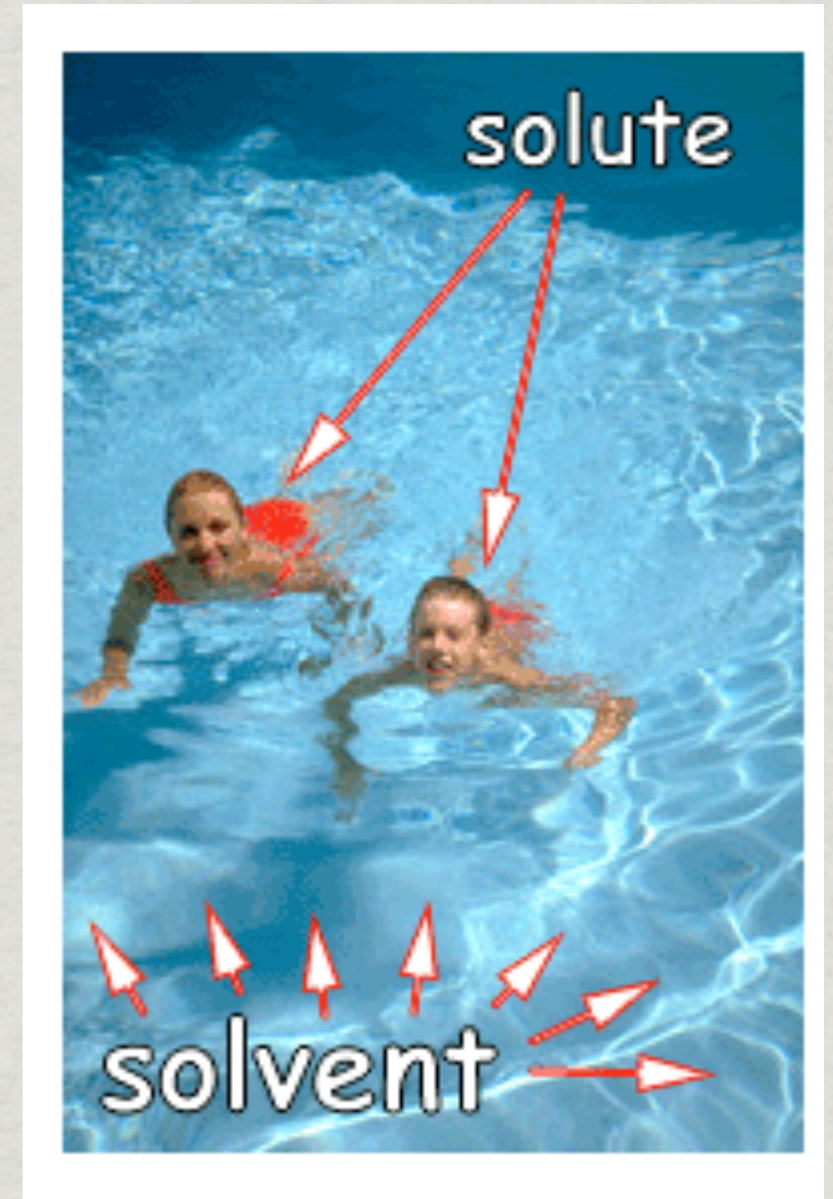
# **Cytology**

## **Types of Solutions**

# Solutions

## DEFINITION OF A SOLUTION:

- A SOLUTION CONSISTS OF TWO PARTS, THE **SOLUTE** AND THE **SOLVENT**
- THE **SOLUTE** IS DISSOLVED IN THE **SOLVENT**
- IN SOLUTIONS FOUND IN LIVING ORGANISMS, THE **SOLVENT** IS WATER WHILE THE **SOLUTES** INCLUDE MANY DISSOLVED SOLIDS

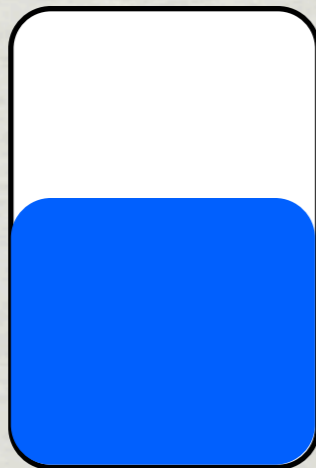


# Solutions

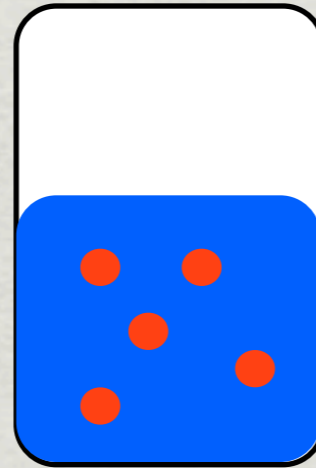
## RELATIONSHIPS BETWEEN SOLUTE AND SOLVENT

- AS THE **SOLUTE** CONCENTRATION **INCREASES**, THE **SOLVENT** CONCENTRATION **DECREASES**
- THEREFORE THERE IS AN **INVERSE** RELATIONSHIP BETWEEN THE SOLUTE AND SOLVENT CONCENTRATIONS IN A SOLUTION

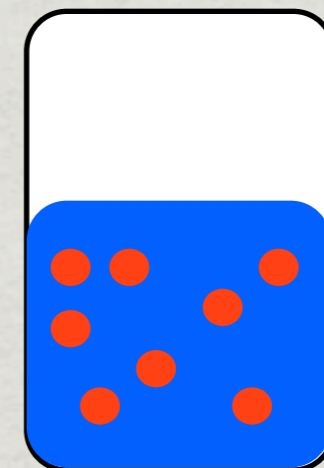
*IF THE SOLUTE IS THE PARTICLE AND THE SOLVENT IS THE SPACE BETWEEN THE PARTICLES. THEN IT MAKES SENSE THAT THE SPACE BETWEEN THE PARTICLES DECREASES WHEN YOU ADD IN MORE PARTICLES.*



**100% WATER**  
**0% SUGAR**



**90% WATER**  
**10% SUGAR**



**75% WATER**  
**25% SUGAR**

# Types of Solutions

## 3 TYPES...

WHEN COMPARED WITH EACH OTHER, SOLUTIONS CAN BE DESCRIBED AS **ISOTONIC**, **HYPERTONIC OR HYPOTONIC**

THIS COMPARISON IS BASED ON THE RELATIVE **SOLUTE** CONCENTRATIONS OF THE SOLUTIONS

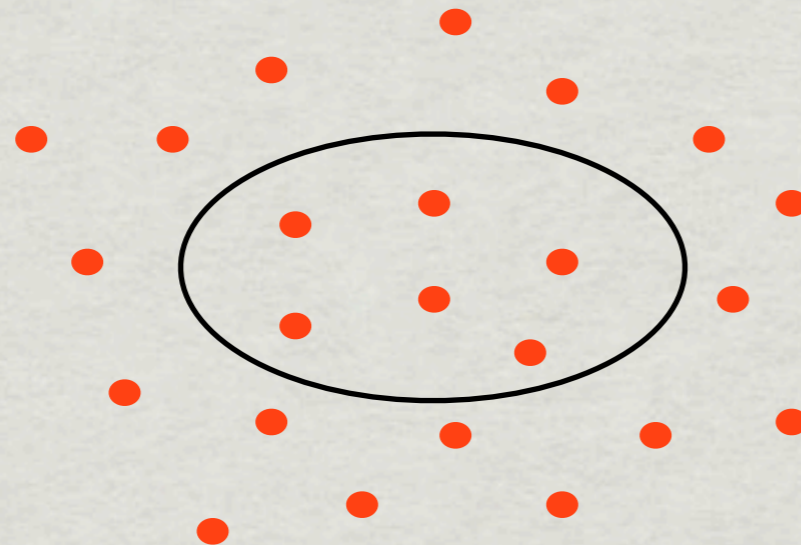
## THE EFFECTS OF SOLUTIONS

- ALTHOUGH MANY TYPES OF PARTICLES CAN MOVE ACROSS THE MEMBRANE, **WATER** MOVES ACROSS FASTER THAN MOST OTHER PARTICLES
- WATER MOLECULES ARE ALWAYS MOVING IN BOTH DIRECTIONS (IN AND OUT OF THE CELL)
- DEPENDING ON THE RELATIVE CONCENTRATION OF WATER ON EITHER SIDE OF THE MEMBRANE, THE **NET** MOVEMENT OF WATER BY OSMOSIS CAN BE GREATER IN ONE DIRECTION THAN THE OTHER

# ISOTONIC SOLUTIONS

**ISO** MEANS THE **SAME** AS, AND **TONICITY** REFERS TO THE STRENGTH OF A SOLUTIONS  
THUS, THE **SOLUTE** CONCENTRATIONS OF TWO ISOTONIC SOLUTIONS ARE **EQUAL**  
THE SOLVENT CONCENTRATIONS ARE EQUAL AS WELL

EG- IF A CELL IS PLACED IN AN **ISOTONIC** SOLUTION, THE CONCENTRATION INSIDE AND OUTSIDE OF THE CELL WILL BE EQUAL



# ISOTONIC SOLUTION

CONSIDER THE CONCENTRATION GRADIENT AND OSMOSIS...

WHAT EFFECT SHOULD THIS HAVE ON THE NATURAL  
MOVEMENT ON PARTICLES?

- SINCE THE CONCENTRATION OF SOLUTE INSIDE AND OUTSIDE THE CELL IS EQUAL, THE CONCENTRATION OF WATER INSIDE AND OUTSIDE OF THE CELL IS EQUAL AS WELL
- THEREFORE THERE WILL BE **NO NET** MOVEMENT WATER BY OSMOSIS
- THUS, AN ISOTONIC SOLUTION WILL HAVE NO EFFECT ON ANIMAL CELLS OR PLANT CELLS

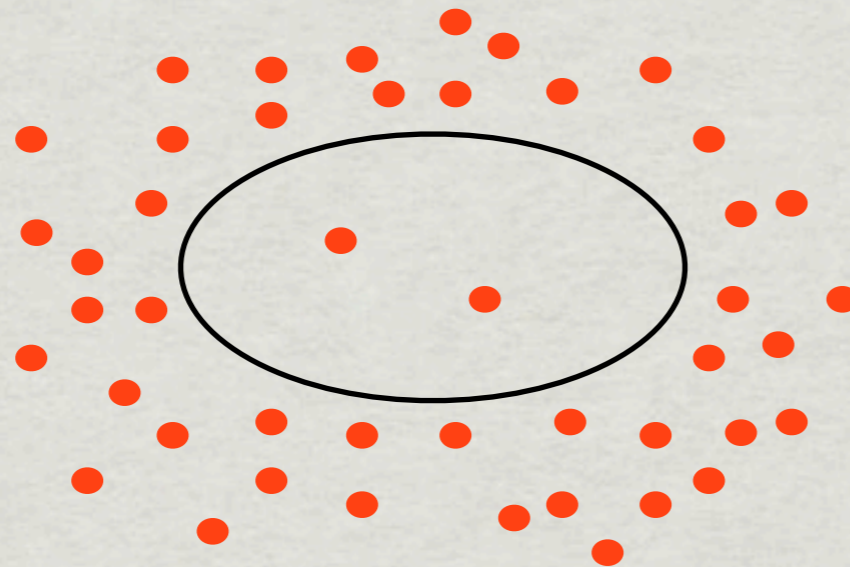
# HYPERTONIC SOLUTIONS

**HYPER** MEANS GREATER THAN

THUS, THE **SOLUTE** CONCENTRATION OF A HYPERTONIC SOLUTION IS **GREATER** THAN THE SOLUTE CONCENTRATION OF THE SOLUTION IT IS BEING COMPARED TO

THE SOLVENT CONCENTRATION OF A HYPERTONIC SOLUTION IS LESS THAN THE SOLVENT CONCENTRATION OF THE SOLUTION IT IS BEING COMPARED TO

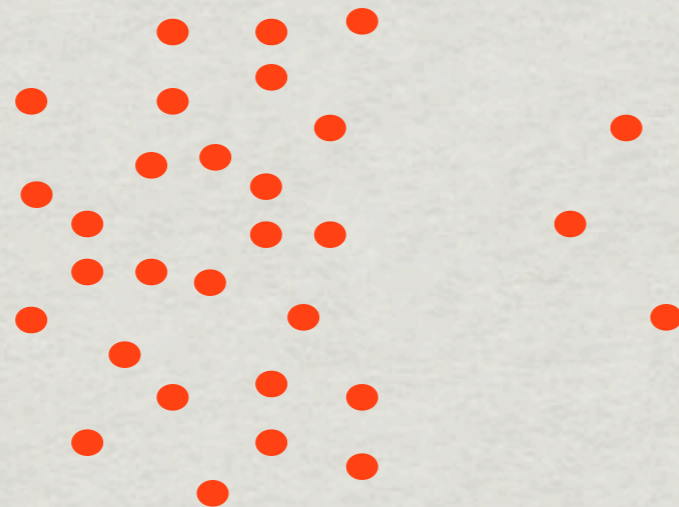
EG- IF A CELL IS PLACED IN A **HYPERTONIC** SOLUTION, THE CONCENTRATION OF THE SOLUTE WILL BE **GREATER** IN THE SOLUTION OUTSIDE OF THE CELL AND THE CONCENTRATION OF WATER WILL BE GREATER INSIDE THE CELL



# HYPERTONIC SOLUTION

**CONSIDER THE CONCENTRATION GRADIENT AND OSMOSIS...**

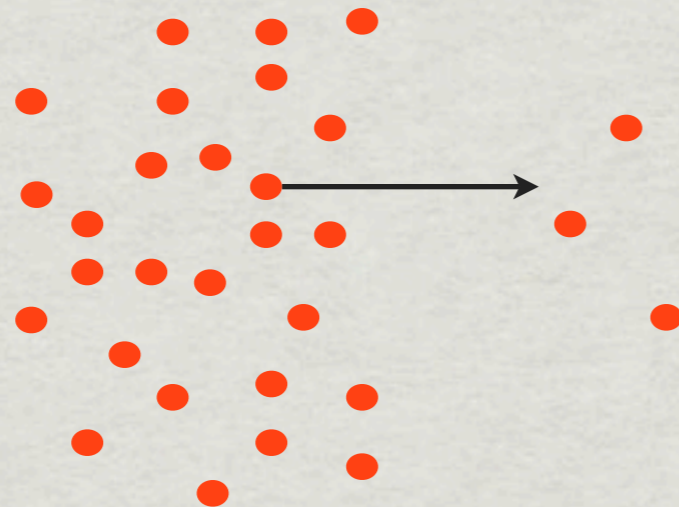
**WHAT EFFECT SHOULD THIS HAVE ON THE NATURAL  
MOVEMENT ON PARTICLES?**



# HYPERTONIC SOLUTION

**CONSIDER THE CONCENTRATION GRADIENT AND OSMOSIS...**

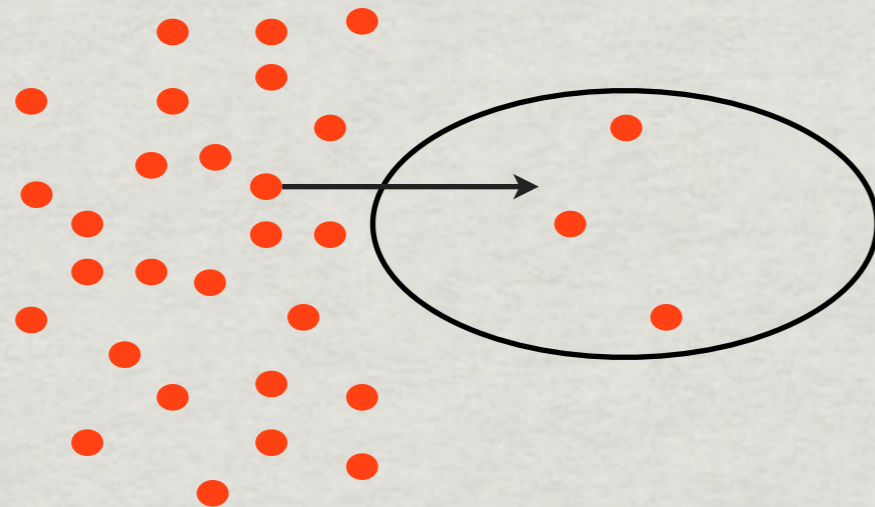
**WHAT EFFECT SHOULD THIS HAVE ON THE NATURAL  
MOVEMENT ON PARTICLES?**



# HYPERTONIC SOLUTION

CONSIDER THE CONCENTRATION GRADIENT AND OSMOSIS...

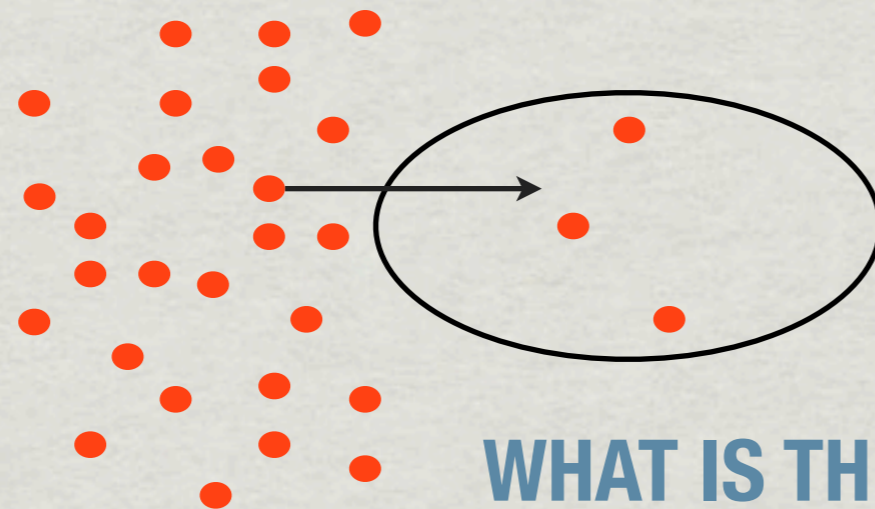
WHAT EFFECT SHOULD THIS HAVE ON THE NATURAL  
MOVEMENT ON PARTICLES?



# HYPERTONIC SOLUTION

CONSIDER THE CONCENTRATION GRADIENT AND OSMOSIS...

WHAT EFFECT SHOULD THIS HAVE ON THE NATURAL  
MOVEMENT ON PARTICLES?

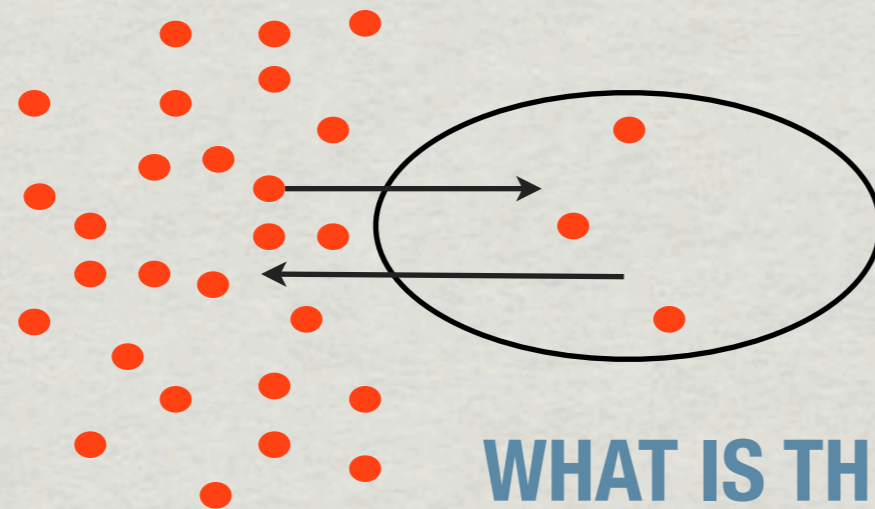


WHAT IS THE NET MOVEMENT OF WATER?

# HYPERTONIC SOLUTION

CONSIDER THE CONCENTRATION GRADIENT AND OSMOSIS...

WHAT EFFECT SHOULD THIS HAVE ON THE NATURAL  
MOVEMENT ON PARTICLES?



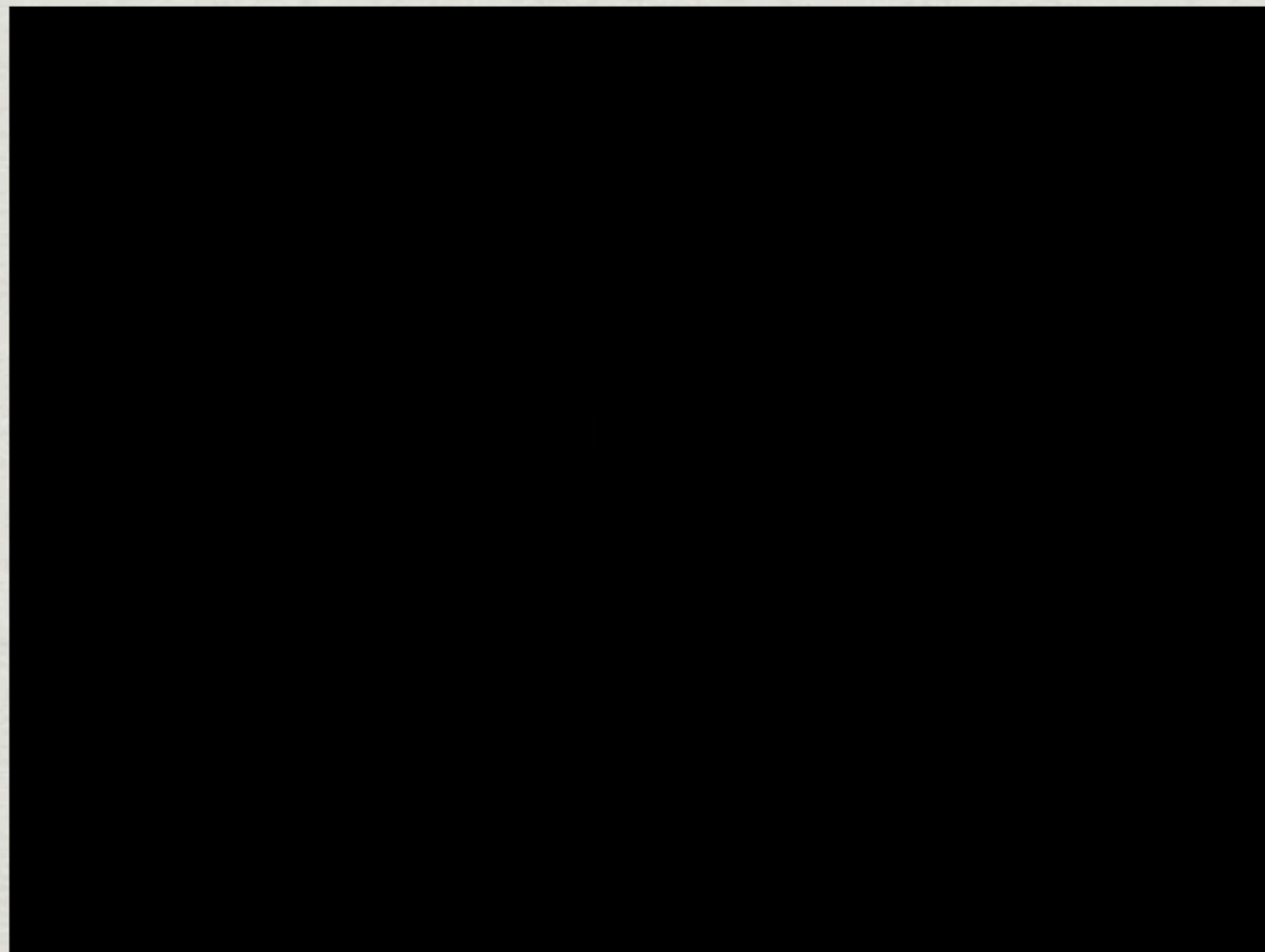
WHAT IS THE NET MOVEMENT OF WATER?

# HYPERTONIC SOLUTIONS

## EFFECTS ON CELLS...

### ANIMAL CELLS

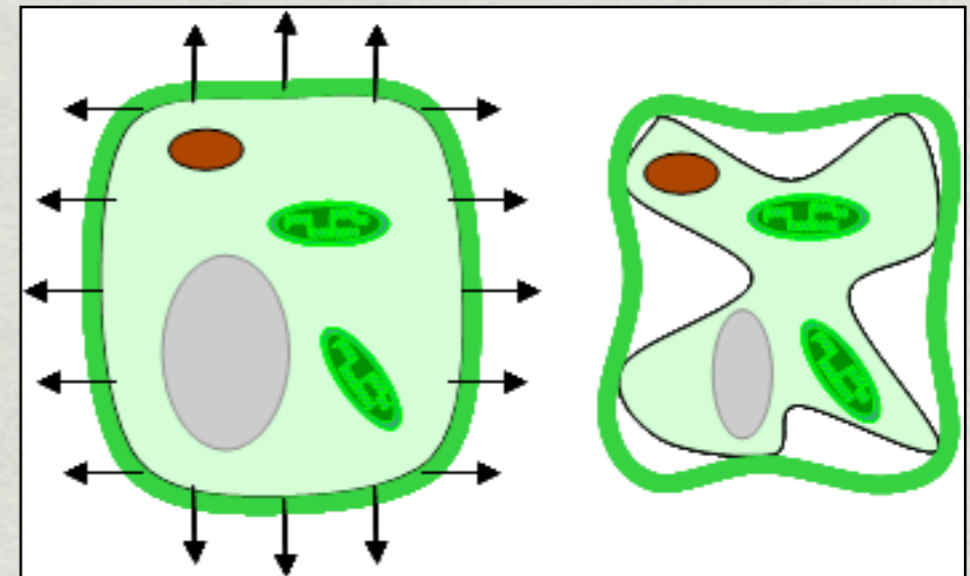
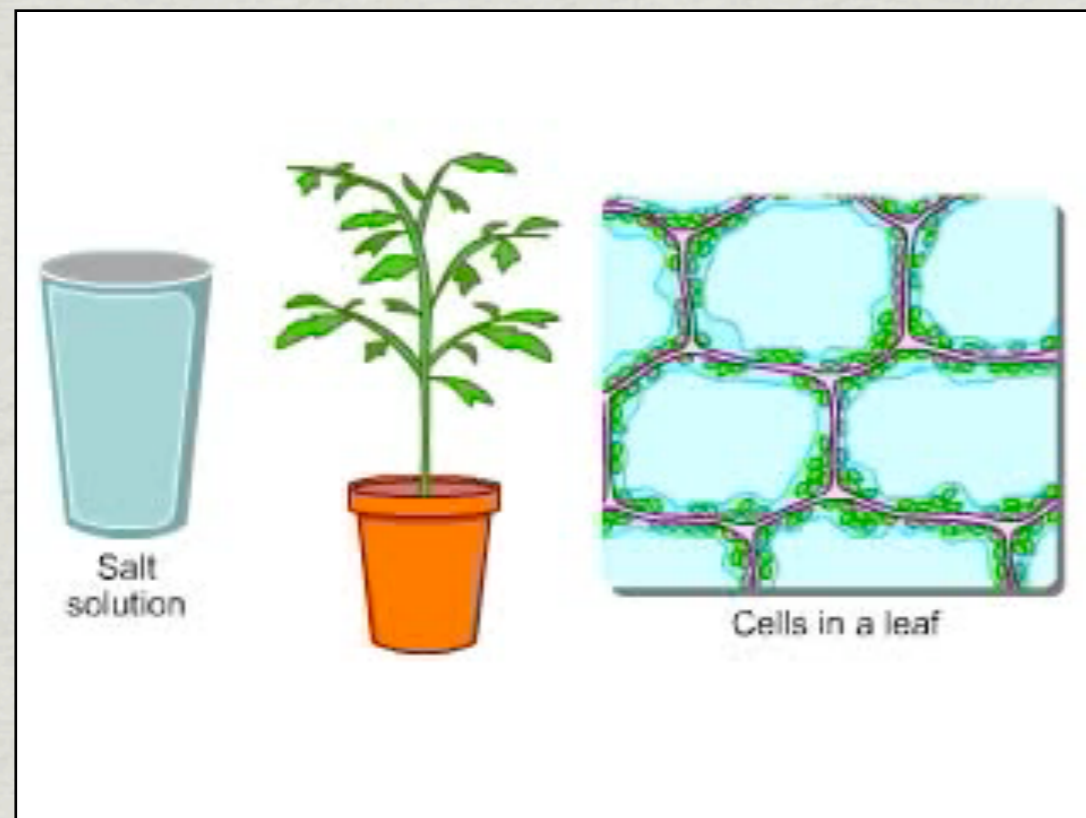
SINCE THE CONCENTRATION OF **WATER** IS GREATER INSIDE THE CELL THAN OUTSIDE THE CELL, NET MOVEMENT OF WATER BY OSMOSIS WILL BE OUT OF THE CELL  
THIS WILL CAUSE THE ANIMAL CELL TO **SHRINK** OR **CRENATE**



# HYPERTONIC SOLUTIONS

## PLANT CELLS

SINCE THE CONCENTRATION OF **WATER** IS GREATER INSIDE THE CELL THAN OUTSIDE THE CELL, NET MOVEMENT OF WATER BY OSMOSIS WILL BE OUT OF THE CELL  
HOWEVER, SINCE THE PLANT CELL HAS A RIGID CELL WALL, THE ENTIRE CELL WILL NOT SHRINK  
INSTEAD, THE LARGE CENTRAL VACUOLE WILL SHRINK, CAUSING THE PLASMA MEMBRANE TO PULL AWAY FROM THE EDGES OF THE CELL  
THIS IS CALLED **PLASMOLYSIS**



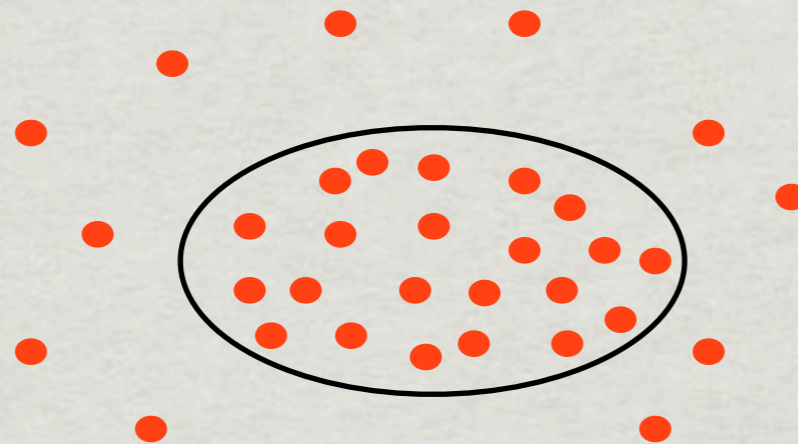
# HYPOTONIC SOLUTIONS

**HYPO** MEANS **LESS THAN**

THUS THE SOLUTE CONCENTRATION IN A **HYPOTONIC** SOLUTION IS **LESS THAN** THE SOLUTE CONCENTRATION OF THE SOLUTION IT IS BEING COMPARED TO

THE SOLVENT CONCENTRATION OF A HYPOTONIC SOLUTION IS GREATER THAN THE SOLVENT CONCENTRATION OF THE OTHER SOLUTION

EG- IF A CELL IS PLACED IN A HYPOTONIC SOLUTION, THE SOLUTE CONCENTRATION WILL BE LESS OUTSIDE OF THE CELL AND THE WATER CONCENTRATION WILL BE GREATER OUTSIDE OF THE CELL



# HYPOTONIC SOLUTION

**CONSIDER THE CONCENTRATION GRADIENT AND OSMOSIS...**

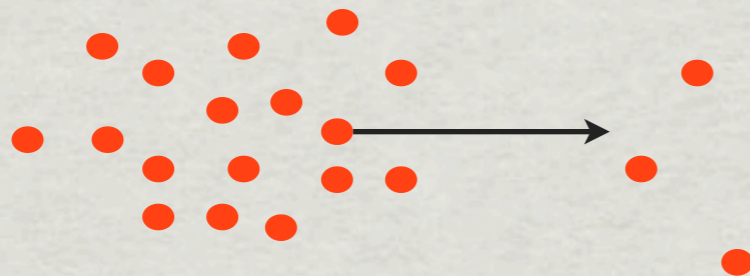
**WHAT EFFECT SHOULD THIS HAVE ON THE NATURAL  
MOVEMENT ON PARTICLES?**



# HYPOTONIC SOLUTION

**CONSIDER THE CONCENTRATION GRADIENT AND OSMOSIS...**

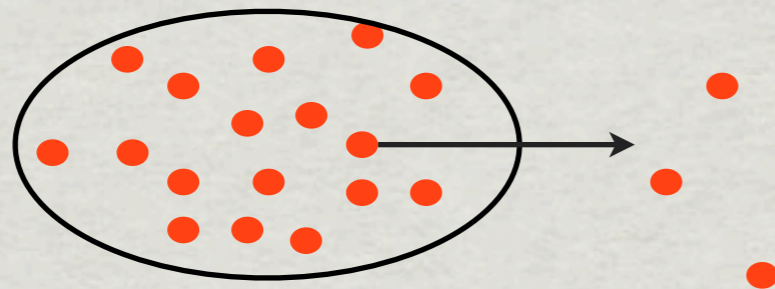
**WHAT EFFECT SHOULD THIS HAVE ON THE NATURAL  
MOVEMENT ON PARTICLES?**



# HYPOTONIC SOLUTION

**CONSIDER THE CONCENTRATION GRADIENT AND OSMOSIS...**

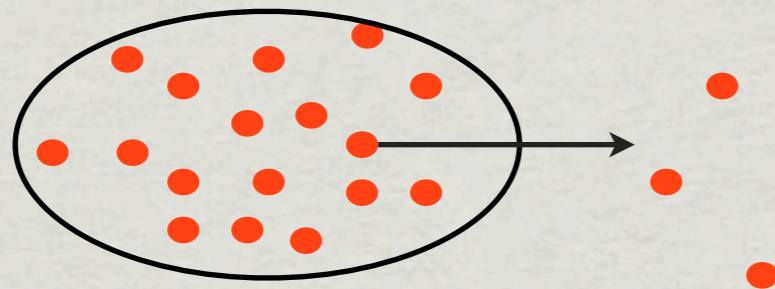
**WHAT EFFECT SHOULD THIS HAVE ON THE NATURAL  
MOVEMENT ON PARTICLES?**



# HYPOTONIC SOLUTION

CONSIDER THE CONCENTRATION GRADIENT AND OSMOSIS...

WHAT EFFECT SHOULD THIS HAVE ON THE NATURAL  
MOVEMENT ON PARTICLES?

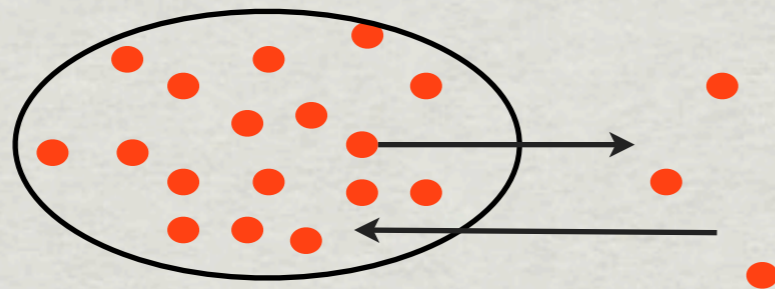


WHAT IS THE NET MOVEMENT OF WATER?

# HYPOTONIC SOLUTION

CONSIDER THE CONCENTRATION GRADIENT AND OSMOSIS...

WHAT EFFECT SHOULD THIS HAVE ON THE NATURAL  
MOVEMENT ON PARTICLES?



WHAT IS THE NET MOVEMENT OF WATER?

# HYPOTONIC SOLUTIONS

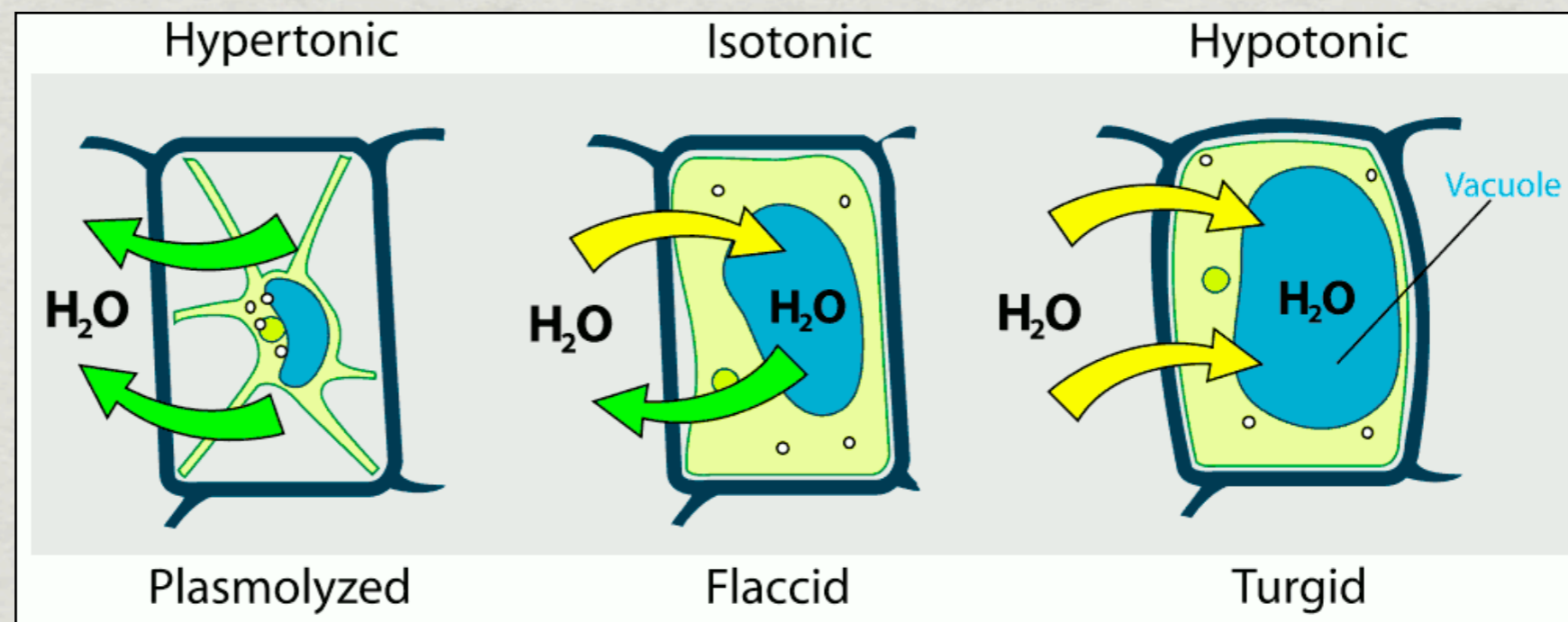
## EFFECTS ON CELLS...

### ANIMAL CELLS

SINCE THE CONCENTRATION OF WATER IS GREATER OUTSIDE OF THE CELL THAN INSIDE OF THE CELL, THE NET MOVEMENT OF WATER WILL BE INTO THE CELL BY OSMOSIS  
THIS WILL CAUSE THE ANIMAL CELL TO SWELL AND POSSIBLY **BURST (LYSIS)**

### PLANT CELLS

SINCE THE CONCENTRATION OF WATER IS GREATER OUTSIDE OF THE CELL THAN INSIDE OF THE CELL, MOVEMENT OF WATER WILL BE INTO THE CELL BY OSMOSIS  
SINCE THE PLANT HAS A RIGID CELL WALL, IT WILL NOT SWELL MUCH AND WILL NOT BURST  
INSTEAD, THE LARGE CENTRAL VACUOLE WILL SWELL PUSHING THE PLASMA MEMBRANE AGAINST THE WALL  
THIS CAUSES AN INCREASE IN **TURGOR PRESSURE**

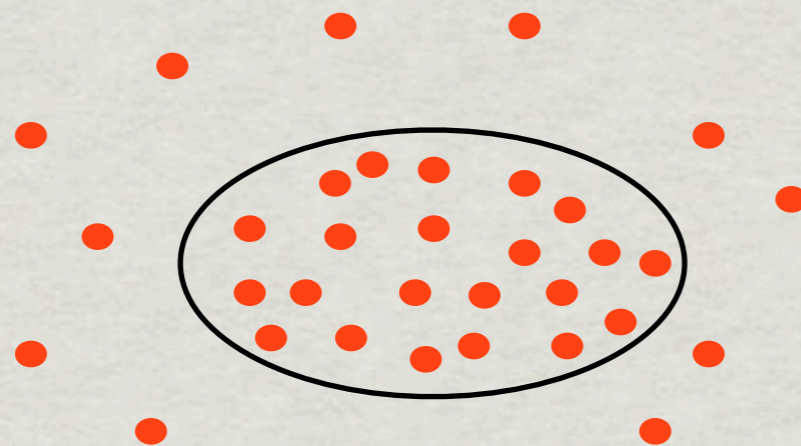


# Application

IF A CELL IS PLACED IN A HYPOTONIC SOLUTION, WHERE IS THE:

SOLUTE CONCENTRATION THE HIGHEST?

WATER CONCENTRATION THE HIGHEST?



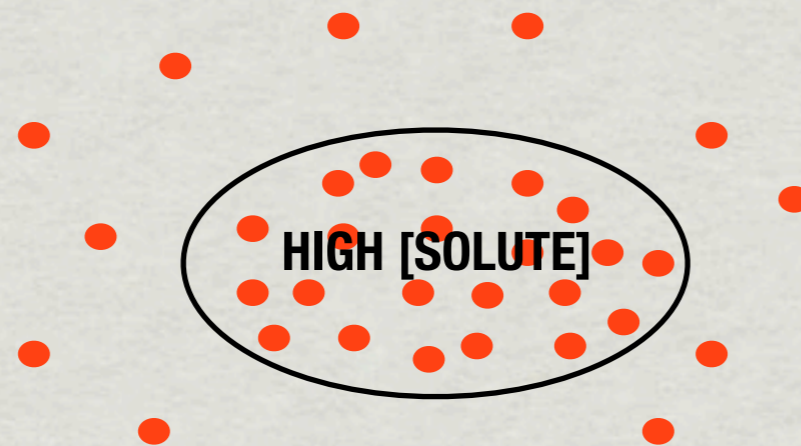
DESCRIBE THE MOVEMENT OF WATER IN QUESTION #1 USING THE APPROPRIATE TERMINOLOGY

# Application

IF A CELL IS PLACED IN A HYPOTONIC SOLUTION, WHERE IS THE:

SOLUTE CONCENTRATION THE HIGHEST?

WATER CONCENTRATION THE HIGHEST?



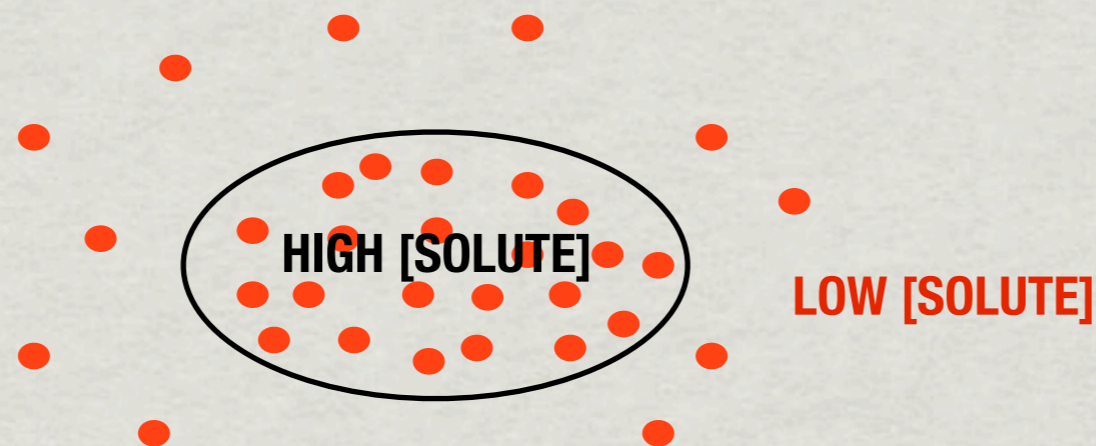
DESCRIBE THE MOVEMENT OF WATER IN QUESTION #1 USING THE APPROPRIATE TERMINOLOGY

# Application

IF A CELL IS PLACED IN A HYPOTONIC SOLUTION, WHERE IS THE:

SOLUTE CONCENTRATION THE HIGHEST?

WATER CONCENTRATION THE HIGHEST?



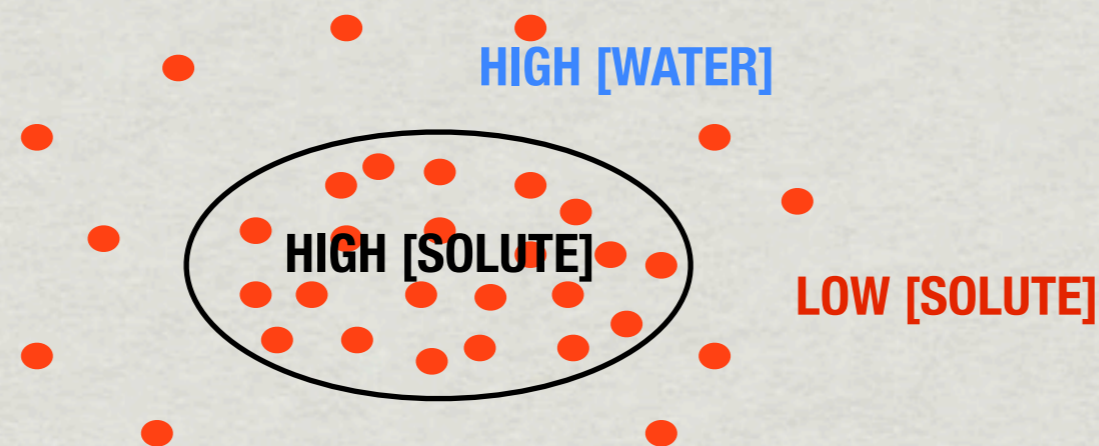
DESCRIBE THE MOVEMENT OF WATER IN QUESTION #1 USING THE APPROPRIATE TERMINOLOGY

# Application

IF A CELL IS PLACED IN A HYPOTONIC SOLUTION, WHERE IS THE:

SOLUTE CONCENTRATION THE HIGHEST?

WATER CONCENTRATION THE HIGHEST?



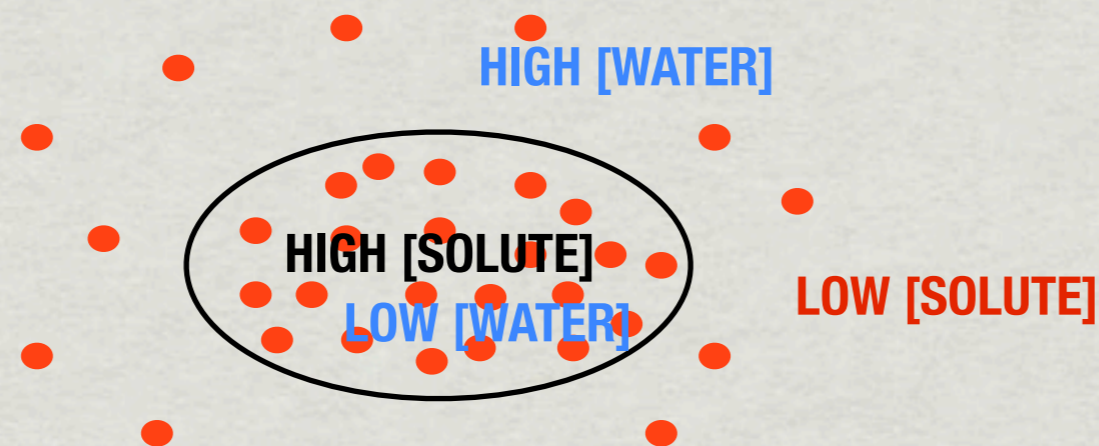
DESCRIBE THE MOVEMENT OF WATER IN QUESTION #1 USING THE APPROPRIATE TERMINOLOGY

# Application

IF A CELL IS PLACED IN A HYPOTONIC SOLUTION, WHERE IS THE:

SOLUTE CONCENTRATION THE HIGHEST?

WATER CONCENTRATION THE HIGHEST?



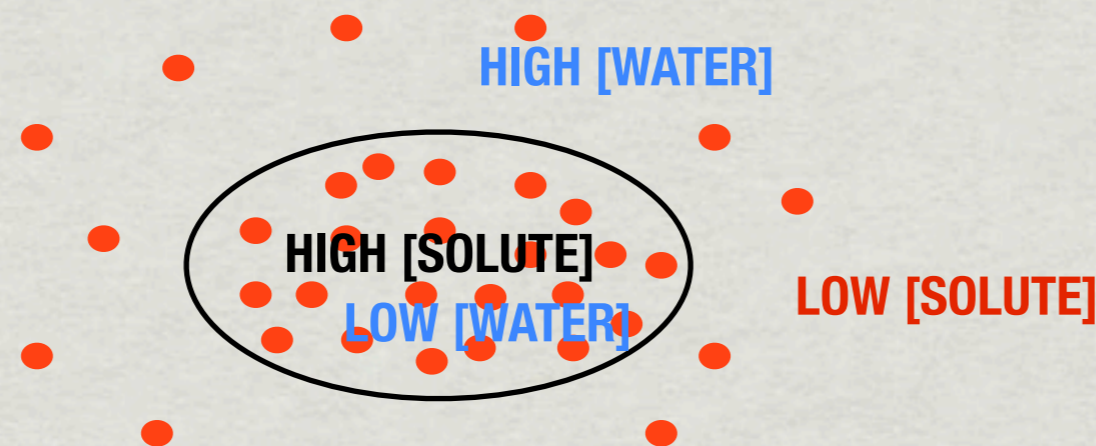
DESCRIBE THE MOVEMENT OF WATER IN QUESTION #1 USING THE APPROPRIATE TERMINOLOGY

# Application

IF A CELL IS PLACED IN A HYPOTONIC SOLUTION, WHERE IS THE:

SOLUTE CONCENTRATION THE HIGHEST?

WATER CONCENTRATION THE HIGHEST?



DESCRIBE THE MOVEMENT OF WATER IN QUESTION #1 USING THE APPROPRIATE TERMINOLOGY

**THE NET WATER (OSMOTIC) MOVEMENT IS INTO THE CELL  
CAUSING THE CELL TO EXPAND (POSSIBLY LYSE) OR AN INCREASE  
IN TURGOR PRESSURE**

# Application

IF A CELL IS PLACED IN A HYPERTONIC SOLUTION, WHERE IS THE:

SOLUTE CONCENTRATION THE HIGHEST?

WATER CONCENTRATION THE HIGHEST?

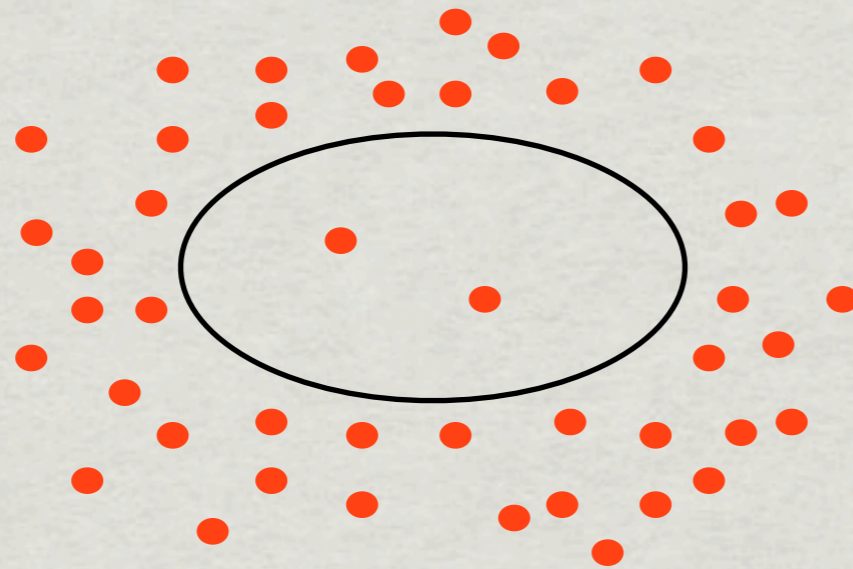
DESCRIBE THE MOVEMENT OF WATER IN QUESTION #1 USING THE APPROPRIATE TERMINOLOGY

# Application

IF A CELL IS PLACED IN A HYPERTONIC SOLUTION, WHERE IS THE:

SOLUTE CONCENTRATION THE HIGHEST?

WATER CONCENTRATION THE HIGHEST?



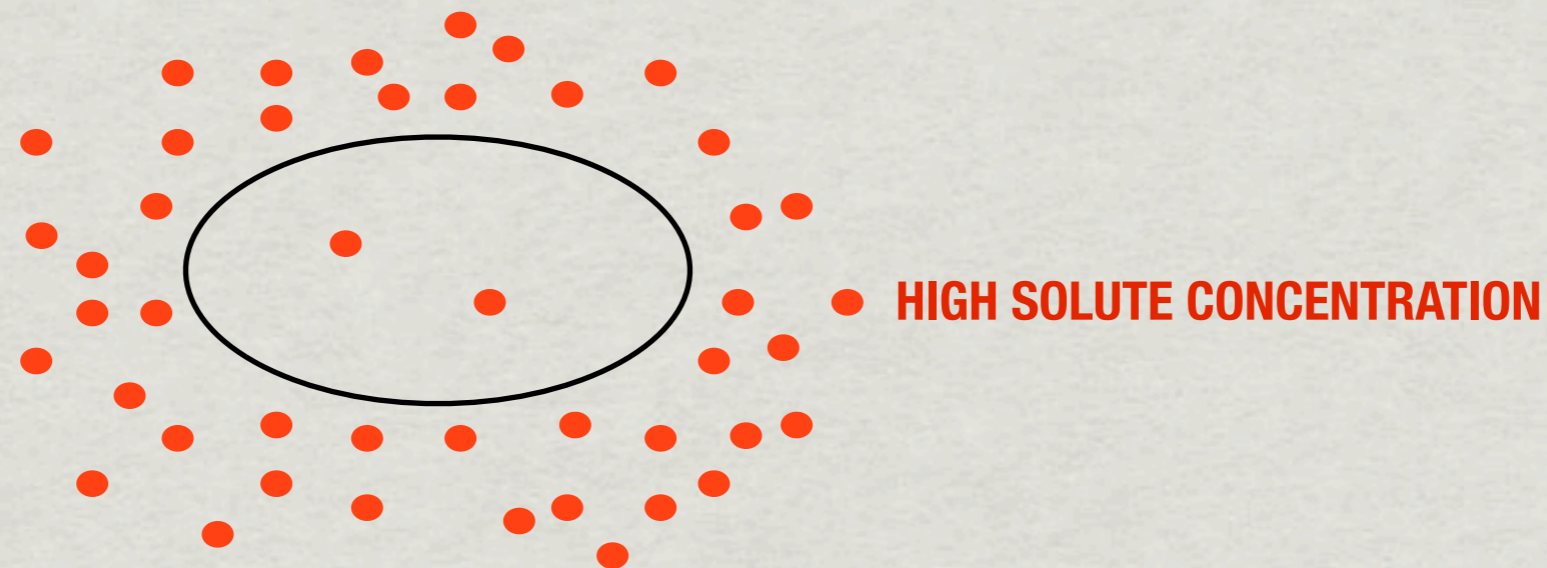
DESCRIBE THE MOVEMENT OF WATER IN QUESTION #1 USING THE APPROPRIATE TERMINOLOGY

# Application

IF A CELL IS PLACED IN A HYPERTONIC SOLUTION, WHERE IS THE:

SOLUTE CONCENTRATION THE HIGHEST?

WATER CONCENTRATION THE HIGHEST?



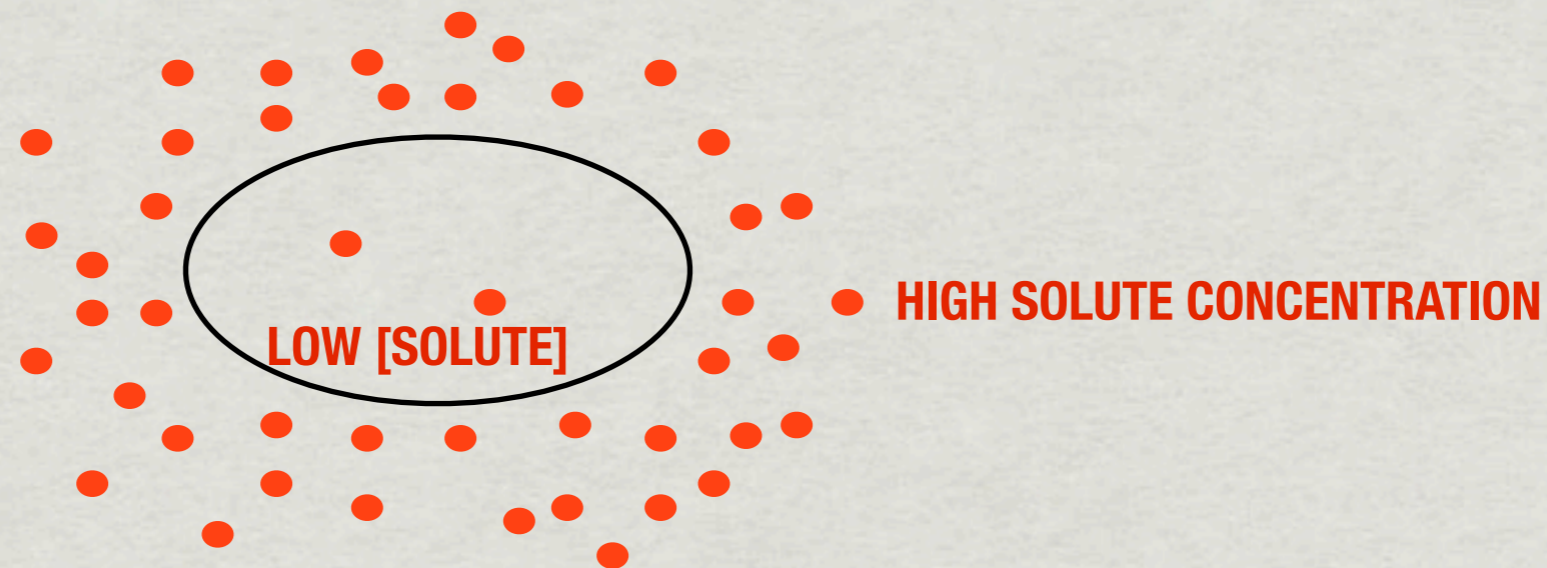
DESCRIBE THE MOVEMENT OF WATER IN QUESTION #1 USING THE APPROPRIATE TERMINOLOGY

# Application

IF A CELL IS PLACED IN A HYPERTONIC SOLUTION, WHERE IS THE:

SOLUTE CONCENTRATION THE HIGHEST?

WATER CONCENTRATION THE HIGHEST?



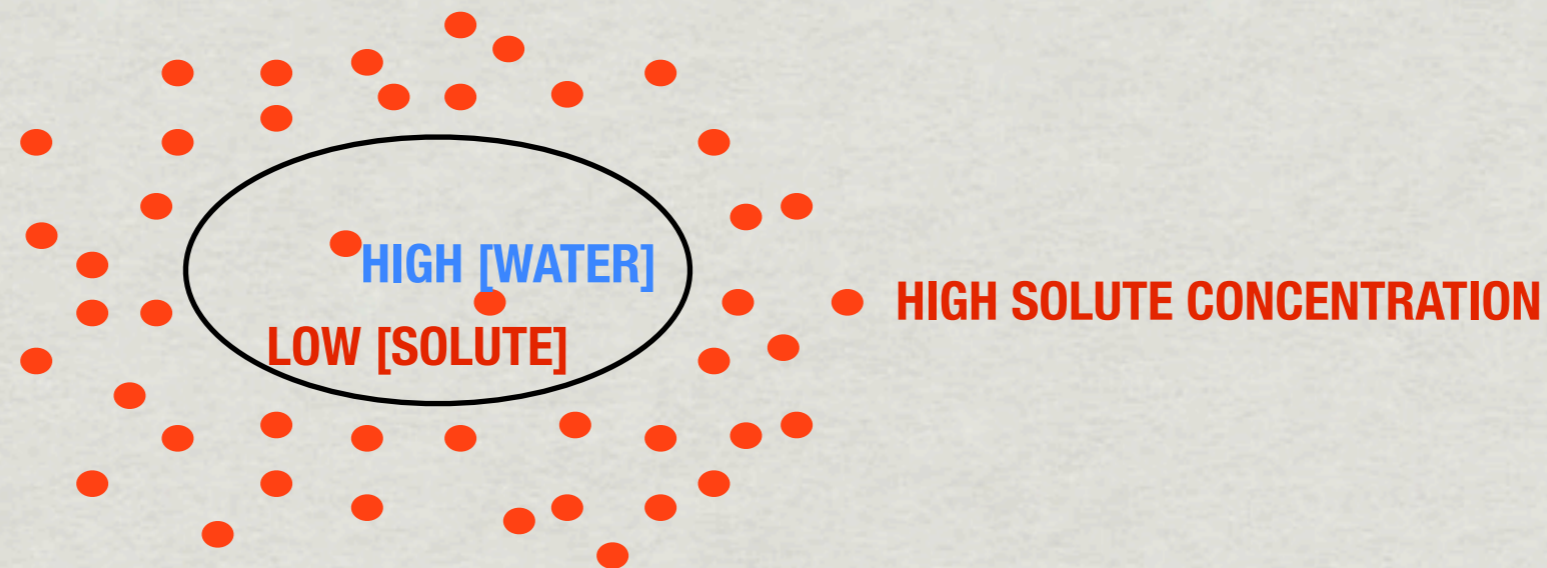
DESCRIBE THE MOVEMENT OF WATER IN QUESTION #1 USING THE APPROPRIATE TERMINOLOGY

# Application

IF A CELL IS PLACED IN A HYPERTONIC SOLUTION, WHERE IS THE:

SOLUTE CONCENTRATION THE HIGHEST?

WATER CONCENTRATION THE HIGHEST?



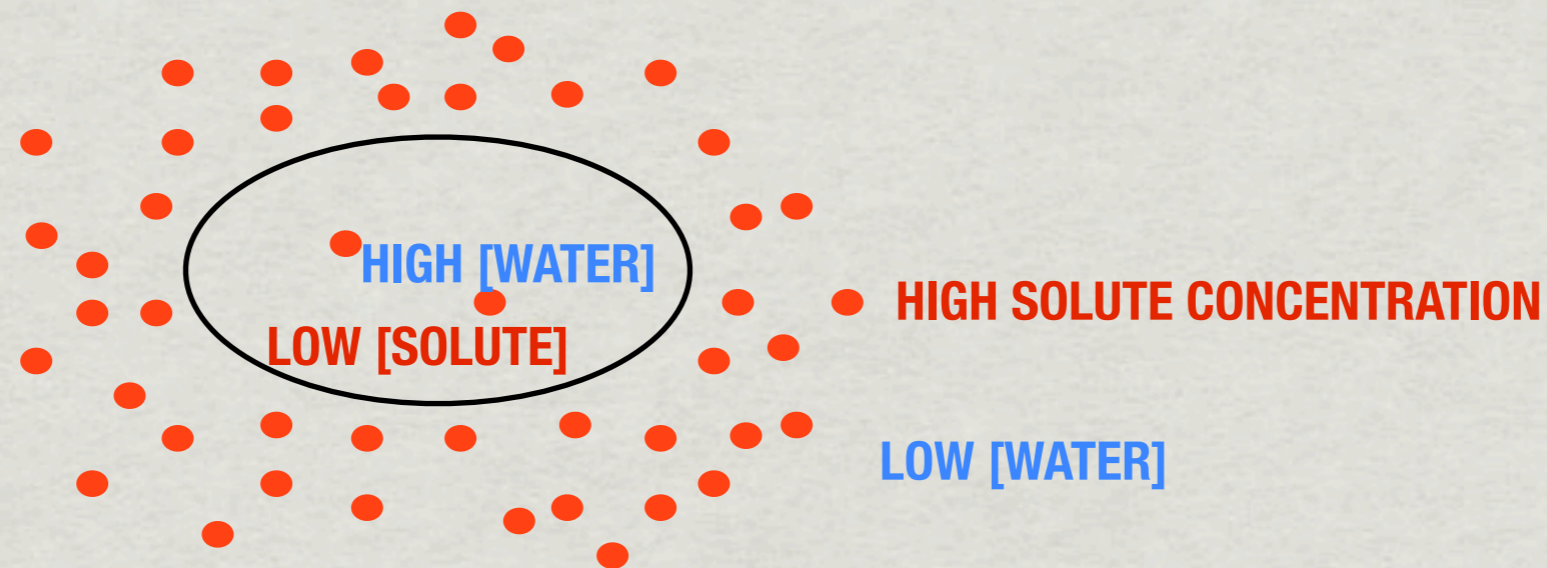
DESCRIBE THE MOVEMENT OF WATER IN QUESTION #1 USING THE APPROPRIATE TERMINOLOGY

# Application

IF A CELL IS PLACED IN A HYPERTONIC SOLUTION, WHERE IS THE:

SOLUTE CONCENTRATION THE HIGHEST?

WATER CONCENTRATION THE HIGHEST?



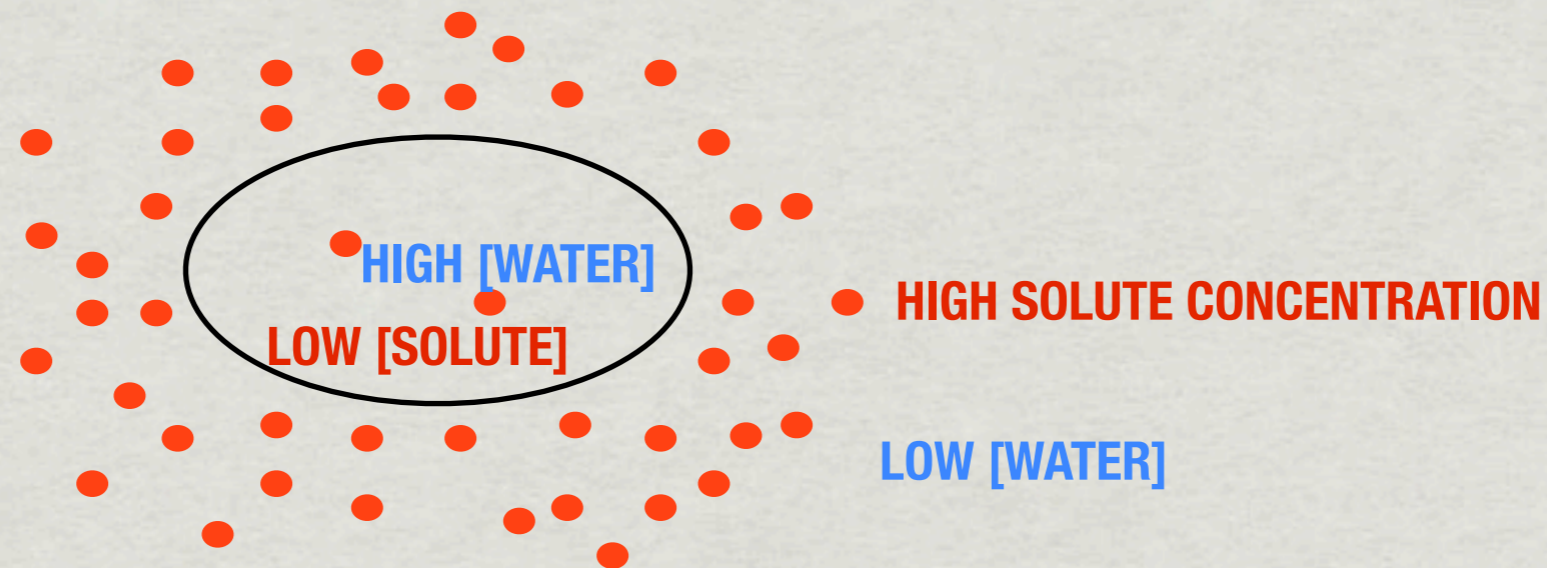
DESCRIBE THE MOVEMENT OF WATER IN QUESTION #1 USING THE APPROPRIATE TERMINOLOGY

# Application

IF A CELL IS PLACED IN A HYPERTONIC SOLUTION, WHERE IS THE:

SOLUTE CONCENTRATION THE HIGHEST?

WATER CONCENTRATION THE HIGHEST?

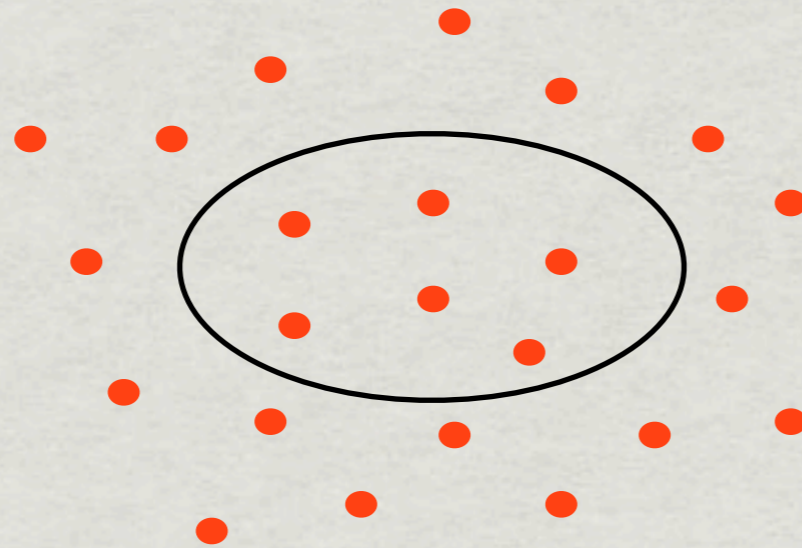


DESCRIBE THE MOVEMENT OF WATER IN QUESTION #1 USING THE APPROPRIATE TERMINOLOGY

**THE NET WATER (OSMOTIC) MOVEMENT IS OUT OF THE CELL,  
CREATING CRENATION OR PLASMOLYSIS**

# Application

EXPLAIN WHY PLACING A CELL IN AN ISOTONIC SOLUTION HAS NO EFFECT ON THE CELL.



**NO OSMOTIC GRADIENT. SOLUTE CONCENTRATION IS EQUAL**

EXPLAIN WHAT WILL HAPPEN TO EACH OF THE FOLLOWING CELLS USING THE APPROPRIATE TERMINOLOGY