2024

Chapter 11

Isotonic and Buffer Solutions

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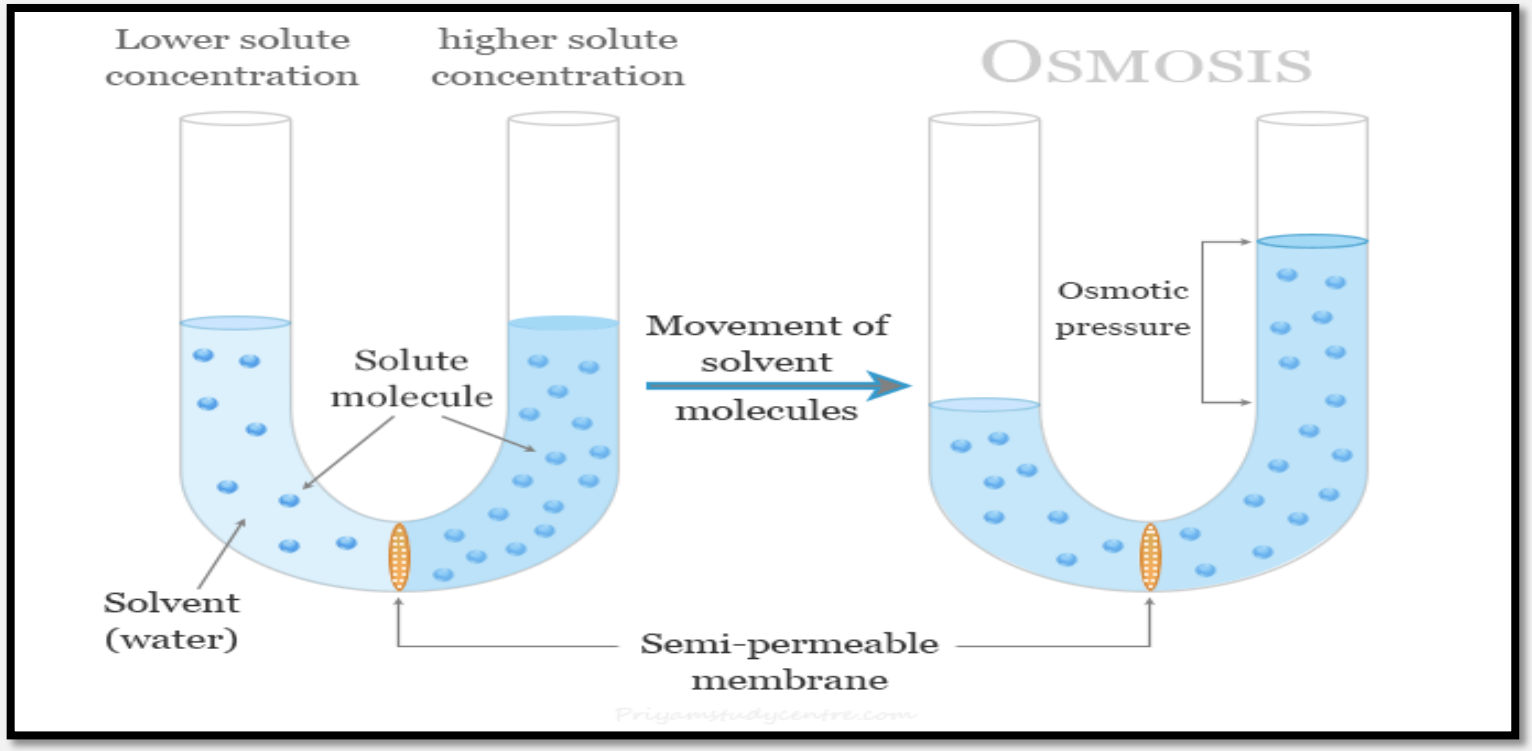
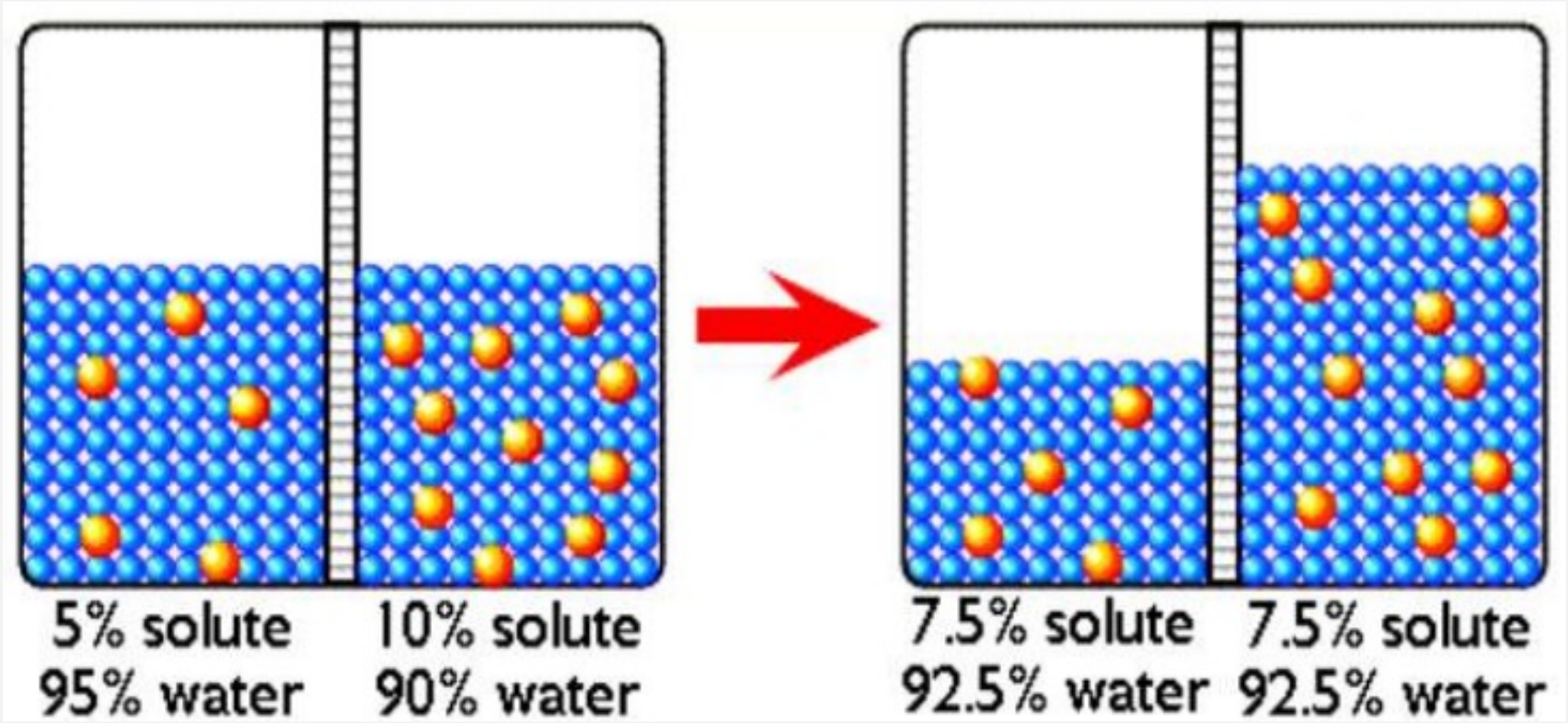
- When a solvent passes through a semipermeable membrane from a dilute solution into a more concentrated one, the concentrations become equalized and the phenomenon is known as **osmosis**.



- The pressure responsible for this phenomenon is termed **osmotic pressure** and varies with the nature of the solute.


5% solute
95% water
10% solute
90% water
7.5% solute
92.5% water
7.5% solute
92.5% water

- If the solute is a **nonelectrolyte**, its solution contains only molecules and the osmotic pressure varies with the concentration of the solute.

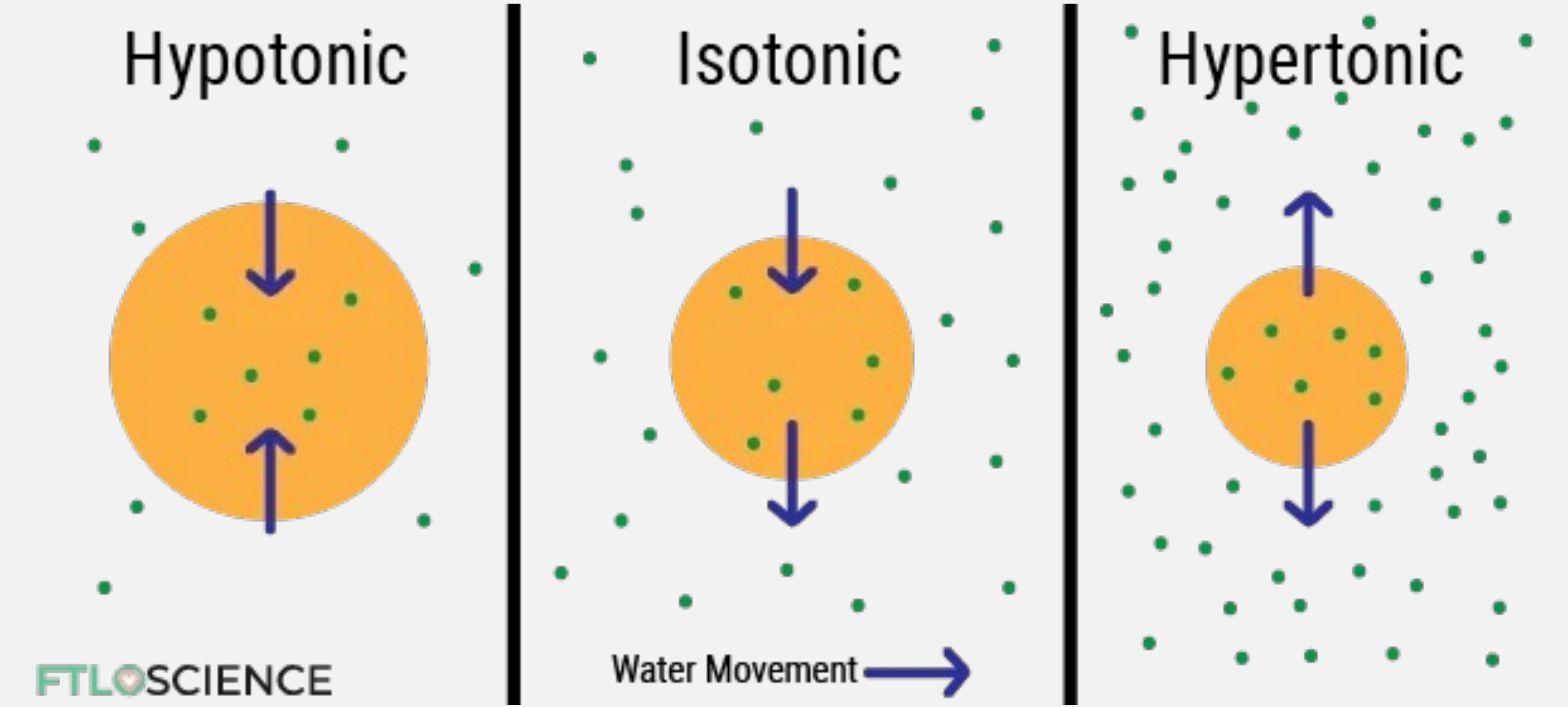
- If the solute is an **electrolyte**, its solution contains ions and the osmotic pressure varies with both the concentration of the solute and its degree of dissociation.

- Thus, solutes that dissociate present a greater number of particles in solution and exert greater osmotic pressure than undissociated molecules.

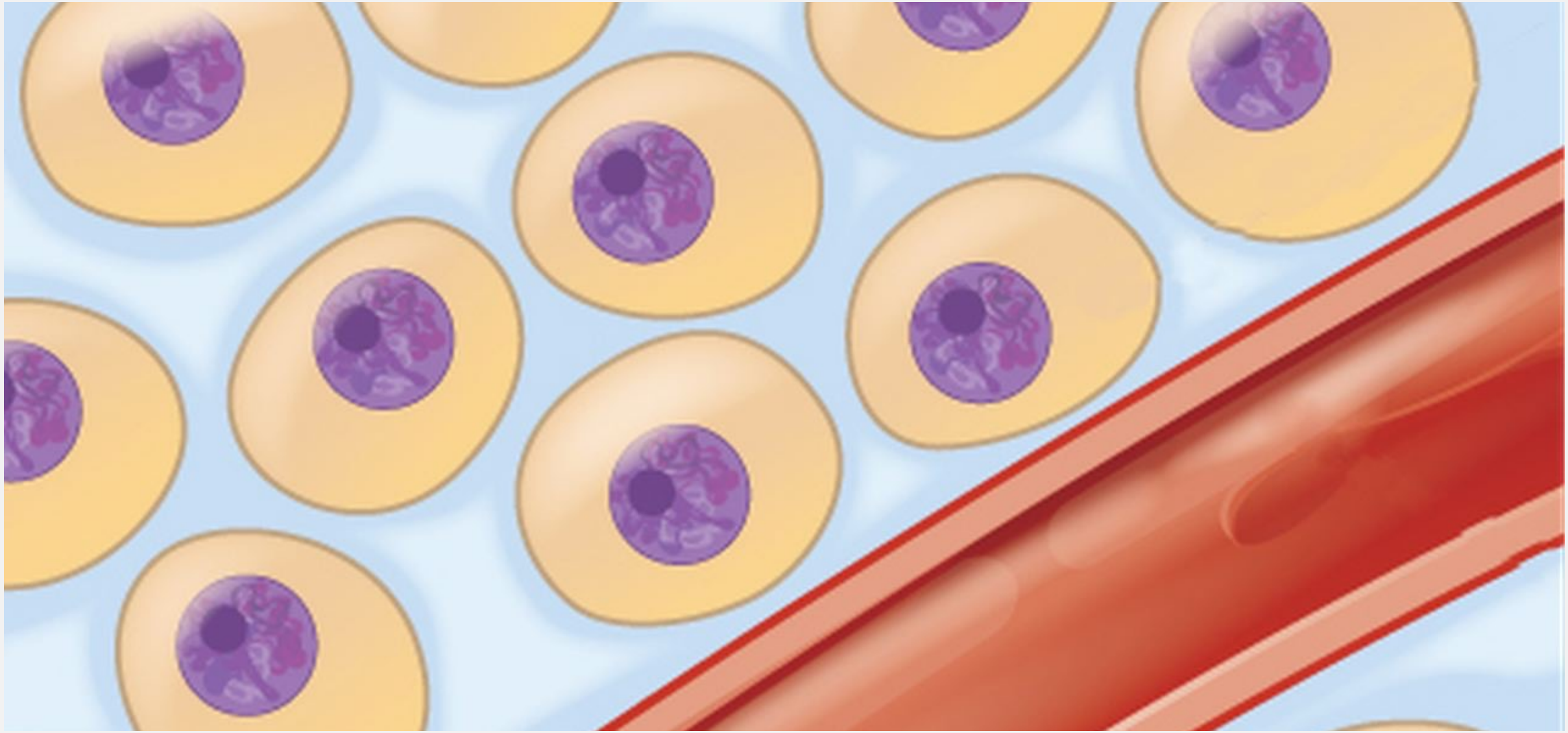
- Like osmotic pressure, the other colligative properties of solutions, *vapor pressure, boiling point, and freezing point,* depend on the number of particles in the solution.
- Therefore, these properties are interrelated and a change in any one of them will result in a corresponding change in the others.

IMPORTANT TERMS

- Two solutions that have the same osmotic pressure are termed **isosmotic**.
- Many solutions intended to be mixed with body fluids are designed to have the same osmotic pressure for greater patient comfort, efficacy, and safety.
- A solution having the same osmotic pressure as a specific body fluid is termed **isotonic** (meaning equal tone) with that specific body fluid.
- Solutions of lower osmotic pressure than that of a body fluid are termed **hypotonic**,
- whereas those having a higher osmotic pressure are termed **hypertonic.**


Hypotonic
Isotonic
Hypertonic
Water Movement
FTLOSCIENCE

Body Fluids



SPECIAL CLINICAL CONSIDERATIONS OF TONICITY

- It is generally accepted that for ophthalmic and parenteral administration, **isotonic solutions** are better tolerated by the patient than those at the extremes of hypo- and hypertonicity.

- With the administration of an isotonic solution, there is homeostasis in the body's intracellular fluids. Thus, in most instances, preparations that are isotonic, or nearly so, are preferred.

- However, there are exceptions, as in instances in which hypertonic solutions are used to "draw" fluids out of edematous tissues and into the administered solution.

EXAMPLES


Isotonic
Eye Drop
Solucion
SEA
These statements have not
This products is not
treat, cure or prevent
SIZE 5 ML


AVIZOR
lacrifresh
moisture
0,10%
Soothes ocular dryness,
irritations and eye strain
HY
Isotonic solution
Sodium Hyaluronate
0,10%
15 ml.
AVIZOR
lacrifresh
moisture
Soothes ocular dryness,
irritation and eye strain
HY
Isotonic solution
Sodium Hyaluronate
0,10%
15 ml.


Isotone Kochsalz-Lösung 0,9% Braun
Infusionslösung, Natriumchlorid
NaCl 0,9%
500 ml
Vor Anwendung Gebrauchs-
information beachten!
Zur intravenösen Anwendung
Steril und frei von
Bakterien-Endotoxinen.
Nach einem Anwendungsgang
sind Behältnis und evtl. ver-
bleibende Restmengen der
Lösung zu verwerfen.
Nur zu verwenden, wenn
Behältnis unverletzt und
Lösung klar ist.
Arzneimittel für
Kinder unzugänglich
aufbewahren!
Apothekenpflichtig
Zul.-Nr.:
6726174.00.00
B BRAUN
B. Braun Melsungen AG
34209 Melsungen
NaCl 0,9%

- Most ophthalmic preparations are formulated to be isotonic, or approximately isotonic, to duplicate ophthalmic tears for the comfort of the patient.

- These solutions are also prepared and buffered at an appropriate pH, both to reduce the likelihood of irritation to the eye's tissues and to maintain the stability of the preparations.

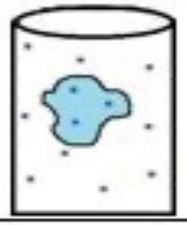
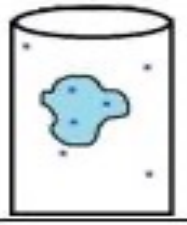
- Injections that are not isotonic should be administered slowly and in small quantities to minimize tissue irritation, pain, and cell fluid imbalance.

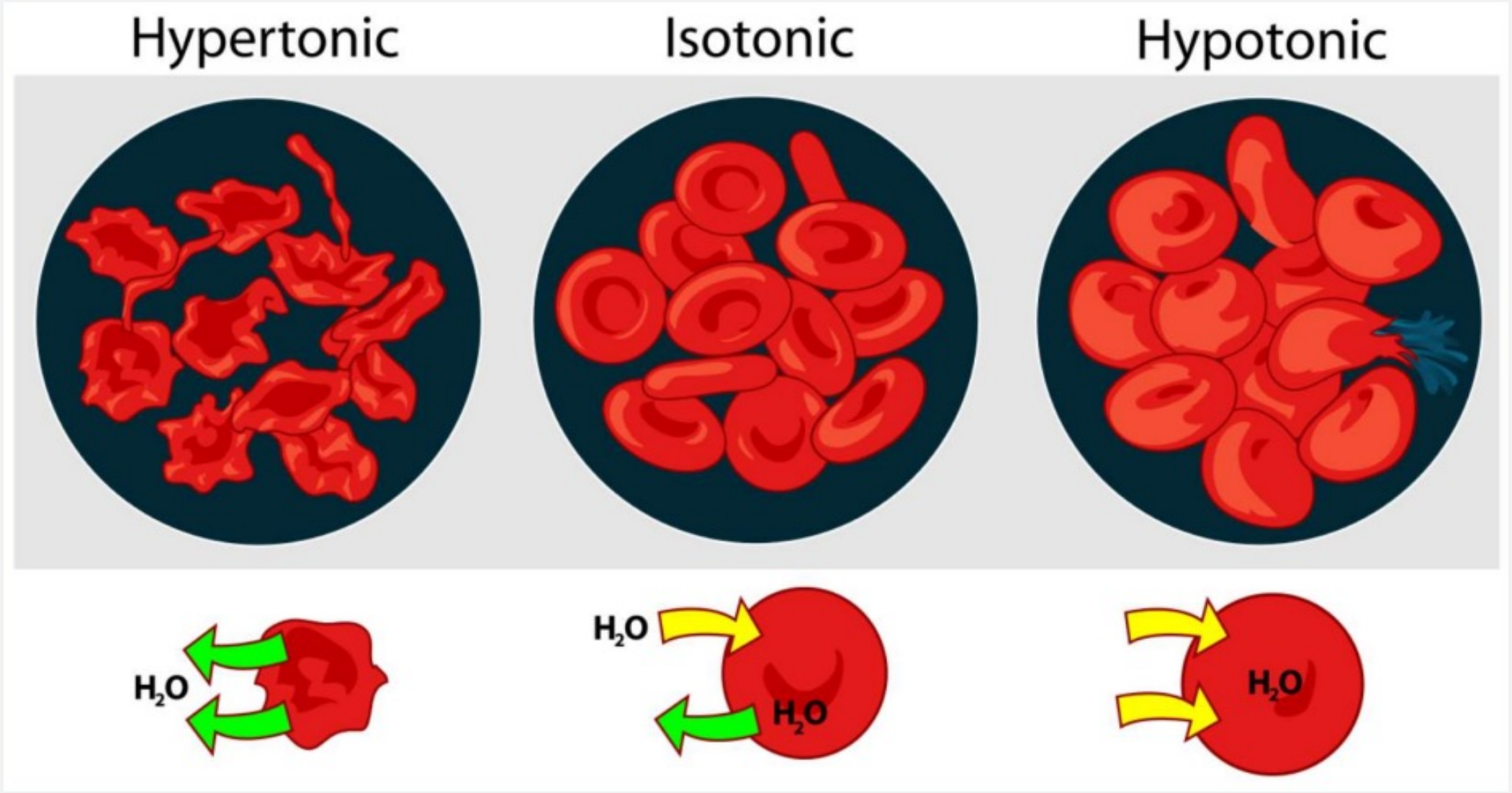
- Intravenous infusions, which are hypotonic or hypertonic, can have profound adverse effects because they generally are administered in large volumes.

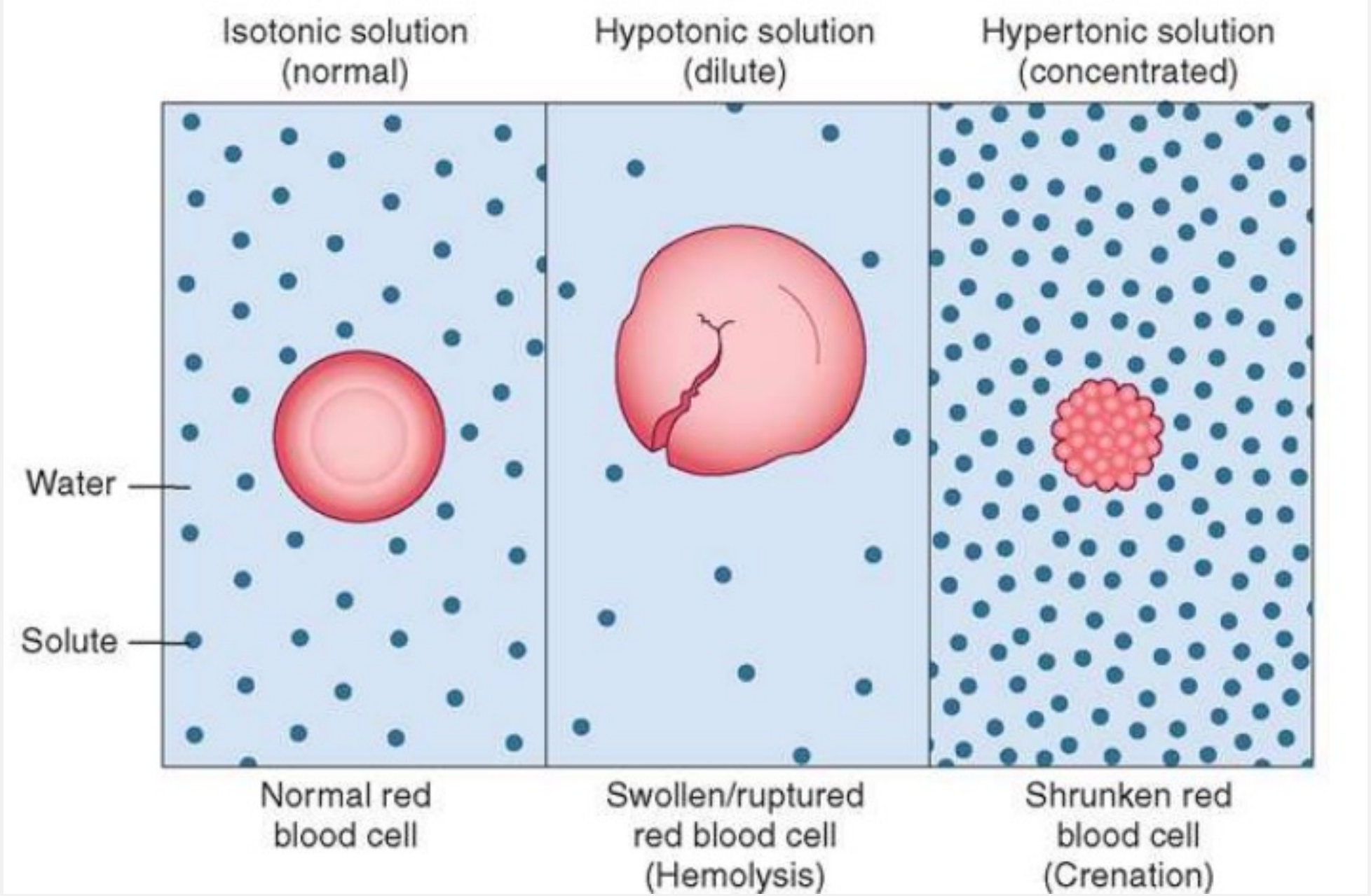
- Large volumes of hypertonic infusions containing dextrose, for example, can result in hyperglycemia, osmotic diuresis, and excessive loss of electrolytes.

- Excess infusions of hypotonic fluids can result in the osmotic hemolysis of red blood cells and surpass the upper limits of the body's capacity to safely absorb excessive fluids.

- Even isotonic fluids, when infused intravenously in excessive volumes or at excessive rates, can be deleterious due to an overload of fluids placed into the body's circulatory system

Solution Type	Isotonic	Hypotonic	Hypertonic
Photo and Caption	 This is an isotonic solution because the cell (light blue object) has the same density of solute (dark blue dots) as the environment (the cup).	 This is a hypotonic solution because the cell (light blue object) has a higher density of solute (dark blue dots) than the environment (the cup).	 This is a hypertonic solution because the environment (the cup) has a higher density of solute (dark blue dots) than the cell (light blue object).
What happens to the water?	Water will flow freely in and out of the cell.	Water will be released from inside the cell into the environment.	Water from the environement will fill the cell.
What happens to the cell?	The cell will stay the same size and mass.	The cell will shrink and its mass will decrease.	The cell will swell and its mass will increase.
Diabetic Emergency	No Emergency	Hypoglycemic	Hyperglycemic


Hypertonic
Isotonic
Hypotonic
H_2O
H_2O
H_2O
H_2O


Isotonic solution
(normal)
Hypotonic solution
(dilute)
Hypertonic solution
(concentrated)
Water
Solute
Normal red
blood cell
Swollen/ruptured
red blood cell
(Hemolysis)
Shrunken red
blood cell
(Crenation)

Isotonic and Buffer Solutions

Thank You